Literature Supporting Claims Regarding the Health and Well-Being Benefits of Plants

Listed in chronological order


Urban sprawl and inner city decline are two common and interconnected outcomes of contemporary metropolitan development. More than 25% of large cities in the world are considered shrinking cities. Detroit is one of the most notorious examples of severe decline in North America. We examined the residential housing vacancy severity in the City of Detroit in comparison with the seventeen other cities in metropolitan Detroit. We developed a systematic and quantitative framework to investigate city shrinking from the perspectives of both causes and dynamics. The framework consists of three consequent regressions: the regional model to analyze the causes and dynamics of urban shrinking, the city models to reveal regional disparity and to identify primary inequality factors, and the regional logistic categorical model to examine the effect of primary social-spatial inequality factors on urban shrinking. Through these analyses, we found that the odds of becoming vacant were 9.01 times higher in census tracts with the highest concentration of less educated population, 7.16 times higher where a good portion of housing structures didn’t have a full kitchen, 7.06 times higher in tracts with the most concentrated Black population, 5.47 times higher where a good portion of housing were multi-unit structures, and 4.76 times higher in tracts with the poorest population. We concluded that urban shrinking was often accompanied with urban sprawl; regional inequality was manifested in multiple scales and socio-spatial inequality became increasingly alarming; the causes and dynamics of urban shrinking were inevitably intertwined; and racial segregation and persistent poverty were the primary cause of long-lasting urban shrinking in Metropolitan Detroit.


Evidence supporting a positive association between neighbourhood greenspace and physical activity is equivocal. Using data from a large, nationally representative survey in England (n = 280,790), we found that while a positive relationship between the amount of neighbourhood greenspace and the odds of achieving recommended weekly physical activity existed for dog owners, no relationship was found for non-dog owners. The findings highlight the importance of neighbourhood greenspaces for supporting physical activity through dog walking in the UK context, but also raise the issue of how to encourage non-dog owners to use greenspaces in health-promoting ways. The results may also help to explain previously mixed findings in the international evidence base, and emphasise the need to adequately account for dog-ownership in future research exploring the relationship between greenspaces and physical activity.

Target 2 of the EU Biodiversity Strategy to 2020 aims at the deployment of Green Infrastructure (GI) and the restoration of at least 15% of degraded ecosystems. We assess different alternatives for the spatial planning of GI and ecosystem restoration across the European Union by using spatial conservation prioritization tools. We compared three different scenarios for the identification of priority areas in which the ecosystem service potential, beneficiaries (i.e., people) and ecosystem condition play different roles. As an example of GI restoration, we also assessed the cost-effectiveness of removal of invasive alien species in the areas prioritized under each scenario.

The comparative assessment of the spatial alternatives for GI shows synergies and conflicts. We found that GI could be efficiently established close to densely populated areas, since high multi-functionality is delivered in these locations (close to human settlements). However, restoration costs, such as the removal of invasive alien species, were higher in such areas given the influence of urban pressures. We also found that GI prioritized in areas under poor ecosystem condition would require a larger spatial extent of implementation, due to a lower ecosystem service potential per unit area.

Given the scarcity of resources for investment in GI and ecosystem restoration, win-win situations should be identified where GI designation can deliver several policy objectives simultaneously. The prioritization framework we have presented here could also be applied at the country or regional level to support local planning.


This study was aimed to clarify the physiological effects of visual stimulation using forest imagery on activity of the brain and autonomic nervous system. Seventeen female university students (mean age, 21.1 ± 1.0 years) participated in the study. As an indicator of brain activity, oxyhemoglobin (oxy-Hb) concentrations were measured in the left and right prefrontal cortex using near-infrared time-resolved spectroscopy. Heart rate variability (HRV) was used as an indicator of autonomic nervous activity. The high-frequency (HF) component of HRV, which reflected parasympathetic nervous activity, and the ratio of low-frequency (LF) and high-frequency components (LF/HF), which reflected sympathetic nervous activity, were measured. Forest and city (control) images were used as visual stimuli using a large plasma display window. After sitting at rest viewing a gray background for 60 s, participants viewed two images for 90 s. During rest and visual stimulation, HRV and oxy-Hb concentration in the prefrontal cortex were continuously measured. Immediately thereafter, subjective evaluation of feelings was performed using a modified semantic differential (SD) method. The results showed that visual stimulation with forest imagery induced (1) a significant decrease in oxy-Hb concentrations in the right prefrontal cortex and (2) a significant increase in perceptions of feeling “comfortable,” “relaxed,” and “natural.”

This study investigates the momentary association between urban greenspace, captured using Normalized Difference Vegetation Index (NDVI) derived from Landsat imagery, and psychological stress, captured using Geographic Ecological Momentary Assessment (GEMA), in the activity spaces of a sample of primarily African American adolescents residing in Richmond, Virginia. We employ generalized estimating equations (GEE) to estimate the effect of exposure to urban greenspace on stress and test for moderation by sex, emotional dysregulation, season, neighborhood disadvantage, and whether the observation occurs at home or elsewhere. Results indicate that urban greenspace is associated with lower stress when subjects are away from home, which we speculate is due to the properties of stress reduction and attention restoration associated with exposure to natural areas, and to the primacy of other family dynamics mechanisms of stress within the home. Subjects may also seek out urban greenspaces at times of lower stress or explicitly for purposes of stress reduction. The greenspace-stress association away from home did not differ by sex, emotional dysregulation, neighborhood disadvantage, or season, the latter of which suggests that the observed greenspace-stress relationship is associated with being in a natural environment rather than strictly exposure to abundant green vegetation. Given the association of urban greenspace with lower stress found here and in other studies, future research should address the mediated pathways between greenspace, stress, and stress-related negative health outcomes for different population subgroups as a means toward understanding and addressing health disparities.


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Soundscape research offers new ways to explore the acoustic environment and potentially address challenges. A comprehensive understanding of soundscape characteristics and quality requires efficient data collection and analysis methods. This paper describes Participatory Soundscape Sensing (PSS), a worldwide soundscape investigation and evaluation project. We describe the calibration method for sound pressure levels (SPL) measured by mobile phone, analyze the PSS’s data temporal-spatial distribution characteristics, and discuss the impact of the participants’ age and gender on the data quality. Furthermore, we analyze the sound comfort level relationships with each class of land use, sound sources, subjective evaluation, sound level, sound harmoniousness, gender, and age using over a year of shared data. The results suggest that PSS has distinct advantages in enhancing the amount and coverage of soundscape data. The PSS data distribution is closely related to the temporal pattern of the human work-rest schedule, population density, and the level of cyber-infrastructure. Adults (19–40 years old) are higher-quality data providers, and women exhibit better performance with respect to data integrity than men. Increasing the proportion of natural source sounds and reducing the proportion of human-made sources of sound is expected to enhance the sound comfort level. A higher proportion of sound harmoniousness leads to higher sound comfort, and the higher proportion of subjective evaluation sound level does not lead to decreased sound comfort. We suggest that the crowdsourcing data with participatory sensing will provide a new perspective in soundscape investigation, evaluation, and planning.


Increasing industrialization, urbanization, and a failure of many world leaders to appreciate the consequences of climate change are deleteriously impacting quality of life as well as diminishing the prospects for long term survival. Economic competitiveness and corporate profitability often pre-empt environmental concerns. The calving of an iceberg in Antarctica and the hurricane activity in the Caribbean during 2017 are unfortunate illustrations of the continuing escalation of environmental issues. We provide historical and current evidence for the importance of Nature Exposure (NE) and introduce the continuum Nature Exposure Sufficiency (NES) and Insufficiency (NEI). Insufficiency includes impoverished environments (e.g., slums and prisons) where nature exposure is very limited. Nature Exposure Sufficiency (NES) is an optimal amount of exposure to nature where many benefits such as reinvigoration can be obtained by everyone. NES also has several benefits for individuals with various health conditions such as arthritis, dementia, or depression. The benefits of NE are not just derivable from parks, forests, and other natural settings. Interiors of buildings and homes can be enhanced with plants and even pictures or objects from nature. Additionally, there is abundant evidence indicating that virtual and artificial environments depicting nature can provide substantial NE and therefore contribute to general wellbeing. Besides the difficulty in achieving cooperation amongst nations, corporations, and other collectives in developing and implementing long range plans to deal with climate change, there is also sometimes an aversion at the individual level whereby people are unwilling to experience nature due to insects and other discomforts. Such individuals are often averse to supplanting the comforts of home, even temporarily, with inadequate facilities that are seemingly less pleasant than their typical dwellings. We propose using the term Nature Exposure Aversion (NEA) to describe such behavior and propose that the aversion is largely due to conditioning. Such behavior may be addressed through desensitization in virtual environments which in turn may contribute to an endorsement of the view that climate
change is occurring and must be dealt with. The issues of Nature Exposure Sufficiency and Insufficiency are intertwined with the sustainability of the planet and future planning and efforts to deal with the environment. If the outcome is unfavorable, the descent of civilization will be more rapid than the ascent.


This paper explores how everyday encounters with two natural phenomena - natural elements and daylight - influence affect and stress levels for people differing in mental health. Nature and daylight exposure both have well-documented beneficial effects on mental health and affect but to what extent their exposure has beneficial effects in daily life is currently under investigated, as is the question whether lower mental health would make one more, or instead, less responsive. To this end, an ecological momentary assessment protocol was employed for a period of 6 days. Fifty-nine participants varying in level of depressive symptoms from none to clinical completed momentary assessments of affect, stress, and their physical environment. Results indicate beneficial effects of nature and daylight on affect and some effects on stress and stress-related outcomes. For nature exposure, but not for daylight exposure, effects were stronger for those in higher need of restoration, stressing the importance of our everyday environment for mental wellbeing.


Purpose: Exposure to nature, particularly vegetation (greenness), may be beneficial for mental health. We investigated whether higher surrounding greenness in early life was associated with subsequent reduced risk of depressive symptoms and whether this association was modified by age, sex, or population density.

Methods: Participants from the Growing Up Today Study were included if they reported on depressive symptoms between 1999 and 2013. Greenness exposure was characterized as the cumulative average normalized difference vegetation index value (1000 m resolution) from 1989 until 2 years before outcome assessment or age 18 based on geocoded addresses. We defined high depressive symptoms as the top 10% of scores on the McKnight Risk Factor Survey or the Center for Epidemiologic Studies of Depression scale, depending on the questionnaire. Data were analyzed using Cox proportional hazards model adjusted for socioeconomic status and other confounders.

Results: There was a 6% lower incidence of high depressive symptoms associated with an interquartile range increase in greenness (95% confidence interval, 11%–0%). This relationship was stronger in higher population density areas (>1000 people/mi², 8% lower incidence, 95% confidence interval 15%–1%).

Conclusion: Living in an area with greater surrounding greenness during childhood may be beneficial for mental health, particularly in more urban areas.

Purpose: Exposure to nature and natural environments may be beneficial for mental health; however, most population-based studies have been conducted among adults whereas few have focused on adolescents. We aimed to investigate the relationship between both greenness (vegetation) and blue space (water), and depressive symptoms among teenagers in the United States.

Methods: The study population included 9,385 participants ages 12–18 in the 1999 wave of the Growing Up Today Study. We characterized greenness exposure using the Normalized Difference Vegetation Index at a 250-m and 1,250-m radius around a subject's residence using data from the moderate-resolution imaging spectroradiometer onboard the National Aeronautics and Space Administration's Terra satellite. Exposure to blue space was defined as the presence of blue space within a 250-m and 1,250-m radius and distance to the nearest blue space. We used logistic regression models to examine associations with high depressive symptoms, measured using self-reported responses to the McKnight Risk Factor Survey.

Results: An interquartile range higher peak greenness in the 1,250-m buffer was associated with 11% lower odds of high depressive symptoms (95% confidence interval .79–.99). Although not statistically significant, this association was stronger in middle school students than in high school students. No such association was seen for blue spaces.

Conclusions: Surrounding greenness, but not blue space, was associated with lower odds of high depressive symptoms in this population of more than 9,000 U.S. adolescents. This association was stronger in middle school students than in high school students. Incorporating vegetation into residential areas may be beneficial for mental health.


The potential health benefits of walking in attractive, predominantly built-up urban settings have not received much attention from scholars, despite the global need to increase walking levels in cities. The current experimental study assessed the affective outcomes associated with several urban walking settings, with a focus on the presence of motor-traffic and architectural styles from different historic periods. We employed a mixed within-between subjects design (n = 269) with employees and students from Bristol (UK) and measured relaxation and hedonic tone experiences, perceived restorativeness, and environmental perceptions following exposures to one of five urban settings. Results identified three categories of affective outcomes, rather than the classic dichotomy 'urban vs natural': the simulated walks in areas with greenery rated significantly better than the others; however, the pedestrianised settings were associated with neutral or positive affective outcomes and perceptions, with statistically significant differences with an area with traffic. These results suggest that walking in high-quality urban settings can have positive outcomes, and highlight the negative role of traffic and the potential benefits of historic elements in the affective walking experience. From a policy perspective, the findings strengthen the case for traffic removal, and indicate that exposure to high quality urban design that includes some natural elements can offer the same affective benefits offered by large green spaces.

Two-thirds of people with dementia reside in their own homes; however, support for community-dwelling people with dementia to continue to participate in everyday activities is often lacking, resulting in feelings of depression and isolation among people living with the condition. Engagement in outdoor activities such as gardening can potentially counteract these negative experiences by enabling people with dementia to interact with nature, helping to improve their physical and psychological well-being. Additionally, the collaborative nature of community gardening may encourage the development of a sense of community, thereby enhancing social integration. Despite increasing evidence supporting its therapeutic value for people with dementia in residential care, the benefits of horticultural therapy have yet to be transposed into a community setting. This paper will examine the theoretical support for the application of horticultural therapy in dementia care, before exploring the potential of horticultural therapy as a means of facilitating improved physical and psychological well-being and social integration for people living with dementia within the community.


Private yards provide city residents with access to ecosystem services that can be realized through passive (vegetation availability) and active (time spent in yards: frequency and duration) means. However, urban densification is leading to smaller yards with less vegetation. Here, we examine how urban form and socio-demographic factors affect the potential ecosystem service benefits people can gain via passive (e.g. climate regulation) and active (e.g. recreation) pathways. Two measures of vegetation cover (0.15–2 m, >2 m) are used as a proxy for passive ecosystem service benefits, and two measures of yard use (use frequency, total time spent across a week) are used for active ecosystem service benefits. We use survey and GIS data to measure personal and physical predictors that could influence these variables for 520 residents of detached housing in Brisbane, Australia. We found house age and yard size were positively correlated with vegetation cover, and people with a greater nature relatedness and lower socio-economic disadvantage also had greater vegetation cover. Yard size was an important predictor of yard use, as was nature relatedness, householder age, and presence of children in the home. Vegetation cover showed no relationship, indicating that greater cover alone does not promote ecosystem service delivery through the active use pathway. Together our results show that people who have higher nature relatedness may receive greater benefits from their yards via both passive and active means as they have more vegetation available to them in their yards and they interact with this space more frequently and for longer time periods.


To mitigate the negative effects of modern cities on health, scientists are focusing on the diverse benefits of natural environments; a conceptual approach to use gardens for promoting human health is being attempted. In this study, the effects of the visual landscape of a traditional garden on psychological and physiological activities were investigated. Eighteen male and
female adults participated in this indoor experiment (mean age, 26.7 years). Twelve different landscape images for city and garden were presented continuously for 90 s. In the time series changes of oxygenated hemoglobin (O2Hb), different patterns of changes were observed between the city and garden. The mean O2Hb values increased for the city landscapes, whereas they decreased for the garden landscapes both in the left and right prefrontal cortices. Significant differences in the negative psychological states of tension, fatigue, confusion, and anxiety were observed between the city and garden landscapes. Important differences in the physiological and psychological responses to the two different landscapes were also detected between male and female participants, providing valuable clues to individual differences in the health benefits of natural landscapes. To validate the use of gardens as a resource for promoting health in urban dwellers, further scientific evidence, active communication, and collaboration among experts in the relevant field are necessary.


We investigated two-directional relations between various types of exposure to the natural world, at work and at home, and employee well-being. In total, 841 employees answered an electronic questionnaire twice with a one-year interval. Path analysis indicated that frequent physical activity in natural surroundings during free time predicted greater vitality over a one-year period after including control variables. The use of one's yard/garden and happiness were marginally positively associated over time. None of the variables involving exposure to the natural world at work were linked to the well-being measures. In the reverse direction, creativity at work predicted more frequent and vitality less frequent use of one's domestic garden. Happiness was marginally positively related to the frequency of physical activity in nature. The results suggest that free time physical activity in natural surroundings is a potential strategy for enhancing employee vitality across time.


The ecological impact of invasive tree pests is increasing worldwide. However, invasive tree pests may also have significant social costs. We investigated the association between the emerald ash borer (EAB)—an invasive tree pest first discovered in the US in 2002—and crime in Cincinnati, Ohio. We used a natural experimental approach, and compared crime (in 11 classes) on census block groups infested with EAB with crime on block groups not infested with EAB between 2005 and 2014. We accounted for demographic and biological differences between infested and un-infested block groups using propensity-score weighting. EAB infestation was significantly and positively associated with relative increases in crime in all but four crime categories. Our results suggest that invasive tree pests may be associated with social costs worth considering when managing invasive species. By extension, healthy trees may provide significant social benefits.

The literature on employee wellbeing (EW) has largely focussed on employees' subjective experiences and has generally assumed that managers' interpretations of EW are consistent and non-problematic. Tensions inherent in managing complex expectations, and diverse results, have not been adequately investigated, and ways in which EW practices are viewed by senior managers have not been sufficiently examined. This paper attempts to fill this gap by exploring the perceptions of senior managers with human resources (HR) responsibilities affecting EW. There is a specific focus on the tensions experienced by these senior managers and the related tactics they adopted to successfully manage them. We gathered data from focus groups made up of 20 senior managers from companies operating in the Milan County in Italy. An analysis of this data identified four predominant dimensions of EW, as well as the tensions felt by the managers and the various tactics they used to overcome them. Finally, we classified the interpretative tactics into four broad resolution strategies.


It is empirically known that wood can cause a comfort enhancement effect in humans. On the other hand, not enough scientific knowledge based on evidence-based research is available on this subject. However, data using physiological indices have increasingly accumulated in recent years. This review provides an overview of the current situation for peer-reviewed reports related to the physiological effects of wood. We reviewed reports that elucidated the effects of wood-derived stimulations on the olfactory, visual, auditory, and tactile sensations using physiological indices such as brain activity (e.g., near-infrared spectroscopy) and autonomic nervous activity (e.g., heart rate variability and blood pressure). It became clear that many studies were limited by (1) a small number of participants, mostly aged in their 20s; (2) use of only a single stimulus (e.g., only olfactory or only visual), or (3) an incomplete experimental design. In addition, this review examined the field of forest therapy, for which there is abundant research. Further study is needed to elucidate the physiological effects of wood on humans.


Background: Shinrin-yoku (experiencing the forest atmosphere or forest bathing) has received increasing attention from the perspective of preventive medicine in recent years. Some studies have reported that the forest environment decreases blood pressure. However, little is known about the possibility of anti-hypertensive applications of Shinrin-yoku. This study aimed to evaluate preventive or therapeutic effects of the forest environment on blood pressure. Methods: We systematically reviewed the medical literature and performed a meta-analysis. Four electronic databases were systematically searched for the period before May 2016 with language restriction of English and Japanese. The review considered all published, randomized, controlled trials, cohort studies, and comparative studies that evaluated the effects of the forest environment on changes in systolic blood pressure. A subsequent meta-analysis was performed. Results: Twenty trials involving 732 participants were reviewed. Systolic blood pressure of the forest environment was significantly lower than that of the non-forest environment. Additionally, diastolic blood pressure of the forest environment was significantly lower than that of the non-forest environment.
Conclusions: This systematic review shows a significant effect of Shinrin-yoku on reduction of blood pressure.


This chapter discusses unexpected qualitative early results of a longitudinal study assessing the impact of biophilic design on a site office with nine workers. A demountable construction site office was retrofitted with plants, natural sunlight, ventilation, open spaces and windows as part of a collaborative effort to green construction supervisors’ spaces. An exploration of humans co-habiting with plants as stewards and shared residents, uncovers some unanticipated findings about human-plant interactions within the site-office, including elements of what anthropologists have called ‘animist’ thinking: treating ‘other-than-human’ living things as types of ‘persons’ with identities and capable of relationships. These new forms of human-nature relations, expressed through a desire to connect with plants, although still largely anthropomorphic, could be viewed as steps towards disrupting dominant views in construction industries that focus on the exceptionalism of humans and dominance of nature.


There is growing scientific recognition that contact with nature in general, and contact with urban green more specific, have the potential to positively contribute to human health. For the purpose of developing healthy urban neighbourhoods, this raises the question how to take scientific evidence about these health benefits into account. Accessibility metrics that are well substantiated by empirical evidence are needed. This paper reviews the quantitative and qualitative aspects relevant for accessibility metrics and empirical studies addressing these aspects in relation to health. Studies comparing different types of green space indicators suggest that cumulative opportunities indicators are more consistently positively related to health than residential proximity ones. In contrast to residential proximity indicators, cumulative opportunities indicators take all the green space within a certain distance into account. Comparing results across studies proved to be hard. Green space accessibility was measured in a variety of ways and the green space indicator that was chosen was often not problematized. We feel that it is time for a more function-oriented approach. How precisely does contact with nature impact health and what type and qualities are relevant in this regard? We think this will lead to a new generation of more evidence-based accessibility metrics that will help to advance the field.


Studies have repeatedly affirmed the positive links between human and environmental health but few have sufficiently addressed the complexity brought about by the range of urbanity, population and both green space and domestic gardens cover associated human settlements. With the global population increasingly residing in cities, the relevance of urbanisation, local population and discrete types of green space provision on measures of health, remains a research imperative. To explore this complexity, a series of regression models were employed to quantify the mitigation of local health deprivation by green space and domestic
gardens, across a four-stage rural-urban gradient, controlling for household income and local population. The population-standardised quantification of green space provision offered greater interpretive power than did a simple measure of land cover density. Domestic gardens, of the two green land-cover types, provided the most convincing mitigating effect on health deprivation. The findings call for increased acknowledgement of urban gardens in local health promotion, and a closer consideration of local population in planning green space provision and management.


This study investigates the impact of austerity plan announcements on employees’ wellbeing. We exploit the unexpected announcement of a drastic wage cut (25%) related to public sector employees in Romania. Using data from the Eurobarometer Surveys and the European Quality of Life Survey, we employ a difference-in-difference research design combined with matching, based on entropy balancing, to identify the causal effects. Our results reveal that the mere announcement of austerity measures leads to an overall drop in life satisfaction among those working in the public sector. We also show that men, and especially married individuals, are most affected by the substantial wage cut announcement. Contrary to previous research, we find that public sector employees with higher levels of education are more likely to be affected by this policy communication compared to those with only secondary or primary levels of education. Our results also suggest that the negative effect of the announcement is not persisting over time.


Oregano essential oil (OEO) has long been used to improve the health of animals, particularly the health of intestine, which is generally attributed to its antimicrobial and anti-inflammatory effects. However, how OEO acts in the intestine of pig is still unclear. This study was aimed at elucidating how OEO promotes the intestinal barrier integrity in a pig model. Pigs were fed a control diet alone or one supplemented with 25 mg/kg of OEO for 4 weeks. The OEO-treated pigs showed decreased \( P < 0.05 \) endotoxin level in serum and increased \( P < 0.05 \) villus height and expression of occludin and zonula occludens-1 (ZO-1) in the jejunum. These results demonstrated that the integrity of intestinal barrier was improved by OEO treatment. The OEO-treated pigs had a lower \( P < 0.05 \) population of Escherichia coli in the jejunum, ileum, and colon than the control. is is in accordance with the greater inactivation \( P < 0.05 \) of inflammation, which was re ected by the mitogen-activated protein kinase (MAPK), protein kinase B (Akt), and nuclear factor κB (NF-κB) signaling pathways and expression of inflammatory cytokines in the jejunum. Our results show that OEO promotes intestinal barrier integrity, probably through modulating intestinal bacteria and immune status in pigs.


Over the last decade, there has been a move by many consumers to purchase locally grown products. Many studies have focused on food with limited studies examining plants. Using an online survey of Connecticut residents in conjunction with a choice experiment, we examine the impact of various attributes (e.g., local labeling, retail outlet, color, bloom, and
price) on preference and willingness to pay (WTP) for azaleas. Results of the latent class model (LCM) indicate that only one of the latent classes, ≈43% of the sample, valued local labeling. Furthermore, the same class that valued local also preferred a nursery/greenhouse outlet over a home improvement center/mass merchandiser. Recommendations for the different retail outlets are given based on the results.


Background: There is increasing appreciation of the proportion of the health burden that is attributed to modifiable population exposure to environmental health hazards. To manage this avoidable burden in the United Kingdom (UK), government policies and interventions are implemented. In practice, this procedure is interdisciplinary in action and multi-dimensional in context. Here, we demonstrate how Multi Criteria Decision Analysis (MCDA) can be used as a decision support tool to facilitate priority setting for environmental public health interventions within local authorities. We combine modelling and expert elicitation to gather evidence on the impacts and ranking of interventions.

Methods: To present the methodology, we consider a hypothetical scenario in a UK city. We use MCDA to evaluate and compare the impact of interventions to reduce the health burden associated with four environmental health hazards and rank them in terms of their overall performance across several criteria. For illustrative purposes, we focus on heavy goods vehicle controls to reduce outdoor air pollution, remediation to control levels of indoor radon, carbon monoxide and fitting alarms, and encouraging cycling to target the obesogenic environment. Regional data was included as model evidence to construct a ratings matrix for the city.

Results: When MCDA is performed with uniform weights, the intervention of heavy goods vehicle controls to reduce outdoor air pollution is ranked the highest. Cycling and the obesogenic environment is ranked second.

Conclusions: We argue that a MCDA based approach provides a framework to guide environmental public health decision makers. This is demonstrated through an online interactive MCDA tool. We conclude that MCDA is a transparent tool that can be used to compare the impact of alternative interventions on a set of pre-defined criteria. In our illustrative example, we ranked the best intervention across the equally weighted selected criteria out of the four alternatives. Further work is needed to test the tool with decision makers and stakeholders.


Background: Allotments in the UK are popular and waiting lists long. There is, however, little evidence on the health benefits of allotment gardening. The aims of this study were to determine the impacts of a session of allotment gardening on self-esteem and mood and to compare the mental well-being of allotment gardeners with non-gardeners.

Methods: Self-esteem, mood and general health were measured in 136 allotment gardeners pre- and post- an allotment session, and 133 non-gardener controls. Allotment gardeners also detailed the time spent on their allotment in the current session and previous 7 days, and their length of tenure.

Results: Paired t-tests revealed a significant improvement in self-esteem (P < 0.05) and mood (P < 0.001) as a result of one allotment session. Linear regression revealed that neither the time spent on the allotment in the current session, the previous 7 days or the length of tenure...
affected the impacts on self-esteem and mood (P > 0.05). One-way ANCOVA revealed that allotment gardeners had a significantly better self-esteem, total mood disturbance and general health (P < 0.001), experiencing less depression and fatigue and more vigour (P < 0.0083).

Conclusions: Allotment gardening can play a key role in promoting mental well-being and could be used as a preventive health measure.


Environment-health research has shown significant relationships between the quantity of green space in deprived urban neighbourhoods and people’s stress levels. The focus of this paper is the nature of access to green space (i.e., its quantity or use) necessary before any health benefit is found. It draws on a cross-sectional survey of 406 adults in four communities of high urban deprivation in Scotland, United Kingdom. Self-reported measures of stress and general health were primary outcomes; physical activity and social wellbeing were also measured. A comprehensive, objective measure of green space quantity around each participant’s home was also used, alongside self-report measures of use of local green space. Correlated Component Regression identified the optimal predictors for primary outcome variables in the different communities surveyed. Social isolation and place belonging were the strongest predictors of stress in three out of four communities sampled, and of poor general health in the fourth, least healthy, community. The amount of green space in the neighbourhood, and in particular access to a garden or allotment, were significant predictors of stress. Physical activity, frequency of visits to green space in winter months, and views from the home were predictors of general health. The findings have implications for public health and for planning of green infrastructure, gardens and public open space in urban environments.


Experimental research shows that there are perceived and actual benefits to spending time in natural spaces compared to urban spaces, such as reduced cognitive fatigue, improved mood, and reduced stress. Whereas past research has focused primarily on distinguishing between distinct categories of spaces (i.e., nature vs. urban), less is known about variability in perceived restorative potential of environments within a particular category of outdoor spaces, such as gardens. Conceptually, gardens are often considered to be restorative spaces and to contain an abundance of natural elements, though there is great variability in how gardens are designed that might impact their restorative potential. One common practice for classifying gardens is along a spectrum ranging from "formal or geometric" to "informal or naturalistic," which often corresponds to the degree to which built or natural elements are present, respectively. In the current study, we tested whether participants use design informality as a cue to predict perceived restorative potential of different gardens. Participants viewed a set of gardens and rated each on design informality, perceived restorative potential, naturalness, and visual appeal. Participants perceived informal gardens to have greater restorative potential than formal gardens. In addition, gardens that were more visually appealing and more natural-looking were perceived to have greater restorative potential than less visually appealing and less natural gardens. These perceptions and precedents are highly relevant for the design of gardens and other similar green spaces intended to provide relief from stress and to foster cognitive restoration.

We analyzed the relationship between crime and indicators of residential yard management in Baltimore City and County. Data came from a survey we conducted of over one thousand front yards that included more than 40 indicators relating to lawns, trees, shrubs, beds and other features. These indicators were related to point counts of crime at the 150 m scale using a combination of ordinary least squares, spatial error, and Poisson regressions. After controlling for income, population density, block-scale tree canopy, and housing type, we found a consistently significant relationship between crime and a number of indicators of yard management. Yard-level variables that were negatively associated with crime included: the presence of yard trees, garden hoses/sprinklers, and lawns, in addition to the percentage of pervious area in a yard. Those positively associated with crime included presence of litter, desiccation of the lawn, lack of cutting of the lawn, and number of small trees in front of or adjacent to the property. While these results do not establish causality, they add evidence to a growing literature that suggests the possibility of several mechanisms by which environmental design may reduce crime: “cues to care” (the inverse of the “broken window” hypothesis) can lead to reduced crime by signaling to criminals the presence of social capital and the active involvement of neighbors in community spaces; and more appealing landscaping draws more “eyes on the street,” which in turn deters criminals.


Recruitment and training of new volunteers is necessary to grow a Master Gardener organization, but retention of current individuals has advantages. Aligning reasons for volunteering with recruitment and continuing education topics with the interests of volunteers is essential in a successful recruitment and retention plan. The objectives of this study were to determine the motivations for volunteering in the Iowa Master Gardener program and to identify popular continuing education topics, preferred delivery methods, and social media usage among this audience. Learning about gardening and horticulture was the most important reason Iowa Master Gardeners volunteer with the program. In addition, altruism is important to these volunteers, but they do not recognize the full impact their projects have on their local community. They have a strong interest in learning about native plants and sustainable horticultural practices. The most preferred delivery methods were live presentations and workshops. Video presentations and webinars were generally less preferred. Respondents used certain social media sites, such as Facebook and Pinterest, some or a lot. Although this study was limited to Iowa Master Gardeners, results regarding motivation factors align closely with previous studies. We speculate that the results for advanced training topics, delivery methods, and social media usage would similarly align for Master Gardener programs across the country.


Humans have evolved into what they are today after the passage of 6–7 million years. If we define the beginning of urbanization as the rise of the industrial revolution, less than 0.01% of our species’ history has been spent in modern surroundings. Humans have spent over 99.99%
of their time living in the natural environment. The gap between the natural setting, for which our physiological functions are adapted, and the highly urbanized and artificial setting that we inhabit is a contributing cause of the “stress state” in modern people. In recent years, scientific evidence supporting the physiological effects of relaxation caused by natural stimuli has accumulated. This review aimed to objectively demonstrate the physiological effects of nature therapy. We have reviewed research in Japan related to the following: (1) the physiological effects of nature therapy, including those of forests, urban green space, plants, and wooden material and (2) the analyses of individual differences that arise therein. The search was conducted in the PubMed database using various keywords. We applied our inclusion/exclusion criteria and reviewed 52 articles. Scientific data assessing physiological indicators, such as brain activity, autonomic nervous activity, endocrine activity, and immune activity, are accumulating from field and laboratory experiments. We believe that nature therapy will play an increasingly important role in preventive medicine in the future.

Soga, M., et al. (2016). "Gardening is beneficial for health: A meta-analysis." Preventive Medicine Reports. There is increasing evidence that gardening provides substantial human health benefits. However, no formal statistical assessment has been conducted to test this assertion. Here, we present the results of a meta-analysis of research examining the effects of gardening, including horticultural therapy, on health. We performed a literature search to collect studies that compared health outcomes in control (before participating in gardening or non-gardeners) and treatment groups (after participating in gardening or gardeners) in January 2016. The mean difference in health outcomes between the two groups was calculated for each study, and then the weighted effect size determined both across all and sets of subgroup studies. Twenty-two case studies (published after 2001) were included in the meta-analysis, which comprised 76 comparisons between control and treatment groups. Most studies came from the United States, followed by Europe, Asia, and the Middle East. Studies reported a wide range of health outcomes, such as reductions in depression, anxiety, and body mass index, as well as increases in life satisfaction, quality of life, and sense of community. Meta-analytic estimates showed a significant positive effect of gardening on the health outcomes both for all and sets of subgroup studies, whilst effect sizes differed among eight subgroups. Although Egger's test indicated the presence of publication bias, significant positive effects of gardening remained after adjusting for this using trim and fill analysis. This study has provided robust evidence for the positive effects of gardening on health. A regular dose of gardening can improve public health.

Smith, K. P. (2016). "Member Participation in a Community-Based Approach to Home Gardening and its Relation to Intermediate Health Behaviors and Health Outcomes." Growing food locally, through community-supported agriculture, community gardens, and home gardens, can increase availability, accessibility, and affordability of fruits and vegetables. Although numerous studies have demonstrated the potential associations between local food production and healthy diets within the community garden context, fewer studies have focused on the role of the home garden and whether it is amenable to intervention. In a predominantly low-income and Latino community in west Denver, Re:Vision International aims to promote the use of home gardens to improve diet, activity, blood pressure, weight status, and overall health. In partnership with Re:Vision, we conducted a post-hoc analysis of survey data to understand the associations between participation in the home garden program and diet, self-
reported health, exercise, body mass index, and blood pressure (n=37). After adjusting for income, marital status, gender, age, and neighborhood attachment, no statistically significant relationships were observed. These analyses are severely limited by a small sample size. However, the direction, dose response relationship, and biological significance suggest that further investigation of home gardens and population health outcomes are warranted. Although no definite conclusions can be drawn, the literature and the direction of the results suggests that participation in a community-based intervention to home gardening may have the potential to change resident’s diet and blood pressure. Further research is needed to confirm these postulations.


Ecosystem services have a significant impact on human wellbeing. While ecosystem services are frequently represented by monetary values, social values and underlying social benefits remain underexplored. The purpose of this study is to assess whether and how social benefits have been explicitly addressed within socio-economic and socio-cultural ecosystem services research, ultimately allowing a better understanding between ecosystem services and human well-being. In this paper, we reviewed 115 international primary valuation studies and tested four hypotheses associated to the identification of social benefits of ecosystem services using logistic regressions. Tested hypotheses were that (1) social benefits are mostly derived in studies that assess cultural ecosystem services as opposed to other ecosystem service types, (2) there is a pattern of social benefits and certain cultural ecosystem services assessed simultaneously, (3) monetary valuation techniques go beyond expressing monetary values and convey social benefits, and (4) directly addressing stakeholders views the consideration of social benefits in ecosystem service assessments. Our analysis revealed that (1) a variety of social benefits are valued in studies that assess either of the four ecosystem service types, (2) certain social benefits are likely to co-occur in combination with certain cultural ecosystem services, (3) of the studies that employed monetary valuation techniques, simulated market approaches overlapped most frequently with the assessment of social benefits and (4) studies that directly incorporate stakeholder's views were more likely to also assess social benefits.


The study explores perceived advantages and barriers of buying cut flowers online by German customers. In August 2014, four focus group discussions were conducted; two each in southern and in western Germany, including both rural and urban regions. The discussions were audio-recorded, transcribed verbatim and analyzed using qualitative content analysis. Results show that regular buyers report positive experiences with online flower shops. They are satisfied with flower quality, and perceive the online shops as easy to use. Despite these positive experiences, online flower shops are only considered for gifts, in particular, if there is no opportunity to meet the recipient in person.

Fostering ecosystem services in urban road corridors is an important challenge for urban planning and governance because residents are often exposed to environmental pressures in these ubiquitous open spaces. We here aim at illustrating multiple ecosystem services that may be underpinned by roadside vegetation. Previous work is broadly scattered in papers from the natural and social sciences and biased by a focus both on regulating services (temperature regulation, air filtration, carbon sequestration) and also on trees. We provide a first synthesis that illustrates (i) the multi-functional capacity of green elements in streetscapes to deliver various ecosystem services; (ii) the relevance of planted and wild-grown herbaceous vegetation as well as trees; and (iii) trade-offs between certain ecosystem services as well as risks related to disservices. Trees and herbaceous road vegetation can mitigate adverse environmental conditions in road corridors, which is particularly important in vulnerable neighborhoods that are undersupplied with green spaces. Enhancing the amenity value of streetscapes might also positively influence public health by promoting physical activity. However, significant knowledge gaps exist, e.g. on the contribution of biodiversity to ecosystem services and on the valuation of green street components by different sociocultural groups. Our synthesis illustrates management options that can support planning and governance approaches toward more livable streetscapes by fostering ecosystem services and counteracting disservices.


Nature is thought to enrich well-being: The more time people spend in nature, the happier they feel. But how consistent is this link, and what mechanisms might account for the salutogenic effects of nature on well-being? The aim of this thesis was to investigate the beneficial effects of nature on emotional well-being in people’s daily lives and to deepen the scientific understanding of the mechanism(s) linking nature to emotional well-being. Following a brief overview of this thesis (Chapter 1 - Introduction), I discuss the current literature on nature and well-being, focusing on theories of biophilia and attentional theories that might account for the nature and well-being relationship (Chapter 2 - Literature Review). In the literature review, I identify several gaps in current research and discuss one possible mediator of the link between nature and well-being - the concept of fascination (defined as the extent to which attention is drawn effortlessly by objects in the environment). Next, I present a series of five empirical studies (Study 1-5) consisting of one correlational daily diary study and four field experiments that collectively sought to test the relationship between nature and two markers of well-being – increased positive affect and decreased negative affect. Study 1-2 explored and established fascination as a reliable mediator of the relationship between nature and positive affect (PA). Study 3-4 replicated fascination as a mediator of the nature-PA link and also eliminated two other potential mediators - mindfulness (Study 3) and heart rate variability as a physiological indicator (Study 4). After establishing fascination as the standard mediator which explains how nature may influence positive affect (PA), Study 5 investigated several other potential factors which together mediated the nature and PA link (fascination, fluency, and savoring).

Path analyses in Study 5 using multi-level structural equation modeling (MSEM) suggested that daily fascination, fluency, and savoring collectively mediated the link between nature and PA: experiencing more fascination in nature contributed to greater fluency in nature, and this fascination-fluency circuit enhanced the experience of savoring, contributing to increases in daily PA. Overall, the results across all five studies confirmed the positive relationship between nature and PA in daily life, and suggested that the cognitive quality of
experiences in nature (fascination and fluency) and emotion regulation following nature 
(savoring) may explain why people feel happier after spending time in nature. In the General 
Discussion, I discuss these findings and the contribution made by this thesis to the literature on 
nature and emotional well-being.

Refaat, T., et al. (2016). "Environmental benefits of green infrastructure techniques and 

Green areas are very important to the ecosystem and to the people who live around them. However, many of these areas have been degraded by human behaviour towards the 
environment. There are three steps involved in solving these problems; the first is to stop the 
abuse, the second is the restoration phase, and, finally, monitoring and maintenance are required. 
The main aim of this paper is to develop the means to restore our buildings and their surrounding 
areas by using green infrastructure techniques in general and green roofs specifically. Green 
infrastructure refers to the natural and engineered systems that act as a living infrastructure; it 
integrates natural vegetation and soils into the community’s fabric through a variety of 
techniques, approaches, technologies and practices. The importance of green infrastructure goes 
beyond the restoration of buildings and their surrounding spaces and extends to social, economic 
and environmental integrity.

The methodology includes a literature review and analyzed examples of applications of 
the green roof method. The research concludes with some recommendations regarding the use of 
green infrastructure generally, and, having shown their positive impact, of green roofs 
specifically.

Pouya, S., et al. (2016). "Restorative Garden as an Useful Way to Relieve Stress in 
Megacities, a Case Study In Istanbul." İNÖNÜ ÜNİVERSİTESİ SANAT VE TASARIM 
DERGİSİ 6(13).

The stress and disorders of the urban life and the pollutions in the large cities such as 
Istanbul, have made the social and individual health decrease, and therefore it is necessary that 
some tact be considered in order to diminish these negative effects. The aim of this study is to 
examine whether there is a relation between restorative gardens in the city and stress. In other 
words, can restorative gardens surrounding residential homes in cities help to create a less 
stressful everyday environment? This paper will begin with a cursory overview of a broad 
concept of stress, health and wellness and proceed to examine in detail Ulrich’s Theory of 
Restorative Garden Design and its implications for gardens in cities. Research shows that 
benefits would accrue to society as a whole if these design features were implemented on a wide 
scale.


More and more researchers are finding anxiety and stress as critical health problems 
influencing quality of life and various illnesses. Studies suggest gardening activities help with 
anxiety. Our goal is to create engaging ways for people to interact with plants and eventually 
reduce anxiety and stress. We made three short games employing a person’s touch interaction 
with a plant as the input interface. Each of the three games implements a unique interaction: 
tapping, patting, and gentle pinching. We then tested the games with ten players, among whom 
five of them (the plant group) played the games with the plant as the input interface. The other 
five (the non-plant group) played the games with a pressure sensor board. The plant group
showed decreased anxiety with a borderline statistical significance (p=0.054) with Cohen’s d of 0.20 (i.e., ‘small’ effect), while the non-plant group showed a non-significant decrease in anxiety after the gameplay (p=0.65). We further examined which in-game elements contributed to calming the participants as well as the design elements that need to be improved for plant-based games.


The study’s objective was to investigate the effects of foliage plants on prefrontal cortex activity and subjective assessments of psychological relaxation. In a crossover experimental design, 24 male university students in their 20s observed a container with and without foliage plants for 3 minutes while oxyhemoglobin (oxy-Hb) concentration in the prefrontal cortex was continuously measured with a portable near-infrared (NIR) spectroscopy device. Afterward, subjective evaluations of emotions were obtained via two self-report questionnaires: a modified semantic differential (SD) method and the Profile of Mood State questionnaire (POMS). Oxy-Hb concentration in the right prefrontal cortex was significantly lower in subjects who viewed the foliage plants than in those who did not, indicating a physiologically relaxed state. The subjects also reported in the SD method significantly more positive emotions (e.g., comfortable, natural, and relaxed) associated with viewing the foliage plants. In the POMS, a significant positive effect on psychological relaxation when subjects viewed the foliage plants was shown. Thus, we conclude that foliage plants have both physiological and psychological relaxation effects in males even after only short exposure.


The present study aimed to assess the physical and psychological health benefits of a 15-session gardening intervention in elderly women and to investigate satisfaction of the gardening intervention. Fifty elderly women (age >70 years) at two senior community centers located in Seoul, South Korea, were selected to participate in this study. Twenty-four elderly women at senior community center “A” participated in a twice-weekly gardening intervention (∼50 minutes per session) during the period Sept. to Nov. 2015; 26 elderly women at senior community center “B” comprised a control group. At the completion of the 15-session gardening intervention, physical health parameters such as body composition, physical functional ability, and hand function ability were assessed in both groups. Additionally, psychological health conditions, such as cognitive ability, depression, and sociality, were assessed. The elderly women also answered a questionnaire to assess the amount of physical activity experienced during daily life. Elderly women in the gardening intervention group exhibited significantly improved muscle mass, aerobic endurance, hand dexterity, cognitive ability, and decreased waist circumference (P < 0.05). In contrast, significantly decreased muscle mass and agility and increased depression were observed in the control group (P < 0.05). Moreover, elderly women in the gardening intervention group reported a significantly higher amount of daily physical activity compared with those in the control group (P < 0.05). Additionally, 95.8% of elderly women in the gardening intervention group reported of being very satisfied with the gardening intervention. In conclusion, the gardening intervention maintained and improved the physical and psychological health of elderly women at a senior community center, whereas elderly women in
the control group experienced age-related reduced physical and psychological health conditions. More studies are needed to evaluate the effects of a gardening intervention in a larger population of elderly women; in addition, a longer intervention period would provide a better measure of health in elderly women.


Sandalwood essential oil (SEO) is extracted from Santalum trees. Although α-santalol, a main constituent of SEO, has been studied as a chemopreventive agent, the genotoxic activity of the whole oil in human breast cell lines is still unknown. The main objective of this study was to assess the cytotoxic and genotoxic effects of SEO in breast adenocarcinoma (MCF-7) and nontumorigenic breast epithelial (MCF-10A) cells. Proteins associated with SEO genotoxicity were identified using a proteomics approach. Commercially available, high-purity, GC/MS characterized SEO was used to perform the experiments. The main constituents reported in the oil were (Z)-α-santalol (25.34%), (Z)-nuciferol (18.34%), (E)-β-santalol (10.97%), and (E)-nuciferol (10.46%). Upon exposure to SEO (2–8 μg/mL) for 24 hours, cell proliferation was determined by the MTT assay. Alkaline and neutral comet assays were used to assess genotoxicity. SEO exposure induced single- and double-strand breaks selectively in the DNA of MCF-7 cells. Quantitative LC/MS-based proteomics allowed identification of candidate proteins involved in this response: Ku70 (), Ku80 (), EPHX1 (), and 14-3-3ζ (). These results provide the first evidence that SEO is genotoxic and capable of inducing DNA single- and double-strand breaks in MCF-7 cells.


AbstractBackground Flowers are reported to have immediate and long-term effects on health and well-being, emotional reactions, mood, social behaviour and memory, but emotional effects have rarely been studied in more detail. Methods This study investigated the influences of flowers on emotional perception of others in healthy adults (n = 64), divided over 4 conditions (3 flower arrays and a flowerless control). The test included a projection test judging pictures of people. One week later memory regarding pictures in the projection test, roommates and the room they had been in, was tested. Results Flowers, positively affected peoples’ mood and their perception of others. With flowers, pictures of other people were judged more positively and less negatively than without flowers. Odorous flowers had a more negative effect. The people in the pictures seemed a bit more open, but clearly less friendly, more arrogant and more depressed under its influence. Furthermore, flowers had a positive influence on the remembrance of the room the participants had been in. Conclusion Flowers exert a more positive influence by their visual appearance than by their odour, and act more on people’s feelings towards unknown others than on liking of the food they eat, whereas flowers have little impact on remembering eating situation aspects. Practical implication The use of flowers might perhaps be recommended for increasing relaxation and mutual understanding in public places (restaurants (non-odorous flowers), meeting rooms and waiting rooms).

Previous research has demonstrated positive associations between the greenness of high school landscapes and school-wide academic performance. We do not know, however, if green landscapes cause better performance or if the association between the two is a product of self-selection. If there is a causal relationship, the pathways through which green school landscapes affect student performance remain unclear. We hypothesize that views onto green landscapes help students recover from mental fatigue and stress. To test these hypotheses, we conducted a randomized controlled experiment with 94 high school students at five high schools. Participants were randomly assigned to classrooms without windows or with windows that opened onto a built space or a green space. Participants engaged in typical classroom activities followed by a break in the classroom to which they were assigned. Attentional functioning was measured using Digit Span Forward and Backwards. Physiological stress levels were measured by skin conductance, body temperature, pNN50 (the proportion of the number of pairs of successive NNs that differ by more than 50 ms divided by the total number of NNs) and LF/HF (the ratio between low-frequency peak and high frequency peak). Results demonstrate that classroom views to green landscapes cause significantly better performance on tests of attention and increase student's recovery from stressful experiences. A lack of mediation effect demonstrates that attention restoration and stress recovery are two distinct processes. Implications for school site selection, design and renovation are discussed.


During a recent presentation, Bill Browning, a founding partner of the environmental design consultancy Terrapin Bright Green, LLC, asked everyone in the audience to imagine their favorite place to go when they wanted to de-stress and relax (Isle, 2014). He then asked everyone to raise their hands if the place they had pictured was located outdoors. Nearly all the hands went up. This simple exercise revealed both the inherent connection humans feel towards nature and the disconnection from nature that has been created within the modern built environment.

The movement towards sustainable design and construction practices has largely led to standardized methods of lowering energy consumption and using resources and building materials more efficiently. Building and business owners have benefited from these practices as ways to cut costs and boost their bottom lines. In recent years, however, there has been a growing belief that focusing solely on low-environmental-impact building designs ignores a fundamental factor necessary for long-term sustainability and future financial growth: people. The overwhelming majority of business costs are spent on staffing and human resource needs. Therefore, investing in the human side of business can recover lost productivity and increase profits while simultaneously fostering vibrant, healthy and beautiful workplaces.

Heightening the importance of investing in the people of businesses and institutions has led to a resurgence of the theory of biophilia and, more recently, biophilic design. These concepts give a name to the feelings evoked by the thought exercise described above. Psychologists and biologists have posited that not only are human beings innately drawn to natural settings and elements, but that having contact with nature or natural patterns within the built environment results in increased employee engagement, efficiency and well-being.

The following report synthesizes a great extent of the research available through 2015 on biophilia and biophilic design, especially as it relates to observed effects on employees in the workplace. The intent is to provide an additional layer of information to inform strategic decision-makers and identify new evidence-based priorities related to design, human resources,
and financial allocations. After defining the terms, the significance and implications of biophilic design in the workplace will be discussed in depth, and several studies of its effects on employees and businesses will be presented.


This study aims to assess forest healing programs to middle-aged people in Korea with metabolic syndrome as a method to control the syndrome through prevention and health improvement rather than treatment. In order to develop healing programs in the urban forests for metabolic syndrome patients, environment condition of the forests and moods of participants were compared. Thermal environments and the concentration of phytoncides were analyzed by the site. Saneum Healing Forest had a lower temperature but a higher humidity than Seoul Forest. Seoul Forest had higher PMV and PPD levels than Saneum Healing Forest, providing patients with freshness. This seems to be due to the seasonal factor of autumn. As for the total emissions of phytoncide, mountain forest generated more than urban forest. Nine components out of investigated twenty turned out to be generated more in the urban forests. The atmospheric composition of phytoncides, volatile organic compounds that are released from vegetation, was analyzed at both sites. Profile of Mood States (POMS) was measured before and after the healing program. The POMS suggested that forest environments reduce stress and increase comfort, calm, and feelings of refreshment. The tendency towards positive mood state in the forest recommend that middle-aged Metabolic syndrome patients participate in healing programs in the forests.


Ecosystem services (ES) are an important tool for quantifying the value of nature, yet there are often disconnects between services defined and measured by scientists and those that are realized and appreciated by the general public. Our study explored public perceptions of urban ES by examining benefits associated with greenways in two U.S. cities. Respondents (n =460) recognized all types of ES, though environmental benefits (e.g., air and water quality regulation; acknowledged by 74% of respondents) were less widely recognized than cultural benefits (e.g., economic impacts, social connectivity; 90%) or experiential benefits (e.g., attractive scenery, recreation; 98%). The distinction between these last two categories is rarely made in conventional ES frameworks, but it may be practically significant from the public’s perspective. Benefit perceptions varied across geographic and socio-demographic contexts. Enhanced integration of cultural and experiential benefits into urban ES frameworks could lead to more equitable and informed decisions about the provision, management, and valuation of urban green space across diverse settings and populations.


Sustainable development efforts in urban areas often focus on understanding and managing factors that influence all aspects of health and wellbeing. Research has shown that public parks and green space provide a variety of physical, psychological, and social benefits to urban residents, but few studies have examined the influence of parks on comprehensive measures of subjective wellbeing at the city level. Using 2014 data from 44 U.S. cities, we
evaluated the relationship between urban park quantity, quality, and accessibility and aggregate self-reported scores on the Gallup-Healthways Wellbeing Index (WBI), which considers five different domains of wellbeing (e.g., physical, community, social, financial, and purpose). In addition to park-related variables, our best-fitting OLS regression models selected using an information theory approach controlled for a variety of other typical geographic and socio-demographic correlates of wellbeing. Park quantity (measured as the percentage of city area covered by public parks) was among the strongest predictors of overall wellbeing, and the strength of this relationship appeared to be driven by parks’ contributions to physical and community wellbeing. Park quality (measured as per capita spending on parks) and accessibility (measured as the overall percentage of a city’s population within ½ mile of parks) were also positively associated with wellbeing, though these relationships were not significant. Results suggest that expansive park networks are linked to multiple aspects of health and wellbeing in cities and positively impact urban quality of life.


A cohort of sixth grade students at two newly constructed elementary schools in Seoul, South Korea, performed a self-assessment of ocular discomfort symptoms in association with indoor air quality (IAQ) by indoor plant intervention from early June to mid-Oct. 2011. Indoor plant intervention made little difference in air temperature and relative humidity, but stabilized the increasing levels of carbon dioxide. The indoor concentrations of formaldehyde and ethylbenzene showed little difference, but those of toluene and xylene showed a decreasing trend in classrooms with indoor plants. The participants in classrooms without indoor plants exhibited an increase in ocular discomfort symptoms at School A and a decrease in symptoms at School B; those in classrooms with indoor plants demonstrated a decrease in frequency at both schools. The variation of symptom severity did not follow a clear trend. Participants assessed their symptom severity of ocular discomfort with four options from three points for frequent occurrence to zero points for no occurrence. Among participants in classrooms without indoor plants, symptom severity significantly worsened at both schools as the scores increased from 1.96 to 2.17 at School A and from 2.27 to 2.34 at School B; among those in classrooms with indoor plants, symptom severity significantly lessened at School A and slightly worsened at School B as the scores decreased from 2.33 to 1.98 at School A and increased from 2.35 to 2.42 at School B. After spending the experimental duration in classrooms without indoor plants at both schools, 34.8% of participants at School A and 33.3% of participants at School B perceived their symptom severity as having increased. At Schools A and B, indoor plants decreased the frequency of participants experiencing an increase of symptom severity by 13.0% and 9.7%, and increased the frequency of participants reporting decrease of symptom severity by 34.8% and 22.6%.


Therapeutic impact of foliage plants and flower arrangements were evaluated on the post-operative recovery of surgical patients in hospital wards. A total of 270 surgical patients were randomly assigned to two hospital wards with plants and without plants representing ward A and ward B, respectively, making a lot of one hundred and thirty five patients in each comparing
ward. Data collected includes parameters for evaluating patients’ physiological status, intake of postoperative analgesics, Environmental Assessment Scale, Patient’s personal preferences for plants and flowers. More effective health signs were observed for patients admitted in the ward A than those in the ward B. Patients admitted in ward A had significantly fewer (30%) consumption of strong postoperative analgesic in comparison to ward B (40%) due to more normal psychological and cognitive responses. More Patients in plant group experienced mild intensity of pain (41.5%), anxiety (41.5%), fatigue (49.6%) as compared to patients in ward B, who experienced severe level of pain, anxiety and fatigue. Patients in ward A were observed with an elevated mood and were socially more active and friendly towards other patients and nursing staff, expressing more positive feelings and describe ward atmosphere more calming, soothing and satisfying in contrast to patients in control group i.e., ward B. Additionally, most of the patients (45%) in ward A preferred cut flowers, especially red color roses over the green and variegated foliage plants. Furthermore, small group discussion and focal interviews with nurses and doctors affirm that arrangement of plants and flowers in hospitals is an effective, inexpensive and more productive complementary approach in medical field for surgical patients.


Young children’s outdoor play serves important and diverse purposes, including physical exercise and opportunities for growth in all developmental areas. Unfortunately, the amount of time that children spend engaged in unstructured, child-directed outdoor play has diminished significantly in the past generation. In this article, the authors describe some of the reasons for this decline and outline the research-supported benefits of outdoor play in general, as well as benefits of play in natural outdoor environments in particular. Suggestions for making the most of outdoor play will benefit children around the world.


People put plants indoors to create a pleasant interior space and to make the indoor air fresher. However, the placement of indoor plants is more instinctive or artistic rather than rational. Thus, this necessitates a systematic method for placing plants indoors to gain positive results for improving the quality of our well-being. This paper aims to investigate the effect of the number and size of plants on perceived air quality, mood, attention, and productivity. An experiment consisting of two variations on the number of plants and three variations on the size of plants was conducted for this study. 18 subjects consisted of 10 males and 8 females with average age of 23.5 years old participated in the study. All subjects performed in all treatments in the experiment with a repeated measures design. From the experiment, it was found that room with 3 small and medium sized plants (3-S and 3-M) produced the highest mood, room with 1-S, 3-M and 3-L produced the smallest reaction time, room with 1-S produced the highest productivity, and room with 3-S has the highest perceived air quality. In conclusion, the number of plants had an impact on the mood of the subjects; the larger the number of plants, the better the mood of the subjects. It was also revealed that interactions between the number and the size of plants affected the perceived air quality and reaction time.

Background/Objectives: physical activity may be beneficial in reducing depression incidence among the elderly. A key unanswered question is whether certain types of physical activity are particularly associated with decreased depression incidence. We examined the relationship between quantity and type of physical activity and subsequent depression using longitudinal data from elderly adults in New York City (NYC).

Methods: we followed 3,497 adults aged 65–75 living in NYC for three years. Total physical activity was measured using the Physical Activity Scale for the Elderly (PASE) and type of physical activity was measured using a latent class analysis of PASE item responses. We used generalised estimating equations to measure the relationship between quantity and latent class of physical activity at waves 1–2 and depression at waves 2–3, controlling for wave-1 depression.

Results: individuals in the second highest quartile (50–75%) (odds ratio (OR) = 0.45; 95% confidence interval (CI) = 0.23, 0.88) and highest quartile of activity (OR = 0.31; 95% CI = 0.16, 0.63) had lower odds of depression. Among all subjects, athletic types (OR = 0.25; 95% CI = 0.12, 0.51) and walker types (OR = 0.58; 95% CI = 0.34, 0.99) had lower odds of depression. Among non-disabled participants, walkers (OR = 0.36; 95% CI = 0.18, 0.73), athletic types (OR = 0.14; 95% CI = 0.06, 0.32), domestic/gardening types (OR = 0.29; 95% CI = 0.12, 0.73) and domestic/gardening athletic types (OR = 0.13; 95% CI = 0.02, 0.75) had lower odds of depression.

Conclusion: respondents who practised the highest levels of physical activity and who performed athletic activities were at lower risk for depression. Interventions aimed at promoting athletic physical activity among older adults may generate benefits for mental health.

mitigate the effects of climate change; in addition, evidence of an association between vegetation and lower mortality rates suggests it also might be used to improve health.


Assessing the cultural benefits provided by non-market ecosystem services can contribute previously unknown information to supplement conservation decision-making. The concept of sense of place embeds all dimensions of peoples’ perceptions and interpretations of the environment, such as attachment, identity or symbolic meaning, and has the potential to link social and ecological issues. This review contains: (1) an evaluation of the importance of sense of place as an ecosystem service; and (2) comprehensive discussion as to how incorporating sense of place in an evaluation can uncover potential benefits for both biodiversity conservation and human well-being. Sense of place provides physical and psychological benefits to people, and has neglected economic value. The biodiversity-related experiences are essential components of the service that need to be further explored. A conceptual framework was used to explore how the existing knowledge on sense of place derived from other fields can be used to inform conservation decision-making, but further research is needed to fill existing gaps in knowledge. This review contributes to a better understanding of the role biodiversity plays in human well-being, and should inform the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).


Natural features, settings, and processes in urban areas can help to reduce stress associated with urban life. In this and other ways, public health benefits from, street trees, green roofs, community gardens, parks and open spaces, and extensive connective pathways for walking and biking. Such urban design provisions can also yield ecological benefits, not only directly but also through the role they play in shaping attitudes toward the environment and environmental protection. Knowledge of the psychological benefits of nature experience supports efforts to better integrate nature into the architecture, infrastructure, and public spaces of urban areas.


The article focuses on the importance of nature and forest therapy in improving one's mental health. Topics discussed include mechanisms of action of nature therapy, research findings on the effect of nature therapy on health, and the reason of major health care providers and medical practitioners in the U.S. in implementing forest therapy in their scope of care.


Fourteen people attending an adult day programme were recruited to a structured horticultural therapy programme which took place over 10 weeks. The effects were assessed using Dementia Care Mapping and questionnaires completed by family carers. High levels of wellbeing were observed while the participants were engaged in horticultural therapy, and these were sustained once the programme was completed. This study adds to the growing evidence on
the benefits of horticultural therapy for people with dementia who have enjoyed gardening in the past.

Guo, J. (2016). The effects of biophilic design in interior environments on noise perception: Designing a person-centered biophilic space for older adults, IOWA STATE UNIVERSITY.

Research suggests that the contemporary built environment has increasingly isolated people from the beneficial experience of natural systems and processes due to societal trends such as urbanization, building design and life style. Biophilia and biophilic design promise to foster a positive relationship to nature. Studies of psychological effects of biophilic design on noise perception have primarily focused on the attributes of natural elements in outdoor area. The aim of this study is to analyze how the visual characteristics of an interior space can influence the subjective loudness and annoyance of noise in older adults. Data were collected by conducting visual and audiovisual experiments and by analyzing content analysis, ANOVA and correlation techniques.

This study investigates the effects of major interior-related factors on the assessment of perceived loudness and noise annoyance. The study created virtual scenarios and presented these to participants by means of computer and audio speakers to provide an environment with auditory and biophilic design features of a dining place.

The study produced a null result but data did suggest that positively rated interior spaces led to lower perceived loudness and annoyance. In addition, the limitations of small sample size, audiovisual testing device and setting needed to be addressed. Finally, this study develops design guidelines to aid design decisions of designers and administrators for older adults in long-term care environment. Based on the proposed design guidelines, redesigning an existing dining space was suggested with design visualizations. Further research is needed to explore the effects of biophilic design in interior design on noise perception.


Research has consistently found exposure to a natural environment to be associated with health and psychological well-being. However, the effect of such an environment on social behavior and relationships remains in question. In a field experiment, male and female confederates accidentally dropped a glove on the ground while walking in a natural environment. The confederates continued walking, apparently unaware of their loss. Passersby were tested either before or after their immersion in an urban green park with large trees, lawns, and flowers. It was found that passersby tested after immersion in the park helped the confederates more readily than those tested before immersion in the park. In a second study, possible mediating factors of this effect (positive mood and desire to help others) were tested. Mood was found to be a mediating factor, whereas desire to help others partially mediated the relation between immersion in a natural environment and helping behavior.


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Color is often found to be the most important factor driving consumer purchase decisions for flowers. However due to the sheer number of flower color options available, pinpointing which flower shades to aim for in a breeding program is a complex task. Discussions with local growers revealed discrepancies between color preferences previously identified and actual consumer demand. The present work examines this in further detail by applying two methods of testing consumer flower color preference with the same panel of consumers: conjoint analysis using color categories and a follow-up question asking consumers to pick their 3 most preferred colors from a chart of 60 colors. Consumers were found to have different tolerance ranges for shades across color categories. Consumers have a wide range of tolerance for red colors, making this a safe target as nearly all shades of red tested were well liked by consumers. By contrast, in the yellow category there was one very high performing shade, with consumer preference dropping off sharply with any deviation from this shade. While this particular shade of yellow could potentially be highly successful with consumers, it is a riskier target as breeders would have a narrow range of tolerance in shade variation to achieve consumer success. This study presents a new understanding of consumer preference as it suggests that consumers exhibit not only preference intensity for sensory stimuli, but also a tolerance range for variations on the stimulus. Interestingly, tolerance ranges are not consistent across categories of sensory stimuli (e.g. color categories).

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The physiological effects of natural and urban environments on the cardiovascular system of coronary artery disease (CAD) patients are not fully understood. This controlled field study examines the effects of restorative walking in a park vs. in an urban street environment on CAD patients’ stress parameters and cardiac function. Methods: Twenty stable CAD patients were randomly allocated to 7 days controlled walking in a city park or in an urban street environment group. The relationship between different environmental exposures and health effects was analyzed using Wilcoxon signed-rank test and exact Mann-Whitney U test. Results: The mean reduction in cortisol levels and negative effects after the walk on the first day was greater in the city park than in the urban street exposed group, while a reduction in negative effects in the urban group were greater after seven days. The reduction in diastolic blood pressure (DBP) in the park group was evident on the seventh day before the walk (4 mm Hg, p = 0.031) and 60 min after the walk (6.00 mm Hg, p = 0.002). The cortisol slope was negatively associated with the DBP changes (r = 0.514, p < 0.05). Conclusions: Physical activity in a green environment with noise and air pollution levels lower than in an urban environment has a greater positive effect on CAD patients’ stress level and hemodynamic parameters. Mitigating green environmental influences may allow urban residents to maintain health and reduce disability.


There is convergent evidence that natural environments allow restoration from stress. This randomised, cross-over, field-based trial compared psychological and physiological responses of unstressed individuals to self-paced 30-min walks in three pleasant environments: residential (urban), natural (green), and natural with water (blue). Changes from baseline (T1) to T2 (end of 30-min walk), and T3 (30 min after leaving environment) were measured in terms of mood, cognitive function, restoration experiences, salivary cortisol, and heart rate variability (HRV). In the final sample (n = 38; 65% male; mean age 40.9 +/- 17.6 years), mood and cortisol improved at T2 and T3 in all environments. Green and blue environments were associated with greater restoration experiences, and cognitive function improvements that persisted at T3. Stress reduction (mood and cortisol changes) in all environments points to the salutogenic effect of walking, but natural environments conferred additional cognitive benefits lasting at least 30 min after leaving the environment.

Physical inactivity and disconnection from natural environments threatens human health. However, research has demonstrated that natural environments potentially support health-enhancing physical activity which could confer greater physical and mental health benefits than physical activity in other types of environment. This thesis approached the study of physical activity in natural environments through three related pieces of research. Firstly, an experimental study was carried out to explore how the presence of litter in beach environments affected psychophysiological responses to exercise. Responses to exercise did not differ in littered and clean conditions but there was evidence that order effects influenced findings. Visual attention to the two scenes differed, but did not mediate differences in psychophysiological responses. Secondly, analysis of a national dataset was undertaken to explore the form and quantity of physical activity conducted within natural environments in England. A series of linear regressions revealed that higher-intensity physical activities occurred in countryside environments, but more total energy expenditure occurred in coastal environments. Thirdly, a quantitative content analysis of brochures which promote recreational walking in natural environments was conducted which investigated their use of persuasive behavioural messages. These brochures omitted behavioural techniques which may be effective at motivating inactive individuals to walk. Extending this, an online survey tested whether improving brochure content heightened intentions to walk in natural environments. By designing content based on the theory of planned behaviour, the intentions of inactive individuals to undertake walking in natural environments were increased. The findings from this thesis demonstrate that the protection of natural environments is vital for preserving and promoting active recreation and could contribute to population-level increases in physical activity with theory-based promotion in the future.


While the connection between horticulture and human health has been known for most of human history only recently have researchers begun to systematically examine this connection from the perspective of Western science and institutions. The edited collection of articles, Green Care for Human Therapy, Social Innovation, Rural Econ-omy and Education, assembled by Gallis Christos, includes a wide-ranging collection of recent scientific research on the links between horticulture and society, through the lens of what has come to be known as ‘green care.’ This volume is an important and timely contribution to the study of horticulture and human health, especially as alternatives to industrial agriculture and the conventional medical model of healthcare are sought by planners, farmers, policy makers, and healthcare providers.


Aims: To test the relationship between greenery in gardens at residential facilities for older people and the self-perceived health of residents, mediated by experiences of being away and fascination when in the garden and the frequency of visitation there. To examine how these indirect effects vary with the number of physical barriers to visiting the garden.

Background: Many older people in residential facilities suffer from complex health problems. Access to a green outdoor environment may enable psychological distance, engage effortless attention, encourage more frequent visitation and promote resident health. Design: A multi-level, cross-sectional, correlational design.
Methods: Questionnaires were administered June–August, 2011 to convenience samples of residents at 72 facilities for older people with complex healthcare needs. One to 10 eligible residents were sampled during self-motivated garden visits at each facility (n = 290). They reported on their garden experiences and health. Facility staff reported on objective garden characteristics and barriers to access. A serial mediation model was tested with multiple linear regression analysis.

Results

The total indirect effect of greenery on self-perceived health was positive and significant. Garden greenery appears to affect health by enhancing a sense of being away, affording possibilities to experience the outdoor environment as interesting and encouraging visitation. Among residents in homes with multiple barriers, only fascination mediated the relationship between greenery and self-perceived health.

Conclusion: Ample greenery in outdoor space at residential facilities for older people appears to promote experiences of being away and fascination, more frequent visitation and better health.


Urban street trees provide many environmental, social, and economic benefits for our cities. This research explored the role of street trees in Melbourne, Australia, in cooling the urban microclimate and improving human thermal comfort (HTC). Three east–west (E–W) oriented streets were studied in two contrasting street canyon forms (deep and shallow) and between contrasting tree canopy covers (high and low). These streets were instrumented with multiple microclimate monitoring stations to continuously measure air temperature, humidity, solar radiation, wind speed and mean radiant temperature so as to calculate the Universal Thermal Climate Index (UTCI) from May 2011 to June 2013, focusing on summertime conditions and heat events. Street trees supported average daytime cooling during heat events in the shallow canyon by around 0.2 to 0.6 °C and up to 0.9 °C during mid-morning (9:00–10:00). Maximum daytime cooling reached 1.5 °C in the shallow canyon. The influence of street tree canopies in the deep canyon was masked by the shading effect of the tall buildings. Trees were very effective at reducing daytime UTCI in summer largely through a reduction in mean radiant temperature from shade, lowering thermal stress from very strong (UTCI > 38 °C) down to strong (UTCI > 32 °C). The influence of street trees on canyon air temperature and HTC was highly localized and variable, depending on tree cover, geometry, and prevailing meteorological conditions. The cooling benefit of street tree canopies increases as street canyon geometry shallows and broadens. This should be recognized in the strategic placement, density of planting, and species selection of street trees.


This article offers an overview of what has been done until now on restorative research with children and opens up new inquires for future research. Most of the work has studied children's exposure to nature and the restorative benefits this contact provides, focusing on the renewal of children's psychological resources. The paper begins with an introduction to children's current tendency toward an alienation from the natural world and sets out the
objectives of the article. It is followed by four main sections. The first two sections report on what we already know in this research area, distinguishing between children with normal mental capabilities and those suffering from attention-deficit hyperactivity disorder (ADHD). The findings gathered in these sections suggest that children's contact with nature improves their mood and their cognitive functioning, increases their social interactions and reduces ADHD symptoms. The next section describes five suggestions for future research: (1) the need for considering the relational dynamics between the child and the environment in restoration research, and the concept of constrained restoration; (2) the possibility of restorative needs arising from understimulation; (3) the importance of considering children's social context for restoration; (4) the relationship between restoration and pro-social and pro-environmental behaviors; and (5) children's restorative environments other than nature. We close by making some final remarks about the importance of restoring daily depleted resources for children's healthy functioning.


Nearly 90% of people’s lives are lived indoors, and their health is affected by the concentrations of CO2 in these spaces. Carbon dioxide concentrations can rapidly change based on human activity in indoor living spaces. Indoor plants and the concentration of CO2 in the local environment are factors that influence most people. Plants, depending on the ambient light and temperature conditions, and which are necessary to perform photosynthesis or respiration, directly affect the concentration of CO2 in the local environment. Furthermore, indoor plants influence the level of CO2 in the local environment but have not been researched enough in recent years concerning their specific effects. This study attempts to determine the effects of indoor plants on the concentration of CO2 in an indoor environment under certain light conditions. Five indoor plants were placed in a glass-walled compartment in order to measure the amount of CO2. The glass compartment used in the study was positioned in a way to prevent direct sunlight yet provide an illuminated environment. The plants were placed into this airtight compartment with a glass wall, which had a volume of approximately 0.5 m3 (0.7 m x 0.7 m x 1 m). The measurements of CO within the compartment were the compartment was set to measure CO2 once every five minutes. The study found that all plants reduced the concentration of CO2 to a certain extent during the day.


Positive experiences of nature elicit beneficial psychological and physiological responses, such as lowered blood pressure and heart rate, reduced muscular tension, better mental focus, lowered levels of stress hormones, and enhanced creative problem-solving abilities. The scientific evidence indicates that some of the 14 patterns support multiple outcomes, whereas other patterns are only linked with one outcome (see the chart below listing an overview of the health outcomes of each pattern). Because each pattern has a


Consumer horticulture encompasses a wide array of activities that are practiced by and of interest to the gardening public, garden-focused nongovernmental organizations, and gardening-related industries. In a previous publication, we described the current lack of funding for research, extension, and education in consumer horticulture and outlined the need for a strategic
Here, we describe our process and progress in crafting a plan to guide university efforts in consumer horticulture, and to unite these efforts with stakeholders’ goals. In 2015, a steering committee developed a first draft of a plan, including a mission statement, aspirational vision, core values, goals, and objectives. This draft was subsequently presented to and vetted by stakeholders at the 2015 American Society for Horticultural Science Consumer Horticulture and Master Gardeners (CHMG) working group workshop, a 2015 Extension Master Gardener Coordinators’ webinar, and a 2015 meeting in Washington, DC. Feedback received from these events is being used to refine and focus plan goals and objectives. The most recent working draft of the plan can be found on the website, where stakeholders and other interested parties can register to receive updates and to provide input into the process.


Allotment gardens are a key feature of the urban landscape, providing numerous benefits beyond those of food production. These include ecosystem services such as local climate modification, pollination, and providing a pleasant location for socialising. The biodiversity of flora underpins many of these ecosystem services. The aims of this study are to assess the spontaneous vascular flora of urban allotment gardens and derive estimates of the species richness and diversity. In doing so, the specific position of allotment gardens within urban green infrastructure will be revealed and the role of allotment users in shaping local biodiversity determined. 358 species of spontaneous flora were recorded in 11 representative allotment garden estates (total area 150 ha) in Poznań, Poland. Fourteen biodiversity features were taken into account. The investigated areas exhibited high plant species richness, high diversity, low synanthropisation level, and contained valuable geobotanical elements, including plants of key importance for the European Community. For these reasons, allotment gardens should be considered as biodiversity hotspots for native species within urban green infrastructure. Based on an analysis of the spatial and functional organization of 110 individual plots, four types of usage, and corresponding plant diversity have been distinguished. The composition of the flora depends mostly on spatial and functional organization of allotment gardens and, to a much lesser extent, on the habitat conditions, which on individual plots varied very little. The high species richness and diversity in allotment gardens has important consequences for urban planning.


Marketers invest nearly 8% of their advertising budget on in-store marketing because >70% of all buying decisions are made at the point of purchase. Older consumers, especially Baby Boomers (typically classified as persons born from 1950 to 1965) have long been considered a core target market for horticultural products. However, some industry concerns have arisen with regard to the lack of purchasing among younger age cohorts, especially Gen X (born 1966–77) and Gen Y (born 1978–90). Brands help to create the perception of added value while also differentiating products from competitors. Often, brands are one of a few pieces of information consumers use to make product choices. We conducted an online survey in May 2014 to investigate the role of age cohort and brand recognition on the likely to buy (LTB) rating of two herb and two vegetable transplants. We showed study participants images of 16 plants, varying the container color (white, green, and yellow), plant type (basil, parsley, tomato, and pepper), plant brand (generic and three national brands), and price. About equal numbers from
three age cohorts (Boomers, Gen X, and Gen Y) were represented in the sample of 566 plant purchasers. We observed that more Boomers had seen (recognized) Brand P, whereas more Gen X and Gen Y participants had seen Brand L. Subjects who had seen the plant brands before the study had a higher mean LTB rating for branded plants compared with those who had not seen the plant brands before the study. Furthermore, both Gen X and Gen Y were more LTB branded plants compared with Boomers. In the conjoint analysis, we found that plant type was the most important product attribute. Price and brand were similarly important but also less important than plant type. All three attributes were more important than container color. Having no brand on the container detracted $0.20 from the perceived value of the plant while the brands added up to $0.15 to the perceived plant value. Future marketing strategies which include branded plants at the point of purchase likely will increase perceived product value and LTB, especially among younger consumers.


A green atmosphere and interaction with nature (plants and flowers) can considerably improve the human senses and sanity by decreasing the stress associated with anxiety, depression, neurotic impairment, and other psychologic symptoms. The current paper reports a therapeutic horticultural study’s findings regarding the effect of indoor foliage plants and flower arrangements on health prospects of surgical patients. Two surgical wards, ward A (with foliage plants and arranged flowers) and ward B (without foliage plants and flowers), were selected for the study. A total of 270 patients were randomly assigned to either ward to give 135 patients in each. Patients admitted to ward A had significantly more optimistic and promising health improvements than those in ward B. Provision of foliage plants and flower arrangements to the patients in ward A resulted in shorter postoperative stays, lower intake of analgesics, lower pain intensity, less stress fatigue, and improved vital signs (blood pressure, heart rate, respiration rate, body temperature) as compared to patients in ward B. Moreover, analyses showed that patients in ward A had a stronger psychologic frame of mind regarding their recovery from surgery and had more positive emotions and feelings regarding their stay in the hospital. They also felt that the ward atmosphere was more calming, pleasant, and satisfactory. Additionally, small group discussions and focal interviews with ward doctors and nurses confirmed the findings of the questionnaire that foliage plants & flower arrangements create a cherished environment in the ward, reduce patients’ stress, improve medical and psychologic status of patients, and also convey positive messages of the hospital. These findings confirm the therapeutic value of horticultural activities, particularly in surgical patients in a stressed hospital setting.


Declining bee populations has garnered media attention, which has pressured plant retailers to ask or demand the reduction or elimination of neonicotinoid insecticide use in greenhouse production. This study investigated consumer perspectives on eco-friendly ornamental plant production practices in combination with a variety of insect management practices. Data from an online study were collected from 1555 Americans in May 2015. Over half (55%), nearly half (48.2%), and more than 30% of the participants felt that “bees are not
harmed,” “better for the environment,” or “plants that attract bees,” respectively, was a characteristic of bee-friendly insect management practices. The latter group erroneously confused bee-friendly insect management practices with plants that are a potential food source for bees. When asked to rate various insect management plant production practices on a five-point Likert scale, consumer mean scores were positive (defined here as 3.5 to 5.0) for “plants grown using bee-friendly insect management practices,” “plants grown using insect management strategies that are safe for pollinators,” “plants grown using best insect management practices to protect pollinators,” and “plants grown using insect management practices that leaves no insecticide residue on the plant.” Plant species accounted for 31.6% of the decision to purchase the plant, followed by price (25.1%), insect management strategy (23.3%), and eco-friendly practices (20.1%) that was similar to prior published findings. Analyses showed that plants labeled as “grown using bee-friendly insect management practices” were worth $0.26, $0.26, $0.89, and $1.15 more than plants labeled as “grown in a sustainably produced potting soil/mix,” “grown using recycled/recaptured water,” “grown using protective neonicotinoid insecticides,” and “grown using traditional insect management practices,” respectively. In addition, plants labeled as “grown using best insect management practices to protect pollinators” were worth $0.10, $0.10, $0.73, and $0.99 more than plants labeled as “grown in a sustainably produced potting soil/mix,” “grown using recycled/recaptured water,” “grown using protective neonicotinoid insecticides,” and “grown using traditional insect management practices,” respectively. Thus, selected insect management strategies were valued more, on average, than eco-friendly production practices.

Ziskovsky, B. (2015). "Expanding the Seasonal Potted Plant Floral Market in North America with Containerized Protea cynaroides L."

The existing floriculture market for Christmas potted plants has been dominated by the Poinsettia (Euphorbia pulcherrima) for an astounding 160 years. Most recent USDA statistics show that the Poinsettia/Christmas market accounts for 23% of all potted plants sales in the US or $144 Million annually. It is the number 1 selling potted plant with Easter lilies a distant second ($22 Million in sales). The average lifespan of a floriculture product (cultivar) is one to two years. Poinsettia is way over due for displacement, but a competing plant with similar Christmas tradition-based credentials has never surfaced. An abundance of money is spent by consumers on floral decorations for the Christmas holiday. That market is not saturated – consumers are limited in their buying by the lack of choice: the only option is a Poinsettia. The Christmas market is a niche with huge profit potential for an alternative or supplemental that offers novelty, beauty, and the symbolic Christmas connection. The commercial development and marketing of a dwarf variety of Protea cynaroides L. meets those criteria. This paper discusses the background information on P. cynaroides, a marketing rationale for that plant to compete with or alongside Poinsettias for Christmas plant sales, and a discussion of what steps can be taken to launch a successful production and marketing program to tap into and possibly capture the rich profit potential of the Christmas floral potted plant market to expand the overall US floriculture market beyond its present levels.

Theory and correlational research suggest that connecting with nature may facilitate prosocial and environmentally sustainable behaviors. In three studies we test causal direction with experimental manipulations of nature exposure and laboratory analogs of cooperative and sustainable behavior. Participants who watched a nature video harvested more cooperatively and sustainably in a fishing-themed commons dilemma, compared to participants who watched an architectural video (Study 1 and 2) or geometric shapes with an audio podcast about writing (Study 2). The effects were not due to mood, and this was corroborated in Study 3 where pleasantness and nature content were manipulated independently in a 2 x 2 design. Participants exposed to nature videos responded more cooperatively on a measure of social value orientation and indicated greater willingness to engage in environmentally sustainable behaviors. Collectively, results suggest that exposure to nature may increase cooperation, and, when considering environmental problems as social dilemmas, sustainable intentions and behavior.

Experimental auctions were employed to investigate U.S. and Canadian consumers’ willingness to pay for sustainable attributes in plants. The results show consumers are willing to pay a price premium for energy and water savings in plant production of $0.15 and $0.12, respectively. Consumers are only willing to pay $0.08 more for sustainably labeled product. Latent class segmentation analysis identifies three distinct consumer segments: Import-Liking, Mainstream, and Eco-local. Mainstream Consumers were the largest segment and willing to pay only modest premiums for eco-friendly attributes. Eco-local consumers comprised 14% of consumers and they were willing to pay the highest amount for the improved production methods and container types, while having the highest willing to pay for local and domestic products.

Objectives: To explore the hypothesis that higher exposure to natural environments in local areas is associated with a lower odds of depression and anxiety in later life. Design: A cross-sectional study based on the year-10 interview of the Medical Research Council Cognitive Function and Ageing Study (CFAS), a population-based study of ageing in the UK. Postcodes of the CFAS participants were mapped onto small geographic units, lower-layer super output areas (LSOAs) and linked to environmental data from government databases. The natural environment was characterised as the percentage of green space and private gardens in each LSOA based on the UK Generalised Land Use 2001 Dataset. Participants: 2424 people aged 74 and over in the CFAS year-10 follow-up interview (2001) from 4 English centres (Cambridgeshire, Nottingham, Newcastle and Oxford). Main outcome measures: Depression and anxiety; clinical and subthreshold cases were identified using the Geriatric Mental State Examination (GMS) package and its associated diagnostic algorithm: the Automated Geriatric Examination for Computer Assisted Taxonomy. Results: Compared with the lowest quartile, living in the highest quartile of neighbourhood natural environment provision was associated with a reduced odds of subthreshold depression (OR 0.66, 95% CI 0.46 to 0.95), anxiety symptoms (OR 0.62, 95% CI 0.46 to 0.83) and their co-occurrence (OR 0.55, 95% CI 0.35 to 0.84) after adjusting for individual-level factors. Controlling for area deprivation attenuated the strength of associations for subthreshold depression by 20% but not for anxiety symptoms or for co-occurrence of the
conditions. Conclusions: A high exposure to natural environments (green space and gardens) in communities was associated with fewer mental disorders among older people. Increasing provision of green environments in local areas could be a potential population-level intervention to improve mental health among older people.


Neonicotinoids have recently been implicated by the media as a contributing factor to the decline of honey and bumblebees. We sought to better understand consumer perceptions and willingness to pay for traditional, neonicotinoid-free, bee-friendly, or biological control pest management practices as growers may seek alternative management practices to systemic insecticides. We conducted a nationwide Internet survey (n = 3082), where consumers answered attitudinal, comprehension, likelihood-to-buy, and demographical questions about indoor (marketed in 10-cm pots) and outdoor (marketed in 30-cm hanging baskets or 10-cm pots) floriculture products. The likelihood-to-buy questions were analyzed using conjoint analysis to determine which attributes had the greatest part-worth scores or which ones were viewed most positively by survey respondents. Of the total participants, 65.1% (n = 2002) of the subjects had purchased an annual flowering plant in the 12 months before the survey. Respondents reported that the most important plant health and appearance factors that affect their purchasing decisions were that the flowering plants have no plant damage, while the second most important factor was that plants have no insects on them. The least important factor in the ranking of stated importance was that no neonicotinoid insecticides were used during the production of the plant. This finding may have resulted from 56.6% of all participants who reported that they did not understand the term. For those who viewed the indoor 10-cm flowering plants (n = 1052), the plant species accounted for 41.2% of the decision to purchase the plant, followed by production type (32.8%) and price (26.0%). All three product attributes were of equal importance to the subjects who viewed the outdoor 10-cm flowering plants (n = 1024), whereas only price had a lower relative importance when compared with production type and species for those who viewed the 30-cm hanging baskets (n = 1006). Across all three studies, use of the term “bee-friendly” had the greatest economic value because it had the highest part-worth utility score, or the greatest willingness-to-buy. For the subjects who viewed the outdoor plants, “bee-friendly” and “use of beneficial insects” had greater economic value (with positive part-worth utility scores), but “neonicotinoid-free” and “traditional insect control” both had negative part-worth utility scores, indicating they were valued less and detracted from the dollar value of the plant. The term “bee-friendly” was worth up to five times more to those respondents that had bought a plant in the last 12 months compared with those who had not. Therefore, if ornamental plants are labeled with pest management practices, most consumers value the term “bee-friendly” more and will likely discount products labeled “neonicotinoid-free.”


Low impact development (LID) and green infrastructure are both conceptual and practical strategies that can upgrade urban landscapes to manage urban water, including surface water and ground water recharge. Landscapes in cities and towns are a limited resource and they
must be ‘multi-tasking’ to optimize functions and benefits. Communities and infrastructure professionals are increasingly interested in the co-benefits that are possible if LID installations incorporate multiple purposes. Nearby nature and urban ecosystems within cities and towns includes all ecological, cultural, and engineered green spaces, such as (but not limited to) parks, open spaces, community gardens, and the urban forest. These spaces, in addition to private properties, are potential LID sites. Environmental services are important yet nearly 40 years of research across social disciplines demonstrates a broad array of human health and wellness benefits associated with the human experience of metro nature. A health oriented co-benefits approach in LID planning and design can promote expanded community support for LID, and potential collaborations with diverse partners, such as urban planners, social services providers, and public health professionals.


There is a need to better understand the types of natural environments that different individuals and groups find mental health promoting. In this exploratory qualitative study, twelve university students were invited to photographically document a natural place that they considered beneficial to their mental health. Thematic analysis of photographs and follow-up in-depth interviews revealed that students prefer natural places that are familiar, contain a variety of natural elements (especially mature trees and some form of water), and are separate from the context of everyday campus life (distanced from both the built and social campus environment). Overall, study findings demonstrate the importance of acknowledging symbolic and social factors when assessing the potential mental health benefits of natural places for different groups and individuals.


The study aims were to replicate initial findings of an environmental preference/environment type "congruence effect" on judgements of perceived restoration potential (Wilkie and Stavridou, 2013. Urban For. Urban Greening, 12,163) and explore if this congruence influenced restoration outcomes. University students (N =120) categorized themselves as 'country' or 'city' persons to indicate environmental preference (nature, urban), viewed an imagery slideshow of one environment (nature, urban green space, urban street), and completed pre-post imagery measures of directed attention, mood, and fatigue. They also rated environments like those in the slideshow for perceived restoration potential and then completed a place identity measure in reference to their preferred environment. The use of the dichotomous environmental preference variable as an indicator of place identity was supported with equal, moderate-to-high levels of place identity reported by both groups. An environment type main effect indicated better positive/negative mood and fatigue outcomes for those in the nature condition compared to the urban street condition. Urban green space exposure resulted in a better improvement to negative mood compared to urban street exposure. Nature and urban green spaces provided equivalent changes in direct attention, mood, and fatigue. There was no environment type effect on directed attention or perceived restoration potential. The environmental preference/environment type congruence findings replicated the previously reported effect on perceived restoration potential (Wilkie and Stavridou, 2013. Urban For. Urban
The highest ratings were after exposure to congruent nature environments and the lowest from exposure to urban street imagery incongruent with a nature preference. A pattern of both significant and non-significant results across outcomes indicated the congruence effect was more evident in those who preferred nature; urban preferences resulted in similar benefits outcomes across environments. These findings support growing evidence urban green spaces provide a range of benefits; and suggest person-place concepts such as place identity should also be considered in restoration research.


Introduction: There is a need for mental health practitioners to understand how inclusive environments that enable participation can be developed. This paper presents the findings from an ethnographic exploration of Mind ‘Sprout’, a supported community garden situated in inner-city Melbourne. The study explored how this community development project created a socially inclusive environment, and enabled occupational participation among people recovering from mental ill-health.

Methods: Consistent with the ethos of ethnography, data were collected through participant observation and asking questions of people as they participated at ‘Sprout’. Six individual interviews and review of organisational documents were also conducted. Qualitative analysis was used to identify the understandings of how the Sprout community was created and experienced by its members.

Results: Three interrelated themes were revealed: Sprout community garden enabled social inclusion and occupational participation by creating community, creating a flexible environment that supports participation and creating a learning environment. The way Sprout operated enabled its members to participate together in occupation and to interact socially within the garden community and beyond as part of the local community.

Conclusion: Sprout has developed a philosophy of active participation. The findings point to the opportunities that community development projects offer for creating environments that enable participation and social inclusion. They also suggest that an opportunity exists for occupational therapists to broaden their practise by leading or collaborating in these projects.


BACKGROUND: Many military veterans are seeking ways beyond conventional treatments to manage their stress injuries. An increasing number is turning to nature, including hiking and fishing, farming and gardening, and building relationships with dogs or horses. Many continue to benefit from medication and therapy, but find that nature provides an additional measure of support, relief and healing in their lives. OBJECTIVE: This paper examines reciprocal interactions between humans and nature during post-conflict recovery, with a focus on the experiences of four North American veterans who regard their personal recovery from stressful and traumatic military experiences as intimately tied to their nature experiences.

METHODS: Experience-centered narrative inquiry often sheds light on details and experiences concealed or overlooked by other research paradigms. In-depth interviews about post-military experiences with recovery were conducted with four veterans who suffer from
stress and/or post-traumatic distress; these experiences are further illuminated by supporting interviews, and theories and praxis in ecopsychology, cognitive science, neuroscience, biophilia, and ecological intelligence.

RESULTS: Through exploring themes of sensory experience, safety, sense of purpose, and renewed relationships, this research gives space to former soldiers’ stories of experience and to their individual realizations that their embodied interconnections with nature provide alternative experiences to their military training and combat exposure.

CONCLUSION: The veterans’ experiences with nature and recovery are pointing towards an avenue of recovery that is little acknowledged in the mainstream literature and praxis, but deserving of attention.


Green neighbourhood environments have been associated with physical and psychological wellbeing in adults. Access to greenness is potentially more important in vulnerable subgroups. In this study based on longitudinal survey data from southern Sweden the cohort was divided into prognostic groups for good self-reported general (n=8891) and mental (n=9444) health. We used independent survey data to assess perceived neighbourhood greenness in 1 km² areas, and estimated effects of changing exposure longitudinally stratified by prognostic group. The overall effect on health was small and statistically uncertain (for general health OR 1.04, 95% CI 0.98–1.10, for mental health OR 1.07, 95% CI 1.00–1.14). A more beneficial effect of increased greenness was indicated among subjects with lowest prognostic of good general health (OR 1.24, 95% CI 1.01–1.52). The study provided only weak evidence for beneficial effects of increased neighbourhood greenness triggered by changing residence. It seems that altered life circumstances, e.g. changed civil or socioeconomic status that often trigger a decision to move, are also the key determinants of the health consequences of changing residence.


The doctrine that urban greenery is positively associated with physical and mental health is widely acknowledged in landscape and urban planning, but is not underpinned by specific research findings. This paper examines how the association between “greenery” and health has developed through the history of landscape and urban design, and sets out the need for clear evidence based research as the foundation of credible arguments for the provision of more and better quality greenery in the city. We discuss the many hypothetical causal pathways between increased urban greenery and improving public health, and from a broad literature review we highlight recent research studies that have found associations between them. Directions for future research are suggested.


Tranquil environments can provide relief from stresses of everyday of life and can be considered restorative environments. This paper considers the effects of “greening” urban environments to enhance tranquillity and ultimately well-being and health benefits. A number of studies have been conducted at the Bradford Centre for Sustainable Environments at the University of Bradford which have examined the effects of natural features on ratings of
tranquillity. These include quantifying the effects of the percentage of natural and contextual features and soundscape quality on rated tranquillity. Recently the resulting prediction equation TRAPT (Tranquillity Rating Prediction Tool) has been used to examine a number of scenarios including city parks and squares, country parks and moorland areas and validated using tranquillity ratings made by visitors to these green spaces and their reported levels of relaxation. In this paper TRAPT is used for predicting tranquillity in city squares of different sizes, to examine rated tranquillity behind natural (green) and manufactured noise barriers and to predict changes in urban streets of introducing avenues of trees, hedges and grass verges. Using such scenarios this paper demonstrates how the application of TRAPT can enable changes in tranquillity to be estimated. This can provide planners, environmentalists, civic leaders and concerned citizens with a further tool to guide improvements in the urban environment by “greening” measures and noise reduction of various kinds and to help counter threats such as over development, tree removal or traffic densification that might threaten existing benefits.


The amygdala is thought to play a critical role in detecting salient stimuli. Several studies have taken ecological approaches to investigating such saliency, and argue for domain-specific effects for processing certain natural stimulus categories, in particular faces and animals. Linking this to the amygdala, neurons in the human amygdala have been found to respond strongly to faces and also to animals. However, the amygdala's necessary role for such category-specific effects at the behavioral level remains untested. Here we tested four rare patients with bilateral amygdala lesions on an established change-detection protocol. Consistent with prior published studies, healthy controls showed reliably faster and more accurate detection of people and animals, as compared with artifacts and plants. So did all four amygdala patients: there were no differences in phenomenal change blindness, in behavioral reaction time to detect changes or in eye-tracking measures. The findings provide decisive evidence against a critical participation of the amygdala in rapid initial processing of attention to animate stimuli, suggesting that the necessary neural substrates for this phenomenon arise either in other subcortical structures (such as the pulvinar) or within the cortex itself.


This laboratory study explored buffering and recovery effects of viewing urban green and built spaces on autonomic nervous system activity. Forty-six students viewed photos of green and built spaces immediately following, and preceding acute stress induction. Simultaneously recorded electrocardiogram and impedance cardiogram signal was used to derive respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP), indicators of respectively parasympathetic and sympathetic activity. The findings provide support for greater recovery after viewing green scenes, as marked by a stronger increase in RSA as a marker of parasympathetic activity. There were no indications for greater recovery after viewing green scenes in PEP as a marker of sympathetic activity, and there were also no indications of greater buffering effects of green space in neither RSA nor PEP. Overall, our findings are consistent with a predominant role of the parasympathetic nervous system in restorative effects of viewing green space.

Background: The objective was to systematically review the literature examining the relationship between quantity and quality of green spaces in the living environment and three health outcomes: perceived general health, perceived mental health, and (all-cause) mortality.

Methods: An online search was followed by a selection process applying eligibility criteria. Three levels of evidence were defined based on the number and quality of the studies, and the consistency of the findings. Fourteen studies on perceived general health, 19 on mental health and seven on all-cause mortality were included in the review.

Results: The evidence synthesis showed strong evidence for significant positive associations between the quantity of green space (objectively measured around the residence) and perceived mental health and all-cause mortality, and moderate evidence for an association with perceived general health. There were insufficient studies on the quality of green spaces to conduct an evidence synthesis. A few studies provided indications that associations depend on subgroups such as gender, age groups and groups with different social economic status, but the findings were mixed.

Conclusions: Further research should focus on exploring relationships between more detailed characteristics of green space and more specific health outcomes in different population subgroups and in different countries. To strengthen the evidence-base, studies with more sophisticated designs, e.g. “natural experiments”, are needed.


Growing evidence suggests an association between access to urban greenspace and mental health and wellbeing. Street trees may be an important facet of everyday exposure to nature in urban environments, but there is little evidence regarding their role in influencing population mental health. In this brief report, we raise the issue of street trees in the nature-health nexus, and use secondary data sources to examine the association between the density of street trees (trees/km street) in London boroughs and rates of antidepressant prescribing. After adjustment for potential confounders, and allowing for unmeasured area-effects using Bayesian mixed effects models, we find an inverse association, with a decrease of 1.18 prescriptions per thousand population per unit increase in trees per km of street (95% credible interval 0.00, 2.45). This study suggests that street trees may be a positive urban asset to decrease the risk of negative mental health outcomes.


One-third of Americans are reportedly living with extreme stress, with 75% to 90% of visits to primary care physicians being for stress-related problems. Past research found visiting green areas lowers blood pressure, reduces headache and fatigue, improves mood, and hastens recovery from stress. The main objective for this study was to determine if stress-related illness
rates in regions of Texas were related to vegetation rates and tree canopy cover. Data on the stress-related illnesses of high blood pressure and heart attacks were collected from the Center for Health Statistics and the Texas Department of State Health Services for all 25 metropolitan statistical areas (MSAs) in Texas. MSAs are counties or group of counties with a central city or urbanized area of at least 50,000 people. Percent canopy cover was calculated for each MSA using the Multi-Resolution Land Characteristics National Land Cover Data canopy cover dataset. Vegetation rates for all the MSAs were examined and mapped for illustration using geographical information system (GIS) software. Visual relationships among the data were observed. Quantitative data were also analyzed. When mapping stress-related illness rate into MSA regions of Texas, no clear trend was observed with vegetation rates or percent tree canopy cover when compared with stress-related illness rates. Semipartial correlations were calculated to analyze the relationship between tree canopy cover and vegetation rate and stress-related illness rate variables after controlling the effect of external variables like income levels, age, population, and ethnicity. There was no significant positive or negative relationship found between stress-related illness data when compared with percent canopy and vegetation index for any the 25 MSAs of Texas.


Ecosystem service (ES) frameworks have been developed to characterize and model the relationships between ecological processes and human benefits. Some argue that these relationships should be specified through expert-derived analytical (i.e., top-down) frameworks, in order to organize accumulated knowledge and create ready-made framings for communities on the ground. In contrast, arguments for the participatory construction of ES assessments emphasize the need for place-sensitive and deliberative (i.e., bottom-up) approaches. In this paper, we draw on a novel water planning exercise in New Zealand to examine the tensions that arise when expert-produced categories intersect with diverse stakeholder worldviews and aspirations. Expert-derived ES categories and analyses intervene in local valuation contexts in a range of ways, narrowing the scope of which ecological processes might be considered as relevant or legitimate (bounding), as well as affecting how these processes are described and compared (measuring). The practices of bounding and measuring ES in scientific and planning assessments should thus be conceptualized as involving political work and not just scientific judgment. This reframes the role of ecological science and scientists in ES debates, and this presents cautions as well as opportunities for future ES work relating to policy.


We present the results of a review of the empirical evidence and of the state of knowledge regarding the mechanisms linking ecosystem services and poverty alleviation. The review was undertaken to determine the state of current knowledge about the scale and nature of these linkages, and focus the future research agenda. Research has, to date, focused largely on provisioning services, and on just two poverty dimensions concerning income and assets, and food security and nutrition. While many papers describe links between ecosystem services and dimensions of poverty, few provide sufficient context to enable a thorough understanding of the poverty alleviation impacts (positive or negative), if any. These papers contribute to the accumulating evidence that ecosystem services support well-being, and perhaps prevent people
becoming poorer, but provide little evidence of their contribution to poverty alleviation, let alone poverty elimination. A considerable gap remains in understanding the links between ecosystem services and poverty, how change occurs, and how pathways out of poverty may be achieved based on the sustainable utilisation of ecosystem services.


This questions review with 60 articles addresses the influence of plants on health, from a psychological standpoint. We have presented the results of our research in 4 main categories, following exposure levels, from complete immersion to plants representation. The results show that plants are indeed a health source for humans, seemingly irrespective of its intensity. Concerning the explanations of these results, this questions review states the 2 great explanatory theories (biophilia and Attention Restorative Theory) and suggests new possible theoretical insights. This synthesis also proposes new researches to implement.


Objectives: To gather information about perceptions of personal health behavior change in cancer survivors following participation in an urban gardening program. Methods: This qualitative study used focus groups of adult cancer survivors with an open-ended question thread format. Data were transcribed and analyzed by identifying, coding, and categorizing primary patterns/themes. Results: Four overarching themes were identified: (1) greater dietary intake of produce; (2) improved mental and physical health; (3) enhanced sense of community and social support; and (4) challenges to long-term maintenance. Conclusions: Perceptions of positive behavior changes associated with harvesting at an urban garden targeting cancer survivors may inform future community and health promotion interventions aimed at improving adherence to evidence-based lifestyle behavior guidelines for cancer survivorship.


We measured dynamic stress responses using ambulatory heart rate monitoring as participants in Philadelphia, Pennsylvania walked past vacant lots before and after a greening remediation treatment of randomly selected lots. Being in view of a greened vacant lot decreased heart rate significantly more than did being in view of a nongreened vacant lot or not in view of any vacant lot. Remediating neighborhood blight may reduce stress and improve health.


The aim of this study was to investigate the personal experiences and perceived effects on mind from visits to forest environments in a subset of patients with severe exhaustion disorder (ED), who participated in a randomised controlled trial for evaluation of forest-based rehabilitation. A subsample of 19 patients with diagnosed ED, who completed the three-month forest-based rehabilitation in the ForRest project, was interviewed. The forest-based rehabilitation consisted of repeated forest visits with the main objective of spending time in rest and solitude in a chosen forest setting. Semi-structured interviews were carried out and analysed
using Grounded Theory. A core category and five subcategories were set up to describe the patients' experiences and development during the forest-based rehabilitation. As patients mostly reported that they strove to achieve peace of mind during the forest visits, Striving for serenity was chosen to be the core category. At first the patients were frustrated when left alone with their own thoughts in an unfamiliar forest environment. They gradually became familiar with the forest environments and also found their favourite places where they experienced peace of mind. They were then able to rest and begin reflective thinking about their life situation, which led to ambitions to change it. The preferred forest environments were characterised by openness, light and a good view, and were felt to be undemanding, peaceful and stimulating. Visits to the forest provided favourite places for rest, were experienced as restorative, seemed to improve reflection and may have contributed to starting the coping process for these patients. However, forest visits, as the only treatment option, are not sufficient as rehabilitation from severe and long-term ED. We suggest that forest visits should be integrated with cognitive behavioural therapy to further improve the recovery and enhance coping in daily life for these patients.


There has been increasing attention on the therapeutic effects of the forest environment. However, evidence-based research that clarifies the physiological effects of the forest environment on hypertensive individuals is lacking. This study provides scientific evidence suggesting that a brief forest walk affects autonomic nervous system activity in middle-aged hypertensive individuals. Twenty participants (58.0 +/- 10.6 years) were instructed to walk predetermined courses in forest and urban environments (as control). Course length (17-min walk), walking speed, and energy expenditure were equal between the forest and urban environments to clarify the effects of each environment. Heart rate variability (HRV) and heart rate were used to quantify physiological responses. The modified semantic differential method and Profile of Mood States were used to determine psychological responses. The natural logarithm of the high-frequency component of HRV was significantly higher and heart rate was significantly lower when participants walked in the forest than when they walked in the urban environment. The questionnaire results indicated that, compared with the urban environment, walking in the forest increased "comfortable", "relaxed", "natural" and "vigorous" feelings and decreased "tension-anxiety," "depression," "anxiety-hostility," "fatigue" and "confusion". A brief walk in the forest elicited physiological and psychological relaxation effects on middle-aged hypertensive individuals.


Lifestyle diseases such as obesity, diabetes, and cardiovascular diseases are on the increase worldwide. This study examines the distinctive effects of exercise in green space compared to other contexts. There is growing evidence that physical activity in nature has considerable positive effects on human health far beyond those benefits assumed by physical activity alone, despite a reduction in opportunities for green exercise. A systematic literature review was undertaken to examine the evidence on the importance of physical activity in green space from different theoretical sub-disciplines including psychiatry, psychology, outdoor
education, sport and exercise psychology and leisure, and recreation. Thematic categories were created to establish the effects of green space and green exercise on different yet inter-linked aspects of human health and well-being, both physical as well as mental. Our systematic review led us to apply ideas from a new theoretical perspective that contributes to existing understanding of how physical activity in green spaces (green exercise) might provide physical benefits and enhance mental health and wellbeing. This perspective, known as Ecological Dynamics, focuses on the relationship between the individual and environment in providing a functional explanation for the enhancement of physical and mental health and wellbeing. From this study it is theoretically rationalised that physical activity in green space, compared to other popular contexts, is more effective in enhancing physical and psycho-social wellbeing.


There is mounting concern for the health of urban populations as cities expand at an unprecedented rate. Urban green spaces provide settings for a remarkable range of physical and mental health benefits, and pioneering health policy is recognizing nature as a cost-effective tool for planning healthy cities. Despite this, limited information on how specific elements of nature deliver health outcomes restricts its use for enhancing population health. We articulate a framework for identifying direct and indirect causal pathways through which nature delivers health benefits, and highlight current evidence. We see a need for a bold new research agenda founded on testing causality that transcends disciplinary boundaries between ecology and health. This will lead to cost-effective and tailored solutions that could enhance population health and reduce health inequalities.


Over 30 years of research has shown that urban nature is a promising tool for enhancing the physical, psychological, and social well-being of the world's growing urban population. However, little is known about the type and amount of nature people require in order to receive different health benefits, preventing the development of recommendations for minimum levels of exposure and targeted city planning guidelines for public health outcomes. Dose–response modelling, when a dose of nature is modeled against a health response, could provide a key method for addressing this knowledge gap. In this overview, we explore how “nature dose” and health response have been conceptualized and examine the evidence for different shapes of dose–response curves. We highlight the crucial need to move beyond simplistic measures of nature dose to understand how urban nature can be manipulated to enhance human health.


For children today, time spent outdoors is becoming more of a luxury—or in some cases, a chore—than a staple. In recent years “nature deficit disorder” among kids has evolved from a turn of phrase to a cultural indictment. Smartphones and other screens are increasingly vying for kids’ attention, but blame lies elsewhere, too: just as recess is being reduced or phased out in many schools, children’s activities are being increasingly structured and scheduled, and concerns over neighborhood crime and safety can impede their ability to play freely outdoors. A 2013 study by the U.S. Centers for Disease Control and Prevention found that nearly three-quarters of
high-school students had less than one hour of physical activity per day, while childhood obesity rates are trending steadily upward.

In some cases, the programs have received support from the Healthy Parks Healthy People initiative of the National Park Service (NPS), launched as a pilot in 2011 and set to expand significantly in 2016 and beyond. The Healthy Parks Healthy People program aims to improve health through regular use and enjoyment of parks and public lands nationwide, says Sara Newman, director of the NPS Office of Public Health. The NPS is also participating in the White House’s Every Kid in a Park initiative, launched in September 2015. This program provides fourth-graders and their families free admission to national parks and other federal lands and waters for a full year, and transportation support to schools that need it.

Other park-prescription programs are locally managed and operated, including a growing number organized around urban trails and other nontraditional “linear” parks that promote non-motorized transport.

Current evidence suggests that children have much to gain from time spent outdoors and much to lose from a lack of park access. In addition to myriad health benefits offered by physical activity in general, research has shown that outdoor exercise in nature can enhance emotional well-being and amplify the benefits of physical exercise. And for kids in particular, being in or near green spaces has been found to be associated with better test scores, improved self-discipline and cognition, and reduced behavioral problems and symptoms of attention-deficit/hyperactivity disorder (ADHD). Several studies suggest that spending time outdoors can protect against myopia (nearsightedness). Still other research indicates that neighborhood green space may help mitigate income-related health disparities.

Parks and green spaces also may contribute to population health by reducing exposures to air pollution and noise, capturing and filtering stormwater runoff, and mitigating heat-related illnesses. These benefits make urban parks an important tool in climate change adaptation, says Payam Dadvand, a researcher and assistant professor at the Centre for Research in Environmental Epidemiology (CREAL) in Barcelona. Eventually, current trends could lead parks straight to the core of the American healthcare system, says Kristin Wheeler, associate director of the Institute at the Golden Gate, a nonprofit partner of the NPS. Someday patients could be incentivized through their insurance to be active outdoors, she suggests, similar to existing small-scale programs that offer financial benefits for exercise and other healthy activities. “This is the way that nature and parks are going to be talked about—it’s going to be commonplace for your doctor to ask you about how much time you’ve spent in nature,” Wheeler says. “It’s this perfect culmination, where everybody’s starting to see this as the wave of the future.”


Stressful events can have both short- and long-term effects on the brain.1,2 A recent investigation by our lab identified regional grey matter volume (rGMV) changes in people in the months following the Japanese earthquake.3 These findings indicated that smaller anterior cingulate cortex volume was a preexisting vulnerability factor for posttraumatic stress disorder (PTSD) symptoms and that decreased volume of the orbitofrontal cortex (OFC) was a result of these acquired symptoms.3 These types of symptoms were regarded as manifestations of the short-term effects of post-earthquake stress. However, the long-lasting effects of stressful events
on brain structures remain unclear. Thus, this study examined the 1-year prognoses of subjects after a stressful event to clarify the long-term effects of stress on structural brain changes.


Research shows that contact with nature plays a vital role in our psychological wellbeing. Domestic gardening is common among older adults who spend more leisure hours gardening than any other age group. Despite this, few studies have systematically explored the significance of domestic gardens in relation to older adults' health and wellbeing. This study examined the perceived therapeutic benefits of gardening, and the effect of ageing in relation to older gardeners' continued participation in gardening, using quantitative and qualitative data from a survey of Australian older adult gardeners (N=331). The quantitative data, which included frequencies, were analysed using the PASW Statistics 18.0 package. The qualitative data, which included participants' responses to open questions, were analysed by deriving themes via Leximancer, an innovative text analytics software that uses word association information to elicit concepts, extracting the most important and grouping these according to themes. In relation to the reasons for gardening, several themes were identified including valuing the aesthetics of gardens, connecting with nature, achievement, and physical and mental activity. The benefits of gardening, and the variety of ways that respondents had adapted or modified their gardening activities in order to continue, are also reported. Gardening was more than a casual leisure pursuit for these participants, who saw it as critical to their physical and psychological wellbeing.


According to attention restoration theory, directed attention can become fatigued and then be restored by spending time in a restorative environment. This study examined the restorative effects of nature on children’s executive functioning. Seven- to 8-year-olds (school aged, n = 34) and 4- to 5-year-olds (preschool, n = 33) participated in two sessions in which they completed an activity to fatigue attention, then walked along urban streets (urban walk) in one session and in a park-like area (nature walk) in another session, and finally completed assessments of working memory, inhibitory control, and attention. Children responded faster on the attention task after a nature walk than an urban walk. School-aged children performed significantly better on the attention task than preschoolers following the nature walk, but not urban walk. Walk type did not affect inhibitory control or verbal working memory. However, preschoolers’ spatial working memory remained more stable following the nature walk than the urban walk.


After a period of decrease, sick leave in Sweden due to psychiatric diagnoses is on the increase. The lack of established rehabilitation programmes for patients with stress-related mental disorders (SRMD) has opened up for the use of garden/nature in a multimodal rehabilitation context (Nature-Based Rehabilitation, NBR). Region Vastra Gotaland (VGR) started an NBR to offer additional rehabilitation for its employees on long-term sick leave due to SRMD, where initial care had not been sufficient. The aim was to explore whether the mental health and well-being of NBR participants had improved at the end of the NBR and at three
follow-ups, and to explore the development of sick leave and health care utilization according to the NBR model (n = 57) and an occupational health service (OHS) model (n = 45). Self-assessment instruments for measuring burnout, depression, anxiety and wellbeing, and data from regional and national registers were used. Results showed decreased scores on burnout, depression and anxiety, and increased well-being scores and significantly reduced health care utilization in the NBR group. A large movement from ordinary sickness benefit to rehabilitation benefit was observed, which was not observed in the OHS group. The two groups were in different rehabilitation phases, which limited comparisons. The results point to beneficial effects of using NBR for this patient group and for enhancing a stalled rehabilitation process.


Green exercise research often reports psychological health outcomes without rigorously controlling exercise. This study examines effects of visual exercise environments on directed attention, perceived exertion and time to exhaustion, whilst measuring and controlling the exercise component. Participants completed three experimental conditions in a randomized counterbalanced order. Conditions varied by video content viewed (nature; built; control) during two consistently-ordered exercise bouts (Exercise 1: 60% VO2peakInt for 15-mins; Exercise 2: 85% VO2peakInt to voluntary exhaustion). In each condition, participants completed modified Backwards Digit Span tests (a measure of directed attention) pre- and post-Exercise 1. Energy expenditure, respiratory exchange ratio and perceived exertion were measured during both exercise bouts. Time to exhaustion in Exercise 2 was also recorded. There was a significant time by condition interaction for Backwards Digit Span scores (F(2,22) = 6.267, p = 0.007). Scores significantly improved in the nature condition (p < 0.001) but did not in the built or control conditions. There were no significant differences between conditions for either perceived exertion or physiological measures during either Exercise 1 or Exercise 2, or for time to exhaustion in Exercise 2. This was the first study to demonstrate effects of controlled exercise conducted in different visual environments on post-exercise directed attention. Via psychological mechanisms alone, visual nature facilitates attention restoration during moderate-intensity exercise.


A rating-based conjoint experiment combined with eye-tracking analysis was used to investigate the effect of plant attributes on consumer purchase likelihood for indoor foliage plants. The experiment assessed the effects of plant type (Dracaena marginata Lam., Guzmania lingulata, or Spathiphyllum wallisii Regel), volatile organic compound (VOC) removal capacity (high, low, or none specified), price ($10.98–14.98/plant), production method [certified organic, organic production (not certified), or conventional], and origin (in-state, domestic, or imported) on consumer preferences. An ordered logit model was used to analyze the data. Organic production methods, in-state origin, domestic origin, and high VOC removal increased participants’ purchase likelihood. Visually attending to the highest price point ($14.98) increased consumers’ purchase likelihood. Age, gender, child (<12 years), pet, relationship status, education, and ethnicity affected participants’ purchase likelihood for indoor foliage plants.
Purchasing barriers for indoor foliage plants are also discussed. Results have implications for indoor foliage plant growers and retailers as they produce, promote, and sell their products.


In mammals, the suprachiasmatic nucleus (SCN) functions as a circadian clock that drives 24-h rhythms in both physiology and behavior. The SCN is a multicellular oscillator in which individual neurons function as cell-autonomous oscillators. The production of a coherent output rhythm is dependent upon mutual synchronization among single cells and requires both synaptic communication and gap junctions. Changes in phase-synchronization between individual cells have consequences on the amplitude of the SCN's electrical activity rhythm, and these changes play a major role in the ability to adapt to seasonal changes. Both aging and sleep deprivation negatively affect the circadian amplitude of the SCN, whereas behavioral activity (i.e., exercise) has a positive effect on amplitude. Given that the amplitude of the SCN's electrical activity rhythm is essential for achieving robust rhythmicity in physiology and behavior, the mechanisms that underlie neuronal synchronization warrant further study. A growing body of evidence suggests that the functional integrity of the SCN contributes to health, well-being, cognitive performance, and alertness; in contrast, deterioration of the 24-h rhythm is a risk factor for neurodegenerative disease, cancer, depression, and sleep disorders.


In the process of rapid urbanization and domination of concrete over nature, lifestyles have changed. Since natural landscape and greenery are crucially important to our quality of life and the majority of the population are going to settle down in urban areas, urban open green spaces as the lungs of the city are often at the center of the debate on urban planning and sustainable development. The overall aim of this paper is to investigate the social, health, environmental and economic benefits of providing urban open green space. The many benefits of urban open green spaces were investigated in a systematic review of scientific online databases, relevant research and other related papers.


Adolescence is a developmental period that entails substantial changes in affective and incentive-seeking behavior relative to both childhood and adulthood, including a heightened propensity to engage in risky behaviors and experience persistent negative and labile mood states. This review discusses the emotional and incentive-driven behavioral changes in adolescents and their associated neural mechanisms, focusing on the dynamic interactions between the amygdala, ventral striatum, and prefrontal cortex. Common behavioral changes during adolescence may be associated with a heightened responsiveness to incentives and emotional cues while the capacity to effectively engage in cognitive and emotion regulation is still relatively immature. We highlight empirical work in humans and animals that addresses the interactions between these neural systems in adolescents relative to children and adults, and propose a neurobiological model that may account for the nonlinear changes in adolescent
behavior. Finally, we discuss other influences that may contribute to exaggerated reward and emotion processing associated with adolescence, including hormonal fluctuations and the role of the social environment.


The article discusses the health benefits of playing in natural outdoor environments. Topics discussed include the relationship between outdoor time and the physical and mental health of children, the role of natural outdoor environments as optimal places to promote children's well-being and health, and the higher risk for children who spend less time outdoors to develop chronic conditions including asthma, obesity, and vitamin D deficiency.


The concept of ecosystem services shifts the human–nature relationship from a conservation-oriented into a utility-oriented one. Advocates of the concept assume that it can alter the attitude and behaviour of human actors with respect to nature. The ecosystem services concept has so far received little attention in scientific literature about collaborative landscape planning. Consequently the potential of information about ecosystem services to influence landscape planning processes is unknown. In this paper we address the impact of different storylines about ecosystem services on actor behaviour. In these storylines, we distinguish three frames on ecosystem services: a social–cultural frame (emphasizing social–cultural services), an economic frame (emphasizing production services) and a sustainability frame (highlighting regulation services). We propose a conceptual framework in which we connect the concept of framing to attitudinal, sender–receiver and contextual factors. The framework is illustrated by a spatial planning experiment with academic students and by a case of collaborative landscape planning. The student experiment illustrates how attitudinal factors may intervene in the impact frames on actor behaviour. The case analysis shows how researchers who facilitated collaborative landscape planning used various frames as they attempted to build up the actor network to create collaborative relations in different phases of the planning process. The significance of our paper is that we provide an approach to investigate how information on ecosystem service benefits is processed by multiple actors in collaborative landscape planning processes. Our exploration implies that planners who facilitate a collaborative planning process have to be aware that purposively using ecosystem service frames stimulates engagement of actors with diverging backgrounds.


The natural environment is increasingly recognized as an effective counter to urban stress, and Forest Therapy has recently attracted attention as a relaxation and stress management activity with demonstrated clinical efficacy. The present study assessed the physiological and psychological effects of a forest therapy program on middle-aged females. Seventeen Japanese females (62.2 +/- 9.4 years; mean +/- standard deviation) participated in this experiment. Pulse rate, salivary cortisol level, and psychological indices were measured on the day before forest therapy and on the forest therapy day. Pulse rate and salivary cortisol were significantly lower
than baseline following forest therapy, indicating that subjects were in a physiologically relaxed state. Subjects reported feeling significantly more comfortable, relaxed, and natural according to the semantic differential (SD) method. The Profile of Mood State (POMS) negative mood subscale score for tension-anxiety was significantly lower, while that for vigor was significantly higher following forest therapy. Our study revealed that forest therapy elicited a significant (1) decrease in pulse rate, (2) decrease in salivary cortisol levels, (3) increase in positive feelings, and (4) decrease in negative feelings. In conclusion, there are substantial physiological and psychological benefits of forest therapy on middle-aged females.


85% of a construction worker's work-day is spent on the construction site. This means that a large part of a worker's health and wellbeing could depend on the construction site and its environs. Construction work, which is inherently stressful due to the ever present threat of fatalities and injuries, compromises the ergonomic reality and human sustenance on construction sites. This necessitates the need to create a beneficial and comfortable environment that is motivational, inspirational, and healing. The biophilic construction site model (BCSM) which involves methodology of 'greening construction sites', is proposed as a healthy means of tapping into the natural resources of the construction site environment. It is intended to create a comfort zone on the construction site that would generate a symbiotic benefit to enhance its humanistic value and engender the health and wellbeing and creative performance of workers. The paper reports on a case study in the form of a focus group study and a comparative analysis of two similar construction sites in the Northern Cape region of South Africa. The findings present the healthy inter-nurture existing between a living construction site and its human occupants as a cost effective psychotherapeutic intervention in sustainable sites initiative and ergonomics, which according to research findings is as of yet missing in the construction management body of knowledge (CMBOK). The paper conclusively recommends the 'greening of construction sites'; specifically the inclusion of plants within site offices, welfare facilities and worksite premises; as a relevant means of harnessing nature's healing and rejuvenating essence towards a more productive goal in construction. (C) 2014 American Society of Civil Engineers.


Objective: To present and discuss the dietary guidelines issued by the Brazilian government in 2014. Design: The present paper describes the aims of the guidelines, their shaping principles and the approach used in the development of recommendations. The main recommendations are outlined, their significance for the cultural, socioeconomic and environmental aspects of sustainability is discussed, and their application to other countries is considered.

Setting: Brazil in the twenty-first century.
Subjects: All people in Brazil, now and in future
Results: The food- and meal-based Brazilian Dietary Guidelines address dietary patterns as a whole and so are different from nutrient-based guidelines, even those with some recommendations on specific foods or food groups. The guidelines are based on explicit principles. They take mental and emotional well-being into account, as well as physical health
and disease prevention. They identify diet as having cultural, socio-economic and environmental as well as biological and behavioural dimensions. They emphasize the benefits of dietary patterns based on a variety of natural or minimally processed foods, mostly plants, and freshly prepared meals eaten in company, for health, well-being and all relevant aspects of sustainability, as well as the multiple negative effects of ready-to-consume ultra-processed food and drink products.

Conclusions: The guidelines' recommendations are designed to be sustainable personally, culturally, socially, economically and environmentally, and thus fit to face this century. They are for foods, meals and dietary patterns of types that are already established in Brazil, which can be adapted to suit the climate, terrain and customs of all countries.


Objectives. We examined the mental health effects of the Great Recession of 2008 to 2009 on workers who remained continuously employed and insured.

Methods. We examined utilization trends for mental health services and medications during 2007 to 2012 among a panel of workers in the 25 largest plants, located in 15 states, of a US manufacturing firm. We used piecewise regression to compare trends from 2007 to 2010 in service and medication use before and after 2009, the year of mass layoffs at the firm and the peak of the recession. Our models accounted for changes in county-level unemployment rates and individual-level fixed effects.

Results. Mental health inpatient and outpatient visits and the yearly supply of mental health-related medications increased among all workers after 2009. The magnitude of the increase in medication usage was higher for workers at plants with more layoffs.

Conclusions. The negative effects of the recession on mental health extend to employed individuals, a group considered at lower risk of psychological distress.


Introduction: It has been suggested that socioeconomic inequalities in health might be reduced among populations with good access to green space. However, the potential for other neighborhood characteristics to reduce socioeconomic health inequalities, or to confound the effects of green space, has not been well explored. Therefore, this study investigates which, if any, neighborhood characteristics are associated with narrower socioeconomic inequalities in mental well-being in a large, international sample of urban residents.

Methods: The 2012 European Quality of Life Survey provided data on 21,294 urban residents from 34 European nations. Associations between mental well-being (captured by the WHO-5 scale) and level of financial strain were assessed for interaction with five different neighborhood characteristics, including reported access to recreational/green areas, financial services, transport, and cultural facilities. Multilevel regression models allowed for clustering of individuals within region and country in this cross-sectional, observational study. Data were analyzed in 2014.

Results: Socioeconomic inequality in mental well-being was 40% (8.1 WHO-5 points) narrower among respondents reporting good access to green/recreational areas, compared with
those with poorer access. None of the other neighborhood characteristics or services were associated with narrower inequality.

Conclusions: If societies cannot, or will not, narrow socioeconomic inequality, research should explore the so-called equigenic environments—those that can disrupt the usual conversion of socioeconomic inequality to health inequality. This large, international, observational study suggests that access to recreational/green areas may offer such a disruption.


A growing body of empirical research suggests that brief contact with natural environments improves emotional well-being. The current study synthesizes this body of research using meta-analytic techniques and assesses the mean effect size of exposure to natural environments on both positive and negative affect. Thirty-two studies with a total of 2,356 participants were included. Across these studies, exposure to natural environments was associated with a moderate increase in positive affect and a smaller, yet consistent, decrease in negative affect relative to comparison conditions. Significant heterogeneity was found for the effect of nature on positive affect, and type of emotion assessment, type of exposure to nature, location of study, and mean age of sample were found to moderate this effect. The implications of these findings for existing theory and research are discussed, with particular emphasis placed on potential avenues for fruitful future research examining the effects of nature on well-being.


The local food movement is arguably the most dynamic segment of the food system, contributing to the challenge to define it. Turning to a dictionary, Webster defines the term local as, “characterized by or relating to position in space: having a definite spatial form or location.” In a recent U.S. Department of Agriculture (USDA), Economic Research Service (ERS) report, Low and co-authors suggest that localness may vary by the audience, purpose and data of the food system dimension where local is applied (Low et al., 2015). Although geography is typically one of the key factors considered in local food systems, policy and program initiatives implicate a connection to a myriad of other aspects as well. According to the 2008 Food, Conservation, and Energy Act, local foods are defined as any foods produced within a radius of 400 miles or in the state where the food was produced as local foods, but this mix of transportation, distance, and jurisdictional criteria hints to the complexity of characterizing local foods (Low et al., 2015; Martinez et al., 2010). As one example of the implications of this complexity, Martinez et al. (2010) showed evidence that geographic proximity considerations have led to some controversy as to whether State-funded branding programs, which are aimed at promoting or identifying state-produced agricultural products, are part of the local food system. More recently, the Agricultural Act of 2014 did not provide a definition of local foods, perhaps because arriving at agreement on a definition defied consensus. In essence, local foods are perhaps the most visible sector of the continually evolving “civic agriculture” paradigm (Lyson, 2004), a lens through which political, socioeconomic and environmental concerns about the conventional food system are addressed. So, for those pursuing a fundamental concept of localized economic control, they may choose to play their advocacy role in the one realm where consumers make some of their most frequent decisions: at meal times, and in food markets. The recent USDA-ERS report on local foods integrated several
“civic agriculture” dimensions, including environmental, economic competitiveness, consumer motivations for direct purchases and linkages to broader non-profit initiatives, into a scan of the local and regional food system update (Low et al., 2015).

So what other criteria—stated or simply assumed—may be underlying the term local foods in the minds of consumers, food industry stakeholders, and those seeking to support food systems that reverse the momentum of globalization to maintain food production in their home region? The growing set of consumer research and community development literature sheds some light on a broader characterization that suggests sustainable production practices, smaller businesses, more producer-oriented governance, and shorter supply chains which may all be implicit assumptions held by those supporting, investing in and consuming local foods.


The burgeoning incidence of stress-related illness and attendant costs to both society and individuals, is an issue of concern in realms from the institutional to the private. Simultaneously there is an increasing rejection of the model of health which posits separation of mind (and emotion) from body and bodily experience. Several recent studies have endeavored to increase our understanding of the role that settings can play in peoples’ “self-help” choices when responding to stress or other emotional upsets in their lives. It is important for designers and environmental policy makers to comprehend, as fully as possible, the healing role that places may play in peoples’ lives.


Understanding how urban residents rate the benefits associated with urban green spaces is crucial in developing appropriate urban green infrastructure strategies. This study explores residents’ beliefs concerning the benefits of urban green spaces and investigates whether similarities and differences can be highlighted in four different French and Portuguese urban areas (Paris, Angers, Lisbon and Porto) through a questionnaire survey (n = 1000) based on the best–worst scaling (BWS) method. The results demonstrated that urban green space benefits are not equally valued among cities, suggesting that there is simultaneously a consensus among the most and least valued benefits across cities, as well as local variations in city residents’ beliefs about some other benefits of urban green spaces. For example, the importance of urban green spaces for personal health and well-being and to facilitate contact with nature were noted by residents of all four urban areas; consensus also exists on the little support given to two microclimatic functions of green spaces, namely, air temperature reduction and noise reduction. On the other hand, some green space benefits, such as the promotion of biodiversity or the contribution to the city image, are differentially valued among the four cities. Overall, the study stresses the importance of developing local assessments of the beliefs surrounding the benefits of urban green spaces. Recognizing these multiple beliefs and communicating clearly about the benefits offered by green spaces may help to mitigate future conflicts between residents and urban planners and managers, and thus contribute to optimizing green infrastructure planning benefits.

Rationale: The social, emotional, and mental health benefits associated with gardening have been well documented. However, the processes underlying the relationship between garden participation and improvements in health status have not been sufficiently studied.

Methods: Using population-based survey data (n = 469 urban residents), objective street environment data, and area-level measures, this research used a path analytic framework to examine several theoretically based constructs as mediators between gardening history and self-reported health.

Results: The results showed that garden participation influenced health status indirectly through social involvement with one's community, perceived aesthetic appeal of the neighborhood, and perceived collective efficacy. Gardeners, compared to non-gardeners, reported higher ratings of neighborhood aesthetics and more involvement in social activities, whereas aesthetics and involvement were associated with higher ratings of collective efficacy and neighborhood attachment. Collective efficacy, but not neighborhood attachment, predicted self-rated health. Gardening also directly influenced improved fruit and vegetable intake. The physical and social qualities of garden participation may therefore stimulate a range of interpersonal and social responses that are supportive of positive ratings of health.

Conclusion: This research suggests that community planners and health professionals should aim to strengthen the social and aesthetic relationships while designing environments and policies as a way to ignite intermediate processes that may lead to improved health status.


Anhedonia—the reduced capacity to experience pleasure—is a trait implicated in mental and physical health. Yet, psychometric data on anhedonia measures in adolescents are absent. We conducted an in-depth psychometric analysis of the Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995)—a self-report measure of anticipated pleasure response to 14 pleasant experiences—in adolescents. Adolescents (N=585; M age=14.5) completed the SHAPS and other paper-and-pencil surveys. Item response theory models were used to evaluate the psychometric performance of each SHAPS item. Correlations of the SHAPS with other personality and psychopathology measures were calculated to evaluate construct validity. Results showed that: (1) certain items (e.g., reported pleasure from basic experiences like “seeing smiling faces” or “smelling flowers”) provided more information about latent anhedonia than others; and (2) SHAPS scales exhibited construct-consistent convergent and discriminant validity (i.e., stronger correlations with low positive affect constructs; weaker correlations with negative affect). Reporting diminished pleasure from basic pleasant experiences accurately indicates adolescent anhedonia, which is important for future scale development and understanding the phenomenology of anhedonia in teens. These data support using the SHAPS for assessing anhedonia in epidemiological research and school-based universal prevention programming in general adolescent populations.

Assessment of the global burden of disease is based on epidemiological cohort studies that connect premature mortality to a wide range of causes1,2,3,4,5, including the long-term health impacts of ozone and fine particulate matter with a diameter smaller than 2.5 micrometres (PM2.5)3,4,5,6,7,8,9. It has proved difficult to quantify premature mortality related to air pollution, notably in regions where air quality is not monitored, and also because the toxicity of particles from various sources may vary. Here we use a global atmospheric chemistry model to investigate the link between premature mortality and seven emission source categories in urban and rural environments. In accord with the global burden of disease for 2010 (ref. 5), we calculate that outdoor air pollution, mostly by PM2.5, leads to 3.3 (95 percent confidence interval 1.6–4.8) million premature deaths per year worldwide, predominantly in Asia. We primarily assume that all particles are equally toxic5, but also include a sensitivity study that accounts for differential toxicity. We find that emissions from residential energy use such as heating and cooking, prevalent in India and China, have the largest impact on premature mortality globally, being even more dominant if carbonaceous particles are assumed to be most toxic. Whereas in much of the USA and in a few other countries emissions from traffic and power generation are important, in eastern USA, Europe, Russia and East Asia agricultural emissions make the largest relative contribution to PM2.5, with the estimate of overall health impact depending on assumptions regarding particle toxicity. Model projections based on a business-as-usual emission scenario indicate that the contribution of outdoor air pollution to premature mortality could double by 2050.


Background: Developments in information technology cause a great deal of stress to modern people, and controlling this stress now becomes an important issue. The aim of this study was to examine psychological and physiological benefits of interaction with indoor plants.

Methods: The study subjects were 24 young male adults at the age of 24.9 +/- 2.1 (mean +/- SD). The crossover experimental design was used to compare the differences in physiological responses to a computer task and a plant-related task. Subjects were randomly distributed into two groups. The first group (12 subjects) carried out transplanting of an indoor plant, whereas the second group (12 subjects) worked on a computer task. Then, each subject switched activities. The psychological evaluation was carried out using the semantic differential method (SDM) and physiological evaluation using heart rate variability (low-frequency (LF) and high-frequency (HF) components) and blood pressure.

Results: Analysis of the SDM data showed that the feelings during the transplanting task were different from that during the computer task: the subjects felt more comfortable, soothed, and natural after the transplanting task than after the computer task. The mean value of total log[LF/(LF + HF)] (sympathetic activity) increased over time during the computer task but decreased at the end of the transplanting task, and the differences were significant. Furthermore, diastolic blood pressure was significantly lower after the transplanting task.

Conclusions: Our results suggest that active interaction with indoor plants can reduce physiological and psychological stress compared with mental work. This is accomplished through suppression of sympathetic nervous system activity and diastolic blood pressure and promotion of comfortable, soothed, and natural feelings.

Based on attention restoration theory we proposed that micro-breaks spent viewing a city scene with a flowering meadow green roof would boost sustained attention. Sustained attention is crucial in daily life and underlies successful cognitive functioning. We compared the effects of 40-s views of two different city scenes on 150 university students' sustained attention. Participants completed the task at baseline, were randomly assigned to view a flowering meadow green roof or a bare concrete roof, and completed the task again at post-treatment. Participants who briefly viewed the green roof made significantly lower omission errors, and showed more consistent responding to the task compared to participants who viewed the concrete roof. We argue that this reflects boosts to sub-cortical arousal and cortical attention control. Our results extend attention restoration theory by providing direct experimental evidence for the benefits of micro-breaks and for city green roofs.


Despite an increasing attention and public preference for rural amenities, little evidence is available on the health benefits of a rural environment. In this study, we identified physiological and psychological benefits of exposure to a rural environment using multiparametric methods. Twelve young male adults participated in a 3-day field experiment (mean +/- standard deviation age, 22.3 +/- 1.3 years). Sleeping environment, diet program, physical activities, and other factors possibly affecting physiological responses were controlled during experiment period. For all participants, salivary cortisol concentration, heart rate variability, and blood pressure were measured at rural and urban field sites. Self-evaluation questionnaires were administered to analyze the psychological states in two different environments. Volatile compounds in the air were also analyzed to investigate air quality. The data were compared between rural and urban environments. The data showed that exposure to a rural environment reduced stress hormone secretion and sympathetic nervous activity and increased parasympathetic nervous activity. Short-term exposure to a rural environment also improved mood states. Our findings indicate that exposure to a rural environment effectively reduced physiological stress and enhanced psychological well-being.


How might contact with nature promote human health? Myriad studies have linked the two; at this time the task of identifying the mechanisms underlying this link is paramount. This article offers: (1) a compilation of plausible pathways between nature and health; (2) criteria for identifying a possible central pathway; and (3) one promising candidate for a central pathway. The 21 pathways identified here include environmental factors, physiological and psychological states, and behaviors or conditions, each of which has been empirically tied to nature and has implications for specific physical and mental health outcomes. While each is likely to contribute to nature’s impacts on health to some degree and under some circumstances, this paper explores the possibility of a central pathway by proposing criteria for identifying such a pathway and illustrating their use. A particular pathway is more likely to be central if it can account for the size of nature’s impacts on health, account for nature’s specific health outcomes, and subsume
other pathways. By these criteria, enhanced immune functioning emerges as one promising candidate for a central pathway between nature and health. There may be others.


Researchers have found that gardens and landscaping designs can diffuse throughout neighborhoods. In the present study, we extend this research by examining if produce gardens on reclaimed vacant lots can have a radiating and positive, linear effect on the surrounding residential parcels. If well-maintained parcels tend to cluster together then we would expect that parcels proximal to a well-maintained produce garden would have better maintenance than parcels near an undeveloped vacant lot. We refer to this transformative process as the Greening Hypothesis. In the present study, we investigate yard maintenance observations of residential properties located near a produce garden, compared with those near an undeveloped vacant lot while controlling for residents’ neighborhood perceptions and census demographic data. Our study area was urban and residential with higher than normal levels of property abandonment and urban blight. Our results, supporting the greening hypothesis, indicated that residential parcels proximal to produce gardens were better maintained than parcels near undeveloped vacant lots. Study implications support policies and programs which include greening initiatives as part of community development strategies.


This paper investigates the effects of urban green and abandoned areas on residential well-being in major German cities, using panel data from the German Socio-Economic Panel (SOEP) for the time period between 2000 and 2012 and cross-section data from the European Urban Atlas (EUA) for the year 2006. Using a Geographical Information System (GIS), it calculates the distance to urban green and abandoned areas, measured as the Euclidean distance in 100 metres between households and the border of the nearest urban green and abandoned area, respectively, and the coverage of urban green and abandoned areas, measured as the hectares covered by urban green and abandoned areas in a pre-defined buffer area of 1,000 metres around households, respectively, as the most important determinants of access to them. It shows that, for the 32 major German cities with more than 100,000 inhabitants, access to urban green areas, such as parks, is significantly positively associated, whereas access to abandoned areas, such as brownfields, is significantly negatively associated with residential well-being, in particular with life satisfaction, as well as mental and physical health. The effects are strongest for residents who are older, accounting for up to a third of the size of the effect of being unemployed on life satisfaction. Using data from the Berlin Aging Study II (BASE-II) for the time period between 2009 and 2012, this paper also shows that (older) residents who report living closer to greens have been diagnosed significantly less often with certain medical conditions, including diabetes, sleep disorder, and joint disease.

The growing of plants are said to improve individuals’ physical and mental states. The growing of plants is a process through which the people are stimulated to positively change. Actually, the growing of plants has been used as a method of the psychological care of the person of the PTSD. For this reason, the growing of plants could be assumed to reflect plastic change in the brain. However, the neural basis of the growing of plants for PTSD is uncertain. This study sought to verify PTSD reaction reduction and changes in brain morphology and stress hormones by growing of plants in women with earthquake stress. Fifty-four right-handed women with mild PTSD in a disaster area participated in this randomized, permuted block method, controlled, crossover trial. Participants were randomly assigned to a horticultural therapy (HT) intervention or stress education (SE) intervention group. Within the 8-week study period, magnetic resonance imaging, psychological index for intervention evaluations, and saliva tests were performed before and after interventions. The HT group showed significantly increased regional gray matter volume (rGMV) of the left subgenual anterior cingulate cortex and left superior frontal gyrus compared with the SE group. The HT group also showed significant improvement in PTSD reactions, posttraumatic growth, and positive affect compared with the SE group. The HT group showed greatly improved salivary cortisol and alpha amylase levels compared with the SE group. These results demonstrate that the growing of plants restore people with PTSD reactions to good condition. Additionally, the growing of plants reduced stress levels in people with PTSD reactions for an earthquake disaster. The growing of plants increased the rGMV of brain areas known to be reduced in PTSD patients. Neural plasticity may underlie the psychological and physiological effects of the growing of plants.


Objectives. We investigated the health and safety effects of urban green stormwater infrastructure (GSI) installments.

Methods. We conducted a difference-in-differences analysis of the effects of GSI installments on health (e.g., blood pressure, cholesterol and stress levels) and safety (e.g., felonies, nuisance and property crimes, narcotics crimes) out- comes from 2000 to 2012 in Philadelphia, Pennsylvania. We used mixed-effects regression models to compare differences in pre- and posttreatment measures of outcomes for treatment sites (n = 52) and randomly chosen, matched control sites (n = 186) within multiple geographic extents surrounding GSI sites.

Results. Regression-adjusted models showed consistent and statistically significant reductions in narcotics possession (18%–27% less) within 16th-mile, quarter-mile, half-mile (P < .001), and eighth-mile (P < .01) distances from treatment sites and at the census tract level (P < .01). Narcotics manufacture and burglaries were also significantly reduced at multiple scales. Non-significant reductions in homicides, assaults, thefts, public drunkenness, and narcotics sales were associated with GSI installation in at least 1 geographic extent.

Conclusions. Health and safety considerations should be included in future assessments of GSI programs. Subsequent studies should assess mechanisms of this association.


Trees and other vegetation, called “roadside vegetation”, are found along a road lane and have different functions. This paper provides the analysis of the impact of vegetation on water
erosion, winter conditions, visibility of formation line, glare effect, inhibition of energy, wind strength, presence of animal habitats and creation of specific microclimate. Apart from typical ecological functions, they also impact the risk for people involved in the traffic flow. These influences have both a positive and negative impact on the safety of vehicle flow on roads. The paper uses the method of data analysis, and accident rates were calculated with the participation of environmental conditions - driving into a tree, hitting an animal, rainfall, snowfall, blinding sun and strong wind gusts. The main conclusions of the study include: (1) roadside vegetation has many positive characteristics and also influences the safety of road users, (2) taking into consideration different environmental conditions, most road accidents are caused by driving into a tree, (3) the overall number of road accidents in Poland influenced by environmental conditions is decreasing despite the growth in the number of vehicles, (4) by employing the standards of woodlot shaping, it is possible to retain the positive influence of the vegetation on the space and, simultaneously, make the space safe for road users.


The Netherlands has a temperate climate influenced by the North Sea, with moderate temperatures throughout the year. However, hot summer days in which temperatures rise above 30 °C, do occur and will occur more frequently in future due to climate change [1]. Particularly in urban areas, this may have adverse consequences for human health and outdoor thermal comfort. In addition, future densification and extension of urban areas may further increase thermal discomfort and negative health impacts.

Green infrastructure can improve thermal comfort in outdoor urban spaces in moderate climates. The impact of green spaces on thermal comfort is often exclusively investigated through meteorological variables and human-biometeorological indices. Yet, studies on perceived thermal comfort are scarce. As thermal comfort is a property of human perception of the thermal environment, this knowledge is crucial for understanding the relationship between green spaces and thermal comfort.

We investigated inhabitants' long-term perception of thermal comfort on warm summer days in three Dutch cities by means of questionnaires. Additionally, we examined the daytime cooling effect of green spaces in Utrecht, in order to find physical evidence to verify thermal comfort perception. To this end we used bicycles equipped with micrometeorological sensors. We compared thermal conditions of 13 parks with thermal conditions in the city centre and in the open grassland outside the city. And we analysed dependences between thermal conditions and spatial variables of parks (size, tree canopy, upwind vegetation cover).

Our results demonstrate that green infrastructure improves generally perceived thermal comfort. People evaluated green urban spaces as the most thermally comfortable spaces which was in line with the physical thermal investigations. Physiological equivalent temperature (PET) in parks on average was 1.9 K lower than in the city centre and 5 K lower than in the surrounding grasslands during the hottest period of the day. Thermal variance between parks was significantly influenced by tree canopy cover (mean radiant temperature p 1/4 0.00005) and upwind vegetation cover (air temperature p 1/4 0.013), not significantly for park size.

Contact with nature can have numerous beneficial effects for children. As the school is a place where children spend a lot of time, the physical environment of the school has considerable potential to influence children. This study investigated the influence of a redesign (greening) of a schoolyard on pupils’ physiological stress, psychological well-being, and executive functioning. A pre–post, quasi-experimental design with a multimethod approach was applied. One-hundred thirty-three middle school pupils (M = 14.4 years) of three middle schools in a rural area in Austria were assessed. The renovated schoolyard significantly diminished pupils’ physiological stress levels and enhanced their psychological well-being. Pupils in the renovated schoolyard setting also perceived the environment as more restorative following the redesign. However, it did not affect executive functioning as hypothesized. Limitations of the study and future research opportunities are discussed.


Studies have shown that natural environments can enhance health and here we build upon that work by examining the associations between comprehensive greenspace metrics and health. We focused on a large urban population center (Toronto, Canada) and related the two domains by combining high-resolution satellite imagery and individual tree data from Toronto with questionnaire-based self-reports of general health perception, cardio-metabolic conditions and mental illnesses from the Ontario Health Study. Results from multiple regressions and multivariate canonical correlation analyses suggest that people who live in neighborhoods with a higher density of trees on their streets report significantly higher health perception and significantly less cardio-metabolic conditions (controlling for socio-economic and demographic factors). We find that having 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighborhood with $10,000 higher median income or being 7 years younger. We also find that having 11 more trees in a city block, on average, decreases cardio-metabolic conditions in ways comparable to an increase in annual personal income of $20,000 and moving to a neighborhood with $20,000 higher median income or being 1.4 years younger.


Environmental psychology research has demonstrated that exposure to mundane natural environments can be psychologically beneficial, and can, for instance, improve individuals’ mood and concentration. However, little research has yet examined the psychological benefits of extraordinary, awe-evoking kinds of nature, such as spectacular mountain scenes or impressive waterfalls. In this study, we aimed to address the underrepresentation of such extraordinary nature in research on human nature interactions. Specifically, we examined whether watching a picture slideshow of awesome as opposed to mundane nature differentially affected individuals' emotions, mood, social value orientation (SVO), and their willingness to donate something to others. Our analyses revealed that, compared to mundane nature and a neutral condition, watching awesome natural scenes and phenomena had some unique and pronounced emotional effects (e.g., feeling small and humble), triggered the most mood improvement, and led to a more
prosocial SVO. We found that participants' willingness to donate did not differ significantly for any of the conditions.


Recently reported research indicate that forest environments have physiological and psychological relaxing effects compared to urban environments. However, some researchers claim that the stress of the subjects from being watched by others during measurements can affect the measurement result in urban experiments conducted in the center of a street. The present study was conducted to determine whether forest environments have physiological and psychological relaxing effects, using comparison of viewing a forest area with viewing an urban area from the roof of an urban building without being watched by others. Near-infrared spectroscopy (NIRS) measurement was performed on subjects while they viewed scenery for 15 min at each experimental site (urban and forest areas). Subjective assessments were performed after the NIRS measurement was complete. Total hemoglobin and oxyhemoglobin concentrations were significantly lower in the forest area than in the urban area. For semantic differential in subjective assessments, feelings of comfortable, natural, and soothed were significantly higher in the forest area than in the urban area, and for profile of mood states, negative emotions were significantly lower in the forest area than in the urban area. The results of physiological and psychological measurements show that viewing the forest enabled effective relaxation.


Health disparities occur when adverse health conditions are unequal across populations due in part to gaps in wealth. These disparities continue to plague global health. Decades of research suggests that the natural environment can play a key role in sustaining the health of the public. However, the influence of the natural environment on health disparities is not well-articulated. Green spaces provide ecosystem services that are vital to public health. This paper discusses the link between green spaces and some of the nation’s leading health issues such as obesity, cardiovascular health, heat-related illness, and psychological health. These associations are discussed in terms of key demographic variables—race, ethnicity, and income. The authors also identify research gaps and recommendations for future research.


Background: Research on the association between the physical environment and physical activity in children has focused on built and developed features or total green space. The impact of natural, undeveloped green spaces is unknown. The objective of this study was to determine whether the presence of undeveloped green spaces in the home neighborhood are associated with physical activity in 11 to 13-year-olds.

Methods: This was a cross-sectional study of grade 6 to 8 urban residing Canadian students who participated in the 2009/10 Health Behaviour in School-Aged Children survey.
Children self-reported the frequency they participated in physical activity in their free-time outside of school hours. Geographic Information Systems (GIS) were used to assess the proportion of land area within 1 km of participants’ homes that was devoted to publicly accessible meadows (i.e., field vegetated primarily by grass and other non-woody plants) and treed areas (i.e., field vegetated primarily by trees and shrubs). Ordinal logistic regression models were used to examine the relationships between the undeveloped green space areas and free-time physical activity. Several intrapersonal, family, and neighborhood environment factors were controlled for in these regression models.

Results: The proportion of neighborhood land covered by meadows was not associated with the physical activity outcome (p > 0.6). However, the proportion of neighborhood land covered by treed areas was independently associated with the physical activity outcome (p = 0.02). For each additional 5% increase in the proportion of neighborhood land covered by treed areas there was a corresponding 5% increase (95% confidence interval: 1-10% increase) in the relative odds of increasing free-time physical activity outside of school hours.

Conclusions: The physical activity levels of 11 to 13-year-old children was associated with the amount of space in their home neighborhood devoted to treed areas.


Researchers are increasingly exploring how neighborhood greenness, or vegetation, may affect health behaviors and outcomes. Greenness may influence health by promoting physical activity and social contact; decreasing stress; and mitigating air pollution, noise, and heat exposure. Greenness is generally measured using satellite-based vegetation indices or land-use databases linked to participants’ addresses. In this review, we found fairly strong evidence for a positive association between greenness and physical activity and a less consistent negative association between greenness and body weight. Research suggests greenness is protective against adverse mental health outcomes, cardiovascular disease, and mortality, though most studies were limited by cross-sectional or ecological design. There is consistent evidence that greenness exposure during pregnancy is positively associated with birth weight, though findings for other birth outcomes are less conclusive. Future research should follow subjects prospectively, differentiate between greenness quantity and quality, and identify mediators and effect modifiers of greenness-health associations.


The relaxation effects of gardening have attracted attention; however, very few studies have researched its physiological effects on humans. This study aimed to clarify the physiological and psychological effects on high school students of viewing real and artificial pansies. Forty high school students (male: 19, female: 21) at Chiba Prefectural Kashiwanoha Senior High School, Japan, participated in this experiment. The subjects were presented with a visual stimulation of fresh yellow pansies (Viola x wittrockiana “Nature Clear Lemon”) in a planter for 3 min. Artificial yellow pansies in a planter were used as the control. Heart rate variability was used as a physiological measurement and the modified semantic differential method was used for subjective evaluation. Compared with artificial pansies, visual stimulation with real flowers resulted in a significant decrease in the ratio of low- to high-frequency heart
rate variability component, which reflects sympathetic nerve activity. In contrast, high frequency, which reflects parasympathetic nerve activity, showed no significant difference. With regard to the psychological indices, viewing real flowers resulted in "comfortable", "relaxed", and "natural" feelings. The findings indicate that visual stimulation with real pansies induced physiological and psychological relaxation effects in high school students.


Purpose: Farms are increasingly used in mental healthcare. This study aimed to systematically review the evidence on the effectiveness of farm-based interventions for patients with mental disorders. Methods: Controlled and uncontrolled studies of farm-based interventions were included. Within- and between group effect sizes were calculated. Qualitative data were summarized using thematic synthesis. The review followed the PRISMA, Cochrane and COREQ standards. Results: The eleven articles included reported results of five studies, three of which were randomized control trials (RCTs). Overall, 223 patients with depressive disorders, schizophrenia or heterogeneous mental disorders attended three types of farms-based interventions. Favourable effects on clinical status variables were found in one study in patients with depressive disorders that did not respond to medication and/or psychotherapy, and in one RCT in patients with schizophrenia. Assessment of rehabilitative effects (functioning and quality of life) was limited and yielded conflicting results. Patients' experiences revealed that social and occupational components of interventions were perceived as beneficial, and provided insights into how farm-based interventions may facilitate recovery. Conclusions: Our results suggest that the farm environment should be considered, especially for patients with mental disorders who do not achieve an adequate response with other treatment options. Further research is needed to clarify potential social and occupational benefits.


Introducing elements of nature in indoors has many benefits on employees, due to the fact that people spent most of their time in enclosed spaces, such as offices. Integrating ornamental plants into indoor environments can be considered a health promotion tool, a low-cost and an effective method for increasing commitment to nature in a world largely urbanized. For this study a questionnaire was developed and applied in a unit in Cluj-Napoca with administrative purposes and with cross-disciplinary activities to determine employees’ perceptions on the image and the effects of plants in the workplace. Questionnaire 'Image of plants in the workplace and employees comfort at work’ with 34 direct and concise questions and demographic data reported results that support the hypothesis that plants in workspace presents sanogenetic characters. Thus, it appears that employees would like to have more plants in the workplace (97%) because provide a sense of relaxation (97%), change the work environment making it similar with space from home (98 %), cheer up the image of an office (99%) and give a sense of relief (98%). Approximately 98% of respondents believe that ornamental plants raises work motivation.

It is well-established that the experience of nature produces an array of positive benefits to mental well-being. Much less is known about the specific attributes of green space which produce these effects. In the absence of translational research that links theory with application, it is challenging to design urban green space for its greatest restorative potential. This translational research provides a method for identifying which specific physical attributes of an environmental setting are most likely to influence preference and restoration responses. Attribute identification was based on a triangulation process invoking environmental psychology and aesthetics theories, principles of design founded in mathematics and aesthetics, and empirical research on the role of specific physical attributes of the environment in preference or restoration responses. From this integration emerged a list of physical attributes defining aspects of spatial structure and environmental content found to be most relevant to the perceptions involved with preference and restoration. The physical attribute list offers a starting point for deciphering which scene stimuli dominate or collaborate in preference and restoration responses. To support this, functional definitions and metrics—efficient methods for attribute quantification are presented. Use of these research products and the process for defining place-based metrics can provide (a) greater control in the selection and interpretation of the scenes/images used in tests of preference and restoration and (b) an expanded evidence base for well-being designers of the built environment.


As gifts are an important market sector for selling fresh flowers, this study investigated the effects of the characteristics associated with the dyads of givers and receivers on the probability of buying fresh flowers as gifts. Based on the theory of gift giving, several factors were hypothesized to influence the probability of buying fresh flowers as gifts, including givers’ financial capability and the perceived gift values of flowers, as well as knowledge of receiver’s needs, preferences, and difficulty to please. A self-administered questionnaire survey was conducted to test the hypotheses. Results of the statistical analysis based on 394 valid questionnaires revealed that the perceived gift values of flowers, i.e., the economic value, functional value, social value, and expressive value, were the most important factors for the consumer decision of whether to buy fresh flowers as gifts. However, different gift values were emphasized for fresh flowers across different relational ties. For example, economic value was the key value when the receivers were parents, whereas social value and expressive value were emphasized when the receivers were romantic partners. Different from many previous studies, this study revealed that financial capability did not influence the likelihood of givers deciding to purchase fresh flowers for gifts. The study results implied that when promoting fresh flowers for gift use, the gift values of fresh flowers need to be emphasized to consumers.


Previous research has suggested that gardening activity could be an effective form of regular exercise for improving physical and psychological health in later life. However, there is a lack of data regarding the exercise intensities of various gardening tasks across different types of gardening and different populations. The purpose of this study was to examine the exercise intensity of gardening activity for older adult allotment gardeners in Wales, United Kingdom.
following a similar procedure used in previous studies conducted in the United States and South Korea by Park and colleagues (2008a; 2011). Oxygen consumption (VO2) and energy expenditure for six gardening tasks were measured via indirect calorimetry using the portable Oxycon mobile device. From these measures, estimated metabolic equivalent units (METs) were calculated. Consistent with Park et al. (2008a; 2011) the six gardening tasks were classified as low to moderate-high intensity physical activities based on their metabolic values (1.9-5.7 METs).


437 nuclear power plants are in operation at present around the world to meet increasing energy demands. Unfortunately, five major nuclear accidents have occurred in the past - i.e., at Kyshtym (Russia [then USSR], 1957), Windscale Piles (UK, 1957), Three Mile Island (USA, 1979), Chernobyl (Ukraine [then USSR], 1986), and Fukushima (Japan, 2011). The effects of these accidents on individuals and societies are diverse and enduring. Accumulated evidence about radiation health effects on atomic bomb survivors and other radiation-exposed people has formed the basis for national and international regulations about radiation protection. However, past experiences suggest that common issues were not necessarily physical health problems directly attributable to radiation exposure, but rather psychological and social effects. Additionally, evacuation and long-term displacement created severe health-care problems for the most vulnerable people, such as hospital inpatients and elderly people.


Psychological and physiological benefits of viewing nature have been extensively studied for some time. More recently it has been suggested that some of these positive effects can be explained by nature's fractal properties. Virtually all studies on human responses to fractals have used stimuli that represent the specific form of fractal geometry found in nature, i.e. statistical fractals, as opposed to fractal patterns which repeat exactly at different scales. This raises the question of whether human responses like preference and relaxation are being driven by fractal geometry in general or by the specific form of fractal geometry found in nature. In this study we consider both types of fractals (statistical and exact) and morph one type into the other. Based on the Koch curve, nine visual stimuli were produced in which curves of three different fractal dimensions evolve gradually from an exact to a statistical fractal. The patterns were shown for one minute each to thirty-five subjects while qEEG was continuously recorded. The results showed that the responses to statistical and exact fractals differ, and that the natural form of the fractal is important for inducing alpha responses, an indicator of a wakefully relaxed state and internalized attention.


Traditional stormwater management design objectives encourage the use of event-based hydrology, which is not appropriate for assessing impacts to downstream receiving watercourses
and waterbodies. Continuous hydrologic simulation is required to accurately quantify the impacts of stormwater facilities including low impact development (LID) and green infrastructure. A new methodology is presented that applies a flow duration analysis for assessing a broad range of downstream impacts. Stormwater user fee credit programs typically offer incentives using criteria based on the same traditional design objectives, such as peak flow and total volume reductions. This paper applies the new methodology to develop user fee credit criteria that reward property owners with on-site facilities that either mimic natural hydrologic conditions or demonstrate reduced downstream impacts (i.e., compared to existing development conditions without the facilities). The methodology is applied to two project examples and reduced user fee charges are demonstrated using the suggested credit criteria.


The article presents the results of a laboratory study conducted at Shanghai Tongji University. The study compares participants’ mood and task performance between naturally-lit and artificially-lit environments, with a view to identify negative impacts, such as lighting variation and temperature asymmetry caused by dynamic natural light. It was observed that the mood change in the naturally-lit environment was more significant, especially the decrease of positive mood, than in the artificially-lit environment. For the subjects in the naturally-lit environment, performance scores decreased with increase in the light intensity and temperature asymmetry. Based on the study results, suitable daylighting design was recommended for classrooms or offices.


Evolving literature suggests that modifiable neighborhood characteristics such as trees and other vegetation are inversely associated with crime. This study examines the relationship between vegetation and crime in New Haven, CT, a midsized city with high crime rates. Spatial lag analyses were used to test the association of tree canopy coverage, measured through high-resolution aerial imagery, with rates of violent (murder, rape, robbery and assault), property (burglary, theft, motor vehicle theft and arson) and total (violent + property) crimes. Greater tree canopy coverage was associated with lower rates of violent, property and total crime, independent of block group level educational attainment, median household income, racial/ethnic composition, population density, vacancies and renter-occupied housing, as well as spatial autocorrelation. Results support the general findings from studies conducted in larger cities, including Chicago, Portland, Baltimore and Philadelphia and points toward trees’ crime prevention potential.


Many studies conducted during the last decade suggest the mental health benefits of green and blue spaces. We aimed to systematically review the available literature on the long-term mental health benefits of residential green and blue spaces by including studies that used standardized tools or objective measures of both the exposures and the outcomes of interest. We
followed the PRISMA statement guidelines for reporting systematic reviews and meta-analysis. In total 28 studies were included in the systematic review. We found limited evidence for a causal relationship between surrounding greenness and mental health in adults, whereas the evidence was inadequate in children. The evidence was also inadequate for the other exposures evaluated (access to green spaces, quality of green spaces, and blue spaces) in both adults and children. The main limitation was the limited number of studies, together with the heterogeneity regarding exposure assessment. Given the increase in mental health problems and the current rapid urbanization worldwide, results of the present systematic review should be taken into account in future urban planning. However, further research is needed to provide more consistent evidence and more detailed information on the mechanisms and the characteristics of the green and blue spaces that promote better mental health. We provide recommendations for future studies in order to provide consistent and evidence-based recommendations for policy makers.


This paper extends the concept of therapeutic landscapes by investigating how green and blue spaces affect older adult health and wellbeing. We draw on interview data from participants aged 65-86 years old who described their everyday experiences with green and especially blue spaces across Metro Vancouver, Canada. Landscapes embedded with therapeutic qualities included parks, gardens, street greenery, lakes, and the ocean. Interactions with these spaces influenced participants' perceived physical, mental, and social health. Issues of safety, accessibility, and personal perception complicated this relationship. Overall, the findings indicate that nature plays a nuanced and influential role in the everyday lives of older adults. Better understanding how older adults experience health and landscape is critical towards developing everyday contact with nature that can improve quality of life for ageing populations.


The objective of the study was to test whether live plants on computer workstations with and without window view had restorative effects. Guided by Stress Recovery Theory and Attention Restoration Theory a mixed randomized experiment was conducted exploring restorative effects of plants, including mediating effects of perceived fascination. Eighty-five participants carried out a 1-hr work session with repeated tasks demanding directed attention in an office with one of three interior conditions: live plants, inanimate objects and control, all with and without a window view. Plant presence led to greater perceived fascination, but perceived fascination was not related to either self-reported restoration or directed attention capacity. The presence of plants during work did not have superior restorative effects compared with inanimate objects, neither with nor without access to a window view. However, environmental enrichment with either plants or inanimate objects at the computer workstation seemed to provide a restorative potential, which should be investigated further.


Cities are a key nexus of the relationship between people and nature and are huge centers of demand for ecosystem services and also generate extremely large environmental impacts.
Current projections of rapid expansion of urban areas present fundamental challenges and also opportunities to design more livable, healthy and resilient cities (e.g. adaptation to climate change effects). We present the results of an analysis of benefits of ecosystem services in urban areas. Empirical analyses included estimates of monetary benefits from urban ecosystem services based on data from 25 urban areas in the USA, Canada, and China. Our results show that investing in ecological infrastructure in cities, and the ecological restoration and rehabilitation of ecosystems such as rivers, lakes, and woodlands occurring in urban areas, may not only be ecologically and socially desirable, but also quite often, economically advantageous, even based on the most traditional economic approaches.


The study of plant behaviour will be aided by conceptual approaches and terminology for cooperation, altruism and helping. The plant literature has a rich discussion of helping between species while the animal literature has an extensive and somewhat contentious discussion of within-species helping. Here, I identify and synthesize concepts, terminology and some practical methodology for speaking about helping in plant populations and measuring the costs and benefits. I use Lehmann and Keller's (2006) classification scheme for animal helping and McIntire and Fajardo's (2014) synthesis of facilitation to provide starting points for classifying the mechanisms of how and why organisms help each other. Contextual theory is discussed as a mechanism for understanding and measuring the fitness consequences of helping. I synthesize helping into four categories. The act of helping can be costly to the helper. If the helper gains indirect fitness by helping relatives but loses direct fitness, this is altruism, and it only occurs within species. Helpers can exchange costly help, which is called mutualism when between species, and reciprocation when within a species. The act of helping can directly benefit the helper as well as the recipient, either as an epiphenomenon resulting from behaviours under natural selection for other reasons, or because the helper is creating a mutual benefit, such as satiating predators or supporting a mutualism. Facilitation between species by stress amelioration, creation of novel ecosystems and habitat complexity often meets the definition of epiphenomenon helping. Within species, this kind of helping is called by-product mutualism. If the helping is under selection to create a mutual benefit shared by others, between species this is facilitation with service sharing or access to resources and within species, direct benefits by mutual benefits. These classifications provide a clear starting point for addressing the subject of helping behaviours.


Sustainability assessment is increasingly being viewed as an important tool to aid in the shift towards sustainable urban ecosystems. An urban ecosystem is a dynamic system and requires regular monitoring and assessment through a set of relevant indicators. An indicator is a parameter which provides information about the state of the environment by producing a quantitative value. Indicator-based sustainability assessment needs to be considered on all spatial scales to provide efficient information of urban ecosystem sustainability. The detailed data is necessary to assess environmental change in urban ecosystems at local scale and easily transfer this information to the national and global scales. This paper proposes a set of key micro-level urban ecosystem indicators for monitoring the sustainability of residential developments. The proposed indicator framework measures the sustainability performance of urban ecosystem in 3
main categories including: natural environment, built environment, and socio-economic environment which are made up of 9 sub-categories, consisting of 23 indicators. This paper also describes theoretical foundations for the selection of each indicator with reference to the literature.


Context Horticultural therapy (HT) is a subgroup of occupational therapy (OT). Both HT and OT have been successful as adjunctive treatment modalities in substance abuse treatment. Studies have indicated that gardening promotes neuroendocrine and affective restoration from stress. Objectives The study intended to assess the effect of HT versus nonhorticultural OT on cortisol levels, depression, symptoms of posttraumatic stress disorder (PTSD), alcohol cravings, and quality of life. Methods The research team designed a randomized pilot study. Setting The study was open for participation from July 2012-October 2012. It took place during multiple occurrences of a 28-d treatment programs for substance use disorder at a Veterans Affairs medical center. Participants Participants were 49 veterans, averaging 46.4 y old (SD = 11.9); the dropout rate was 37%. Intervention " Participants were randomly assigned to the HT or the OT group. They attended supervised HT and OT groups 5 h/d for 3 wk. Outcome Measures Pre- and posttreatment, participants completed the Quality of Life Enjoyment and Satisfaction Questionnaire Short Form (Q-LES-Q-SF), the Alcohol Craving Questionnaire (ACQ-NOW), the Posttraumatic Stress Disorder Checklist Civilian Version (PCL-C), and the Center for Epidemiologic Studies Depression Scale (CES-D). Salivary cortisol samples were taken at wk 1, 2, and 3. Results A repeated measures analysis of variance (ANOVA) (F-220 = 0.878) revealed that the HT performed was associated with a 12% reduction in salivary cortisol levels from wk 1 to wk 3, but the difference was not statistically significant (P =.43). Separate 1-way analyses of covariance (ANCOVAs) revealed no statistically significant differences in the self-administered tests, although both the Q-LES-Q-SF and CES-D showed a trend toward improving quality of life and depressive symptoms in the HT group compared with the OT group. Additional analysis of the nonbiologic tests suggests that most participants in the HT and OT had some benefit from the programmed activities. Conclusions The trends suggest that HT may modulate stress in veterans, as evidenced by decreased cortisol levels and depressive symptoms, and may improve quality of life more than the programs in which the OT group participated. Further investigation with larger samples, including a nontreatment control group, is needed to determine whether the observed trends are treatment effects or due to abstinence.


Exposure to green space has been associated with better physical and mental health. Although this exposure could also influence cognitive development in children, available epidemiological evidence on such an impact is scarce. This study aimed to assess the association between exposure to green space and measures of cognitive development in primary schoolchildren. This study was based on 2,593 schoolchildren in the second to fourth grades (7–10 y) of 36 primary schools in Barcelona, Spain (2012–2013). Cognitive development was assessed as 12-mo change in developmental trajectory of working memory, superior working
memory, and inattentiveness by using four repeated (every 3 mo) computerized cognitive tests for each outcome. We assessed exposure to green space by characterizing outdoor surrounding greenness at home and school and during commuting by using high-resolution (5 m × 5 m) satellite data on greenness (normalized difference vegetation index). Multilevel modeling was used to estimate the associations between green spaces and cognitive development. We observed an enhanced 12-mo progress in working memory and superior working memory and a greater 12-mo reduction in inattentiveness associated with greenness within and surrounding school boundaries and with total surrounding greenness index (including greenness surrounding home, commuting route, and school). Adding a traffic-related air pollutant (elemental carbon) to models explained 20–65% of our estimated associations between school greenness and 12-mo cognitive development. Our study showed a beneficial association between exposure to green space and cognitive development among schoolchildren that was partly mediated by reduction in exposure to air pollution.


Introduction. The green areas play an important role in improving the environmental quality and climate of the city. However, despite the undoubted importance of these areas, the benefits to public health are still under investigation.

Results. The Authors perform a review of studies on the relationship between health and green areas and describe the main areas for which evidence on this relationship is currently available. They include: effects on air quality, on social cohesion, on mental health, with particular reference to the stress, and on physical activity.

Conclusions. Most of the evidence comes from cross-sectional and descriptive studies and the approaches used to measure the association show themselves to be often unsatisfactory. The Authors conclude the review stressing the need for greater integration between the different professionals involved in urban planning and in health care analysis in order to identify research approaches more appropriate to understand such complex issues, striving toward a planning design of green areas that will satisfy both environmental sustainability and health requirements.


Contemporary ecological models of health prominently feature the natural environment as fundamental to the ecosystem services that support human life, health, and well-being. The natural environment encompasses and permeates all other spheres of influence on health. Reviews of the natural environment and health literature have tended, at times intentionally, to focus on a limited subset of ecosystem services as well as health benefits stemming from the presence, and access and exposure to, green infrastructure. The sweeping influence of green infrastructure on the myriad ecosystem services essential to health has therefore often been underrepresented. This survey of the literature aims to provide a more comprehensive picture—in the form of a primer—of the many simultaneously acting health co-benefits of green infrastructure. It is hoped that a more accurately exhaustive list of benefits will not only instigate further research into the health co-benefits of green infrastructure but also promote consilience in the many fields, including public health, that must be involved in the landscape conservation necessary to protect and improve health and well-being.

Objectives: We examined associations of several health outcomes with green and conventional low-income housing, where the prevalence of morbidities and environmental pollutants is elevated.

Methods: We used questionnaires and a visual inspection to compare sick building syndrome (SBS) symptoms and asthma-related morbidity among residents in multifamily units in Boston, Massachusetts, between March 2012 and May 2013. Follow-up was approximately 1 year later.

Results: Adults living in green units reported 1.35 (95% confidence interval [CI] = 0.66, 2.05) fewer SBS symptoms than those living in conventional (control) homes (P < .001). Furthermore, asthmatic children living in green homes experienced substantially lower risk of asthma symptoms (odds ratio [OR] = 0.34; 95% CI=0.12, 1.00), asthma attacks (OR=0.31; 95% CI =0.11, 0.88), hospital visits (OR = 0.24; 95% CI = 0.06, 0.88), and asthma-related school absences (OR = 0.21; 95% CI = 0.06, 0.74) than children living in conventional public housing.

Conclusions: Participants living in green homes had improved health outcomes, which remained consistent over the study period. Green housing may provide a significant value in resource-poor settings where green construction or renovation could simultaneously reduce harmful indoor exposures, promote resident health, and reduce operational costs.


Background: Increasing global urbanisation has resulted in a greater proportion of the world’s population becoming exposed to risk factors unique to urban areas, and understanding these effects on public health is essential. The aim of this study was to examine the association between access to green space and mental health among adult twin pairs.

Methods: We used a multilevel random intercept model of same-sex twin pairs (4338 individuals) from the community-based University of Washington Twin Registry to analyse the association between access to green space, as measured by the Normalised Difference Vegetation Index and self-reported depression, stress, and anxiety. The main parameter of interest was the within-pair effect for identical (monozygotic, MZ) twins because it was not subject to confounding by genetic or shared childhood environment factors. Models were adjusted for income, physical activity, neighbourhood deprivation and population density.

Results: When treating twins as individuals and not as members of a twin pair, green space was significantly inversely associated with each mental health outcome. The association with depression remained significant in the within-pair MZ univariate and adjusted models; however, there was no within-pair MZ effect for stress or anxiety among the models adjusted for income and physical activity.

Conclusions: These results suggest that greater access to green space is associated with less depression, but provide less evidence for effects on stress or anxiety. Understanding the mechanisms linking neighbourhood characteristics to mental health has important public health implications. Future studies should combine twin designs and longitudinal data to strengthen causal inference

Background: Given the concerns about low rates of physical activity among low-income minority youth, many community based organizations are investing in the creation or renovation of public parks, in order to encourage youth to become more physically active. To what degree park renovations accomplish this goal is not known.

Methods: We used the System for Observing Play and Recreation in Communities (SOPARC), to measure park users and their physical activity levels before and after two parks were renovated. We compared findings to 4 parks-- 2 that were unrenovated parks and 2 that were undergoing renovation. We also surveyed parks users and local residents about their use of the parks.

Results: Compared to parks that had not yet been renovated, the improved parks saw more than a doubling in the number of visitors and a substantial increase in energy expended in the parks. Increased park use was pronounced in adults and children, but was not seen in teens and seniors. Park renovations were associated with a significantly increased perception of park safety.

Conclusions: Park improvements can have a significant impact on increasing park use and local physical activity.


As of 2007, over 50% of the global population is now urban. With more global urbanites, has come increased urbanisation and displacement of green space and natural environments from our urban centres. Biophilic design aims to restore natural stimuli in our built and designed environments to protect, maintain, restore and enhance our physiological, cognitive and psychological connections with the natural world. As part of a wider salutogenic approach to health, biophilic design has the potential to catalyze landscape architecture into playing a central role in public health of urban environments.


The literature on human experience in green environments had widely showed the positive outcomes of getting in contact with nature. This study addresses the issue of whether urban residents’ evaluations of urban and peri-urban natural settings and the positive outcomes deriving from contact with such settings vary as a function of their biodiversity. A field study assessed benefits and subjective well-being reported by urban residents visiting four different typologies of green spaces, selected on the basis of urban forestry expert criteria according to a 2 × 2 factorial design. The biodiversity level (low vs. high) was crossed with the setting location (urban vs. peri-urban) as follows: urban squares with green elements, urban parks, pinewood forest plantations, and peri-urban natural protected areas. A questionnaire including measures of length and frequency of visits, perceived restorativeness, and self-reported benefits of the visit to the green spaces was administered in situ to 569 residents of four Italian medium-to-large size cities: Bari, Florence, Rome and Padua. Results showed the positive role of biodiversity upon perceived restorative properties and self-reported benefits for urban and peri-urban green spaces. Consistently with the hypotheses reported herein, a mediation role of perceived restorativeness in
the relation between experience of natural settings (i.e. higher level of biodiversity) and self-reported benefits was found. The design and management implications of the findings are discussed.


This study investigated the effects of roadside vegetation on driving performance on a two-lane rural road. In a driving simulation, 44 participants drove along seven roadside tree configurations. The configurations were characterized by two offsets of trees from the road edge (1.5 and 4.0 m) and three spacings between trees (10.0, 17.5, and 25.0 m) located on the roadside of a two-lane rural road that was 6.0 m wide. One additional configuration, without trees, was used as the baseline condition. The investigation was developed over five geometric elements: sharp left curve, sharp right curve, gentle left curve, gentle right curve, and tangent. Compared with the baseline condition, when trees were close to the road edge, drivers were found to decrease their speed significantly and move toward the centerline of the road. By contrast, when the offset of trees was increased, drivers adopted higher speeds that increased the distance from the road edge but with a lower left lateral displacement. This occurred along all five geometries, especially on sharp curves. Tree spacing did not affect the drivers’ speed but significantly influenced the lateral position: drivers moved farther away from the road edge when tree spacing was decreased. The results demonstrated that drivers balanced the useful guidance information that roadside trees provided with the risk associated with the presence of trees: when trees were far away, the sense of guidance was predominant, and drivers adopted higher speeds; when trees were closer, drivers saw the trees as a risk, slowed down, and moved further away from them. Such driving behavior has direct impacts on the safety implications of roadside trees.


Developmental theories suggest age-related changes in the structure of affect. Paradoxically, the internal structure of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) has not been tested in Spanish older adults by means of confirmatory factor analysis (CFA) despite it is the most widely used measure of emotional well-being in later life. The aim of this study was to examine competing models of the internal structure of the Spanish version of the PANAS, its measurement invariance, reliability, and external validity. Participants were a representative sample of 585 community-dwelling people aged 60 and over, who also completed depression, loneliness and life satisfaction measures. Results showed that the orthogonal two-factor model with correlated errors (RMSEA = .057, 90% CI [.051, .063], SRMR = .084, CFI = .97, NNFI = .97) was the best fitting solution. Measurement invariance analyses confirmed that the two-independent factor structure can be used across young-old and very old people, as well as in both males and females. It showed good reliability (PA: alpha = .93, NA: alpha = .83), criterion, convergent and discriminant validity (p < .01). Our discussion highlights the role of age and culture in the experience and expression of emotions.

Biophilia—the innate human attraction to nature—is a concept that has been recognized for several decades by the scientific and design communities, and intuitively for hundreds of years by the population at large. Biophilic design, design that brings nature into the built environment, has often been regarded as a luxury for employers that want the best possible workplace for their employees, or that want to showcase their efforts to be more environmentally responsible.

Green building efforts traditionally focus on costs of energy, water, and healthy materials—all important topics. Yet, human costs are 112 times greater than energy costs in the workplace (Browning, et al., 2012). Incorporating nature into the built environment is not a luxury, but a sound economic investment in health and productivity. Biophilic design has been shown to improve employee well-being, increase productivity, and boost the bottom line.


Urbanization has many benefits, but it also is associated with increased levels of mental illness, including depression. It has been suggested that decreased nature experience may help to explain the link between urbanization and mental illness. This suggestion is supported by a growing body of correlational and experimental evidence, which raises a further question: what mechanism(s) link decreased nature experience to the development of mental illness? One such mechanism might be the impact of nature exposure on rumination, a maladaptive pattern of self-referential thought that is associated with heightened risk for depression and other mental illnesses. We show in healthy participants that a brief nature experience, a 90-min walk in a natural setting, decreases both self-reported rumination and neural activity in the subgenual prefrontal cortex (sgPFC), whereas a 90-min walk in an urban setting has no such effects on self-reported rumination or neural activity. In other studies, the sgPFC has been associated with a self-focused behavioral withdrawal linked to rumination in both depressed and healthy individuals. This study reveals a pathway by which nature experience may improve mental well-being and suggests that accessible natural areas within urban contexts may be a critical resource for mental health in our rapidly urbanizing world.

being and suggests that accessible natural areas within urban contexts may be a critical resource for mental health in our rapidly urbanizing world.


This study investigated the impact of nature experience on affect and cognition. We randomly assigned sixty participants to a 50-min walk in either a natural or an urban environment in and around Stanford, California. Before and after their walk, participants completed a series of psychological assessments of affective and cognitive functioning. Compared to the urban walk, the nature walk resulted in affective benefits (decreased anxiety, rumination, and negative affect, and preservation of positive affect) as well as cognitive benefits (increased working memory performance). This study extends previous research by demonstrating additional benefits of nature experience on affect and cognition through assessments of anxiety, rumination, and a complex measure of working memory (operation span task). These findings further our understanding of the influence of relatively brief nature experiences on affect and cognition, and help to lay the foundation for future research on the mechanisms underlying these effects.


Our work assessed the influence of an urban environmental education program on children's attitudes toward outdoor play, as well as knowledge of neighborhood features that can facilitate this type of activity. The project team engaged 6 schools near the newest Urban Ecology Center location in Milwaukee, Wisconsin, USA, through a community-academic partnership entitled More Than a Pretty Place. Intervention classrooms participated in programming over the 2012-2013 academic year and pre and post surveys were implemented in classrooms. Data were analyzed using multilevel regression models. The intervention group reported reduced fears of outdoor play in nature and increased frequency of visits to the Urban Ecology Center. The proportion of students who acknowledged knowing of a place to play outside in nature increased significantly in both groups. Our findings indicate an important role for environmental education in addressing fears that may dissuade children from engaging in outdoor play in natural areas.


Urban green spaces, including parks, provide numerous ecosystem services (ES) for city inhabitants. Besides provisioning and regulating services, they also provide cultural services by giving people opportunities to recreate and experience nature in the city. The focus of this paper is on cultural ES provided by urban parks in four European cities (Berlin, Stockholm, Rotterdam, and Salzburg). We compare attitudes towards ES provision, perception, and use of urban parks. In particular, we compare the perception of several park characteristics to their stated importance for park visitors. Results indicate that there are similarities between cities regarding attitudes towards ES provision and the importance of different park characteristics for visitors. Park use patterns such as the share of regular park visitors or the activities carried out, however, vary significantly between cities. The city-specific context, including park availability, quality, and
perception but also the inhabitants’ preferences for cultural ES and existing substitutes, is thus crucial for urban planning.


The floral industry is inherently different from other businesses, including high levels of service with a tangible product. In the last few decades consumers have been able to purchase flowers at the equivalent of fast-food outlets, for example, mass-markets (Becker, 1997). Almost all traditional retail florists carry essentially the same goods; florists must distinguish themselves by performing better than the competition (Becker, 1997).

According to the American Institute of Floral Designers “a florist is a person or business entity associated with the sale of flowers, plants, or other related products” (AIFD, p.300). A florist must be a designer, businessperson, and advisor. A designer must arrange flowers in a pleasing manner. A businessperson must sell perishable flowers and the products available in the display room. An advisor informs the consumer on the product desired for a range of special events.

Consumers are diverse, some are indecisive and want the florist to tell them what they should purchase. Others know what they want and have no questions or want any suggestions. Differences among marketing and targeted consumers are especially important for retail full service floral shop success. Retail full service floral shops offer floral services through weddings, funerals, gift shops, and other special events.

There has been a marked decrease in the number of floral shops over recent years. Several marketing developments have been identified as partial reasons for the decrease. These changes include: (1) mass-markets, (2) wire service, (3) order gatherers, and (4) packaged flowers. Retail florists in today’s industry are competing against mass-markets that are able to buy and sell mass-produced fresh cut flowers at lower prices. These mass-markets offer little design to no design or other services. Florists are also competing against order gatherers. Consumers order from order gatherers who in turn contact a local floral shop to fill the consumers order. Wire services pose a threat to local retail full service floral shops. Stores that receive more incoming wire orders than outgoing wire orders are negatively impacted by wire service commissions and membership fees. In the early 2000’s packaged flower shipping became popular. Flowers are advertised and shipped directly from the grower to the consumer therefore totally bypassing the retail full service floral shop.

Overall, these developments in flower marketing have made it more challenging for florist to maintain a profitable business. The relative acceptance of the marketing developments by the florist industry and their preference by consumers will be the determining factor in the future success of retail full service floral shops. This survey study based upon collection and analysis of knowledge and experience of current florists and consumers will provide more understanding of the present status and future direction of retail full service floral shops in Central Kentucky and Tennessee.


Viewing peaceful natural environments has been shown to restore cognitive abilities and reduce physiological arousal. As such, visual access to the natural environment is becoming more commonplace in built environments. One exception to that trend is in educational settings.
where windowless classrooms are used to reduce outside distractions. The current study examines differences across multiple sections of a college writing course in two types of identically designed classrooms those with a view of a natural setting and those with a view of a concrete retaining wall. Results showed that students in the natural view classrooms were generally more positive when rating the course. Students in the natural view condition also had higher end of semester grades, but no differences in attendance were observed between conditions. Such findings suggest that classrooms with natural views offer advantages and also suggest that the inclusion of natural elements in courses could facilitate positive perceptions and better grades.


Consumer horticulture encompasses interior and exterior ornamental, food, and community gardening. These activities influence the environment in many ways, affecting water quality and quantity, waste management, wildlife, and environmental sustainability. Consumer horticulture also impacts human health and well-being. In spite of keen consumer interest and the robust commercial impact, there is a paucity of support for consumer horticulture at both the state and federal levels. To explore strategies for increasing support for consumer horticulture, a workshop with four presentations was held at the annual conference of the American Society for Horticultural Science on 31 July 2014 in Orlando, FL. Presentations described the formation of a new Southern Experiment Extension/Research Activity, Landscapes and Gardens for Better Living (SERA44); the local funding sources and local issues that focus research, education, and extension efforts in consumer horticulture; and the need to develop shared goals to drive regional projects. The need for a national strategic plan for consumer horticulture, and a process for creating one, was outlined. A strategic plan could galvanize the support of diverse stakeholders; focus research, education, and extension efforts; and build a strong case for resources dedicated to consumer horticulture.


Urban plant biodiversity is influenced by both the physical environment and attitudes and preferences of urban residents for specific plant types. Urban residents are assumed to be disconnected from their immediate environment, and cultural and societal factors have been emphasized over environmental factors in studies of landscaping choices. However, we postulate that local climatic and environmental factors can also affect preferences for plant attributes. Therefore, spatial and temporal patterns in urban tree biodiversity may be driven not only by the direct effect of environmental variables on plant function, but also by the effect of environmental variables on attitudes toward trees and associated choices about which types of trees to plant. Here, we tested the relative effects of socio-economic and local environmental factors on preferences toward tree attributes in five counties in southern California in and surrounding Los Angeles, based on 1,029 household surveys. We found that local environmental factors have as strong an effect on preferences for tree attributes as socio-economic factors. Specifically, people located in hotter climates (average maximum temperature 25.1 °C) were more likely to value shade trees than those located in cooler regions (23.1 °C). Additionally, people located in desert areas were less likely to consider trees to be important in their city compared with people located in naturally forested areas. Overall, our research demonstrates the inherent connections between...
local environmental factors and perceptions of nature, even in large modern cities. Accounting for these factors can contribute to the growing interest in understanding patterns of urban biodiversity.


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Researchers in environmental psychology, health studies and urban design are interested in the relationship between the environment, behaviour settings and emotions. In particular, happiness, or the presence of positive emotional mindsets, broadens an individual's thought-action repertoire with positive benefits to physical and intellectual activities, and to social and psychological resources. This occurs through play, exploration or similar activities. In addition, a body of restorative literature focuses on the potential benefits to emotional recovery from stress offered by green space and 'soft fascination'. However, access to the cortical correlates of emotional states of a person actively engaged within an environment has not been possible until recently. This study investigates the use of mobile electroencephalography (EEG) as a method to record and analyse the emotional experience of a group of walkers in three types of urban environment including a green space setting.

Using Emotiv EPOC, a low-cost mobile EEG recorder, participants took part in a 25 min walk through three different areas of Edinburgh. The areas (of approximately equal length) were labelled zone 1 (urban shopping street), zone 2 (path through green space) and zone 3 (street in a busy commercial district). The equipment provided continuous recordings from five channels, labelled excitement (short-term), frustration, engagement, long-term excitement (or arousal) and meditation. A new form of high-dimensional correlated component logistic regression analysis
showed evidence of lower frustration, engagement and arousal, and higher meditation when moving into the green space zone; and higher engagement when moving out of it.

Systematic differences in EEG recordings were found between three urban areas in line with restoration theory. This has implications for promoting urban green space as a mood-enhancing environment for walking or for other forms of physical or reflective activity.


A rating-based conjoint experiment combined with eye-tracking analysis was used to investigate the effect of plant attributes on consumer purchase likelihood for indoor foliage plants. The experiment assessed the effects of plant type (Dracaena marginata Lam., Guzmania lingulata, or Spathiphyllum wallisii Regel), volatile organic compound (VOC) removal capacity (high, low, or none specified), price ($10.98–14.98/plant), production method [certified organic, organic production (not certified), or conventional], and origin (in-state, domestic, or imported) on consumer preferences. An ordered logit model was used to analyze the data. Organic production methods, in-state origin, domestic origin, and high VOC removal increased participants’ purchase likelihood. Visually attending to the highest price point ($14.98) increased consumers’ purchase likelihood. Age, gender, child (<12 years), pet, relationship status, education, and ethnicity affected participants’ purchase likelihood for indoor foliage plants. Purchasing barriers for indoor foliage plants are also discussed. Results have implications for indoor foliage plant growers and retailers as they produce, promote, and sell their products.


Although it is well established that exposure to nearby nature can help reduce stress in individuals, the shape of the dose–response curve is entirely unclear. To establish this dose–response curve, we recruited 160 individuals for a laboratory experiment. Participants engaged in the Trier Social Stress Test (TSST) to induce psychological stress, and were then randomly assigned to view one of ten, 6-min, 3-D videos of neighborhood streets. The density of tree cover in the videos varied from 1.7% to 62.0%. We measured their stress reactions by assessing salivary cortisol and skin conductance levels. Results show a clear disparity between women and men. For women, we found no relationship between varying densities of tree cover and stress recovery. For men, the dose–response curve was an inverted-U shape: as tree cover density increased from 1.7% to 24%, stress recovery increased. Tree density between 24% to 34% resulted in no change in stress recovery. Tree densities above 34% were associated with slower recovery times. A quadratic regression using tree cover density as the independent variable and a summary stress index as the dependent variable substantiated these results [R2 = .22, F (2, 68) = 9.70, p < .001]. The implications for our understanding of the impacts of nearby nature, and for the practice of planning and landscape architecture are discussed.


Although it is well established that viewing nature can help individuals recover from a stressful experience, the dose-response curve describing the relationship between tree cover...
density and stress recovery is totally unclear. A total of 160 participants engaged in a standard Trier Social Stress Test to induce stress. Participants were then randomly assigned to watch 1 of 10 three-dimensional videos of street scenes that varied in the density of tree cover (from 2% to 62%). Participants completed a Visual Analog Scale questionnaire at three points in the experiment. Analysis revealed a positive, linear association between the density of urban street trees and self-reported stress recovery, adjusted $R^2 = .05$, $F(1, 149) = 8.53$, $p < .01$. This relationship holds after controlling for gender, age, and baseline stress levels. A content analysis of participants’ written narratives revealed a similar but even stronger association. These findings suggest that viewing tree canopy in communities can significantly aid stress recovery and that every tree matters.


Past studies have documented interpersonal benefits of natural environments. Across four studies, we tested the hypothesis that exposure to more beautiful nature, relative to less beautiful nature, increases prosocial behavior. Study 1 yielded correlational evidence indicating that participants prone to perceiving natural beauty reported greater prosocial tendencies, as measured by agreeableness, perspective taking, and empathy. In Studies 2 and 3, exposure to more beautiful images of nature (versus less beautiful images of nature) led participants to be more generous and trusting. In Study 4, exposure to more beautiful (versus less beautiful) plants in the laboratory room led participants to exhibit increased helping behavior. Across studies, we provide evidence that positive emotions and tendencies to perceive natural beauty mediate and moderate the association between beauty and prosociality. The current studies extend past research by demonstrating the unique prosocial benefits of beautiful nature.


Subjective connection with nature, or nature relatedness, is similar to other environmental worldview measures in predicting sustainable attitudes and behaviors, yet is unique in predicting happiness. In two studies, the authors assessed the overlap between nature relatedness and other subjective connections (e.g., with friends or country) and examined these connections as a possible confound in explaining the link between nature relatedness and happiness. Study 1 adapted a measure of general connectedness and administered it to student (n = 331) and community (n = 415) samples along with multiple nature relatedness and happiness indicators. Study 2 examined more established measures of subjective connections in another community sample (n = 204). General connectedness predicted happiness well, yet nature relatedness remained a significant distinct predictor of many happiness indicators, even after controlling for other connections. Results support the notion that nature relatedness could be a path to human happiness and environmental sustainability, though confirming this causal direction requires additional research.


During the emergency work at the Fukushima Daiichi Atomic Power Plant (APP), the Tokyo Electric Power Company (TEPCO) and the Japanese government experienced various
problems in medical and health care management issues, including special medical examinations, on-site triage and initial treatment, patient transportation, lodging and food, and long-term health care for emergency workers. To resolve these problems, the Ministry of Health, Labor and Welfare (MHLW) issued a series of compulsory directives and provided administrative guidance to TEPCO. Based on the experiences and lessons learned, the MHLW recognized that the proper management and implementation of medical and health care management in response to a similar accident would require sufficient measures and systematic preparation, including the following: 1. In case of large-scale nuclear accidents, the government needs to assist in dispatching medical staff to the affected plants. 2. Nuclear facility operators, medical facilities and fire departments should make an agreement to clarify the division of the roles played prior to the accident and should conduct emergency drills periodically with the full attendance of related personnel to identify and resolve the problems. 3. Operators need to develop a support base at a safe distance from the plant and to prepare to develop makeshift lodgings in case of emergency. 4. Operators need to come to an agreement to share food stocks among closely located nuclear plants and prepare cooking equipment that can be used in case of blackout to provide warm foods and drinks to as many workers as possible. 5. It is necessary to conduct long-term follow-up for emergency workers, including health care system, medical examinations and mental health consultations.


Various studies have reported the physical and mental health benefits from exposure to “green” neighborhoods, such as proximity to neighborhoods with trees and vegetation. However, no studies have explicitly assessed the association between exposure to “green” surroundings and cognitive function in terms of student academic performance. This study investigated the association between the “greenness” of the area surrounding a Massachusetts public elementary school and the academic achievement of the school’s student body based on standardized tests with an ecological setting. Researchers used the composite school-based performance scores generated by the Massachusetts Comprehensive Assessment System (MCAS) to measure the percentage of 3rd-grade students (the first year of standardized testing for 8–9 years-old children in public school), who scored “Above Proficient” (AP) in English and Mathematics tests (Note: Individual student scores are not publically available). The MCAS results are comparable year to year thanks to an equating process. Researchers included test results from 2006 through 2012 in 905 public schools and adjusted for differences between schools in the final analysis according to race, gender, English as a second language (proxy for ethnicity and language facility), parent income, student-teacher ratio, and school attendance. Surrounding greenness of each school was measured using satellite images converted into the Normalized Difference Vegetation Index (NDVI) in March, July and October of each year according to a 250-meter, 500-meter, 1,000-meter, and 2,000-meter circular buffer around each school. Spatial Generalized Linear Mixed Models (GLMMs) estimated the impacts of surrounding greenness on school-based performance. Overall the study results supported a relationship between the “greenness” of the school area and the school-wide academic performance. Interestingly, the results showed a consistently positive significant association between the greenness of the school in the Spring (when most Massachusetts students take the MCAS tests) and school-wide performance on both English and Math tests, even after adjustment for socio-economic factors and urban residency.

Many cities and communities are working toward urban sustainability goals. Yet, retailers and merchants may not find environmental benefits to be compelling when compared to the direct costs of landscape and trees. Nonetheless, a quality outdoor environment may provide atmospherics effects that extend store appeal to the curb and heighten the positive experiences and psychological reactions of visitors while in a shopping district. A multi-study program of research shows that having a quality urban forest

WOLF, K. and E. HOUSLEY (2014). "REFLECT & RESTORE."

A holistic, optimistic approach to health supports productive individuals, and livable communities where people can thrive. Health is not simply an absence of disease or in remity, but is a state of complete physical, mental and social well-being. Wholesome living environments integrate the opportunities of built, social, natural, and (increasingly) online components to help people be at their best. One important aspect of health – mental function and wellness – is not only the outcome of personal and lifestyle situations, but is highly dependent on the natural and built environments that surround a person.

The World Health Organization designates mental health as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community. Each person’s health, especially mental health and wellness, is intricately integrated with the social and built environments around them. Achieving individual potential, managing stress, and living as a productive, contributing community member is a challenge when people must deal with the busyness of modern lifestyles, overwhelming time demands, and urban conditions. Mental health can be further compromised if one is stressed by conditions of low income, inadequate housing, and lack of career opportunity.


As our populations become more urbanised, public green space will assume key functions in the promotion of the health and well-being of the populace. We assessed the beneficial outcomes of physical activities undertaken in Australian national parks using a questionnaire-based survey combined with GPS tracking of walkers, hikers, and runners. We estimated energy expenditure of park visitors based on GPS tracking trip data using two different estimation methods. Park visitors perceived considerable improvement in numerous health and well-being indicators; many of which increased with increasing activity levels. We found that hikers burned the greatest amount of net energy (916 kcal) as they preferred more difficult tracks with greater slopes, followed by runners (790 kcal) and walkers (450 kcal). For many walkers and hikers, physical activity was incidental to other activities such as sightseeing, socialising, and experiencing nature; such activities, thus, deserve highlighting when promoting attributes of parks and other public green spaces. GPS tracking allowed for sampling a broad population of park visitors at a participation rate of 80%, and the calculation of additional trip characteristics
such as trip distance and velocity. Identifying health and well-being benefits via an inter-disciplinary approach using GPS tracking data to determine the intensity and spatio-temporal distributions of physical activity in relation to different park infrastructure is a promising area for attention to raise awareness of the direct benefits of visiting public green spaces.


Urban green space, such as parks, forests, green roofs, streams, and community gardens, provides critical ecosystem services. Green space also promotes physical activity, psychological well-being, and the general public health of urban residents. This paper reviews the Anglo-American literature on urban green space, especially parks, and compares efforts to green US and Chinese cities. Most studies reveal that the distribution of such space often disproportionately benefits predominantly White and more affluent communities. Access to green space is therefore increasingly recognized as an environmental justice issue. Many US cities have implemented strategies to increase the supply of urban green space, especially in park-poor neighborhoods. Strategies include greening of remnant urban land and reuse of obsolete or underutilized transportation infrastructure. Similar strategies are being employed in Chinese cities where there is more state control of land supply but similar market incentives for urban greening. In both contexts, however, urban green space strategies may be paradoxical: while the creation of new green space to address environmental justice problems can make neighborhoods healthier and more esthetically attractive, it also can increase housing costs and property values. Ultimately, this can lead to gentrification and a displacement of the very residents the green space strategies were designed to benefit. Urban planners, designers, and ecologists, therefore, need to focus on urban green space strategies that are ‘just green enough’ and that explicitly protect social as well as ecological sustainability.


Australia’s high rate of urbanisation means that most people experience a significant disconnect between their food production and consumption. Over several decades, suburban gardens have ceased to be major sites of food production and Australians reportedly have a declining understanding and appreciation of how their food is grown. Recent years have seen a renewed interest in the quality, provenance, freshness and price of food, driving a companion interest in Australians growing their own food at home or in community gardens.

This paper examines who is currently growing their own food, the motivations and barriers in relation to home and community gardening and the potential for home grown food to deliver benefits such as health and social inclusion improvements and to protect food security. The research is based on a literature review, a survey of 1,390 households across Australia and interviews with experts and community gardeners.

The data suggest that more than half (52 per cent) of all Australian households are growing some of their own food and a further 13 per cent report they intend to start. Yet despite this high penetration of food gardening, yields are relatively low and there is a high turnover of participation. Health, taste and cost savings are the greatest drivers for households to grow their own food.

Aims: Nature-assisted therapy for mental health problems receives increased attention. However, quantitative evaluations are rare. This study evaluates the effects of an all-outdoors vocational rehabilitation program for individuals on long-term sick leave due to sustained stress-related symptoms. Methods: In a comparative pre-post intervention design the intervention group contained 48 participants from Mariendal Gardens (MG), while 45 participants at Stress & Job management (SJ) formed the comparison group. At MG all activities took place outdoors, while activities at SJ were mainly indoors. Questionnaires were completed at baseline, 3- and 6-month follow-up. Outcomes included Perceived Stress Scale (PSS-10) and measures of sleep, mindfulness, self-efficacy, daily functioning, and work ability. Data were analyzed using mixed model repeated measures analysis of variance. Results: At baseline the MG-group PSS-10 mean score was 25.15 points (SD=7.20), while the SJ-group mean score was 23.91 (SD=7.48). At 3-months the MG within-group score dropped 4.61 [2.71; 6.52] points (p<0.01), corresponding to a standardized mean difference (Cohen's d) of d=0.64 [0.38; 0.91], while the SJ within-group score dropped 4.16 [1.73; 6.59] points (p<0.01), corresponding to d=0.56 [0.23; 0.88]. The between-group mean difference was not significant (p=0.77). Similarly, results for sleep, mindfulness, self-efficacy, daily functioning, and work ability demonstrated significant within-group effects and minimal between-group differences. Conclusions: Both interventions demonstrated small to large pre-post effect sizes. Negligible differences were observed between the effects of the two interventions, indicating no added effect of the all-outdoors setting. Results should be interpreted with caution as unequal lost to follow-up rates threatens the comparability of changes in the two groups.


Objective: This study examines effects of a school garden intervention on elementary school children's physical activity (PA). Method: Twelve schools in New York were randomly assigned to receive the school garden intervention (n = 6) or to the waitlist control group that later received gardens (n = 6). PA was measured by self-report survey (Girls Health Enrichment Multi-site Study Activity Questionnaire) (N = 227) and accelerometry (N = 124.8 schools) at baseline (Fall 2011) and follow-up (Spring 2012, Fall 2012, Spring 2013). Direct observation (N = 117.4 schools) was employed to compare indoor (classroom) and outdoor (garden) PA. Analysis was by general linear mixed models. Results: Survey data indicate garden intervention children's reports of usual sedentary activity decreased from pre-garden baseline to post-garden more than the control group children's (Delta = -.19, p = .001). Accelerometry data reveal that during the school day, children in the garden intervention showed a greater increase in percent of time spent in moderate and moderate-to-vigorous PA from baseline to follow-up than the control group children (Delta = +.58, p = .010; Delta = +1.0, p = .044). Direct observation within-group comparison of children at schools with gardens revealed that children move more and sit less during an outdoor garden-based lesson than during an indoor, classroom-based lesson. Conclusion: School gardens show some promise to promote children's PA.

The influence of urban green infrastructure on the indoor environment and the effects on human comfort and economic consequences are still unclear. This paper gives a systematic overview of the relationship, in terms of so-called ‘ecosystem services’, between urban green infrastructure and the indoor environment through a literature review in different disciplines. Urban green infrastructure (mainly trees, green walls and roofs) was found to contribute, both positively and negatively, to the indoor environment via the influence on the climate, energy use, air quality, sonic environment and aesthetic quality. Four main factors that influence these effects were identified, being vegetation characteristics, building characteristics (including layout and geometry), and geographical conditions. Although the reviewed papers have investigated the different ecosystem services on a wide range of space and time scales, the performance of urban green on the meso- and macro climate has received less attention than on the micro scale. Also direct effects of urban green infrastructure on indoor air quality and sonic environment were rarely studied. Another finding is that, whereas the modelling approach on climate regulation has been widely adopted by researchers throughout the world, empirical studies have mainly been performed in the USA. We also analysed the data found on economic implications. The economic effects of adjoining vegetation and green roofs on climate regulation provided energy savings of up to almost $250/tree/year, while the air quality regulation was valued between $0.12 and $0.6/m² tree cover/year. Maximum monetary values attributed to noise regulation and aesthetic appreciation of urban green were $20 – $25/person/year, respectively. Of course these values are extremely time- and context-dependent but do give an indication of the potential economic effects of investing in urban green infrastructure. Based on this review, we conclude that new methods, measurement instruments and field experiments are needed to improve empirically supported correlations and develop concrete recommendations for urban planning and design.


To determine the effect of a nature-assisted rehabilitation programme in a group of patients with reactions to severe stress and/or mild to moderate depression. Changes in sick-leave status and healthcare consumption in these patients were compared with those in a matched population-based reference cohort (treatment as usual). Design: Retrospective cohort study with a matched reference group from the general population. Subjects: A total of 118 participants referred to a nature-assisted rehabilitation programme, and 678 controls recruited from the Skane Health Care Register. For both groups, information on sick leave was extracted from the National Social Insurance Register and on healthcare consumption data from the Skane Health Care Register. Methods: The interventional rehabilitation programme was designed as a multimodal programme involving professionals from horticulture and medicine. The programme was conducted in a rehabilitation garden, designed especially for this purpose. Results: A significant reduction in healthcare consumption was noted among participants in the programme compared with the reference population. The main changes were a reduction in outpatient visits to primary healthcare and a reduction in inpatient psychiatric care. No significant difference in
sick-leave status was found. Conclusion: A structured, nature-based rehabilitation programme for patients with reactions to severe stress and/or depression could be beneficial, as reflected in reduced healthcare consumption.


Background: High and low ambient temperatures are associated with increased mortality in temperate and subtropical climates. Temperature-related mortality patterns are expected to change throughout this century because of climate change. We compared mortality associated with heat and cold in UK regions and Australian cities for current and projected climates and populations.

Methods: Time-series regression analyses were carried out on daily mortality in relation to ambient temperatures for UK regions and Australian cities to estimate relative risk functions for heat and cold and variations in risk parameters by age. Excess deaths due to heat and cold were estimated for future climates.

Results: In UK regions, cold-related mortality currently accounts for more than one order of magnitude more deaths than heat-related mortality (around 61 and 3 deaths per 100,000 population per year, respectively). In Australian cities, approximately 33 and 2 deaths per 100,000 population are associated every year with cold and heat, respectively. Although cold-related mortality is projected to decrease due to climate change to approximately 42 and 19 deaths per 100,000 population per year in UK regions and Australian cities, heat-related mortality is projected to increase to around 9 and 8 deaths per 100,000 population per year, respectively, by the 2080s, assuming no changes in susceptibility and structure of the population.

Conclusions: Projected changes in climate are likely to lead to an increase in heat-related mortality in the United Kingdom and Australia over this century, but also to a decrease in cold-related deaths. Future temperature-related mortality will be amplified by aging populations. Health protection from hot weather will become increasingly necessary in both countries, while protection from cold weather will be still needed.


The integration of flowers in daily human life has a long history and substantiates our appreciation for their delicacy and wide variation in possible shapes and colours. Since the very early civilizations flowers were used for medical purposes and above all have been part of important cultural and religious customs. Records of their use have been preserved over centuries in different parts of the world and in most if not all major religions flowers have a featuring role. Whereas in the past flower production for floral design was local and probably limited and restricted to wealthy and powerful people that could afford gardens for pleasure, nowadays floral production has become a knowledge and infrastructural intensive, highly specialised industry with trading networks on a global scale and floricultural exhibitions being organised all over the world. As with all intensive industry, concerns on environmental aspects including carbon footprints as well as the well-being of labourers have been raised and have led to certification programs that resulted in impressive reductions in energy and resources as well as environmental impact. It can be expected that given the global environmental and economic issues, ornamental
production will have to even intensify these efforts substantially to provide flowers at low environmental costs for people to enjoy in and around their homes.


This study investigated the psychological (perceived restorativeness, subjective vitality, mood, creativity) and physiological (salivary cortisol concentration) effects of short-term visits to urban nature environments. Seventy-seven participants visited three different types of urban areas; a built-up city centre (as a control environment), an urban park, and urban woodland located in Helsinki, the capital of Finland. Our results show that the large urban park and extensively managed urban woodland had almost the same positive influence, but the overall perceived restorativeness was higher in the woodland after the experiment. The findings suggest that even short-term visits to nature areas have positive effects on perceived stress relief compared to built-up environment. The salivary cortisol level decreased in a similar fashion in all three urban environments during the experiment. The relations between psychological measures and physiological measures, as well as the influence of nature exposure on different groups of people, need to be studied further. (C) 2013 Elsevier Ltd. All rights reserved.


This review of the literature tackles the question of the psychological benefits linked to gardening in older adults. First, the current data on these benefits are reviewed, and the findings reveal that gardening is linked to feelings of accomplishment, well-being and peace, a decrease of depressive symptoms, a protective effect on cognitive functions as well as to the development of social links for community living older adults. In institutionalized older adults, gardening promotes internal locus of control and well-being, and is related to a decrease of sadness and anxiety. Second, several explanatory theories are discussed. All of them postulate an action on the cognitive and/or emotional spheres, which were included into a integrated model that must be tested in future research. In conclusion, gardening appears to be a beneficial activity for promoting older adults' functioning but the current knowledge still has to be extended to understand the specific mechanisms of action. This deeper understanding is necessary in order to improve the future actions depending on this activity.


The authors posit that the critical question for the post-disaster and post-conflict policy-making community may be whether their actions foster or inhibit individual and societal expressions of urgent biophilia and restorative sense of place. The authors argue that inhibiting such expression may aggravate a disaster or conflict scenario, whereas the evidence presented in the case studies in the book Greening in the Red Zone suggests that fostering such expression releases a series of cascading effects whereby humans rebuild a sense of personal equilibrium, restore and reconcile their place in the ecosystem, create anew a sense of community and of place, and put into motion the first steps toward restoring a healthier social-ecological system.
The authors call upon policy makers to consider the role of participatory natural resource management—or of greening—in responses to disaster and conflict.


This contribution builds upon earlier work on the concept of biophilia while synthesizing literatures on restorative environments, community-based ecological restoration, and both community and social-ecological disaster resilience. It suggests that when humans, faced with a disaster, as individuals and as communities and populations, seek engagement with nature to further their efforts to summon and demonstrate resilience in the face of a crisis, they exemplify an urgent biophilia. This urgent biophilia represents an important set of human-nature interactions in social-ecological systems characterized by hazard, disaster, or vulnerability, often appearing in the ‘backloop’ of the adaptive cycle. The relationships that human-nature interactions have to other components within interdependent systems at many different scales may be one critical source of resilience in disaster and related contexts. In other words, the affinity we humans have for the rest of nature, the process of remembering that attraction, and the urge to express it through creation of restorative environments, which may also restore or increase ecological function, may confer resilience across multiple scales.


The role of community-based natural resources management in the form of “greening” after large scale system shocks and surprises is argued to provide multiple benefits via engagement with living elements of social-ecological systems and subsequent enhanced resilience at multiple scales. The importance of so-called social-ecological symbols, especially the potent hybrid symbols of trees and their handling after a disaster is interrogated. The paper explores the notion of hybridity, and applies it to the hybrid symbol of the tree in postdisaster contexts. The paper briefly highlights three U.S. cases documenting the symbolic roles of trees in a context of significant shock to a social-ecological system: the terrorist attacks on New York City in 2001, the devastating hurricane that struck New Orleans in 2005, and the sudden tornadoes that wreaked havoc upon the small Midwestern city of Joplin, Missouri in 2011.


Health studies have repeatedly used air temperature (Ta), sometimes adjusted for humidity, when analyzing the impact of weather on mortality. The aim of this study is to highlight the importance of mean radiant temperature (Tmrt) and its impact on heat related mortality. Tmrt is an essential meteorological parameter that influences the thermal comfort (heat load) of humans. It is useful when assessing the impact of weather, especially heat, on people’s health. Tmrt is directly influenced by urban geometry and surface material, which also makes it a good measure to identify urban hot spots. The performance of models using Ta and Tmrt for daily mortality is compared for Stockholm County, Sweden. It is demonstrated that Tmrt models fit heat related mortality better than Ta models, which implies that health studies should consider using Tmrt rather than Ta. The use of Tmrt models allows us to determine more accurate thresholds for increased risks of heat related mortality, and thus to better identify
adverse weather conditions and heat prone urban geometries. Such information is needed to implement heat-warning systems and mitigate harmful effects of heat stress.


Background: The aims of this study were to explore associations of the distance and use of urban green spaces with the prevalence of cardiovascular diseases (CVD) and its risk factors, and to evaluate the impact of the accessibility and use of green spaces on the incidence of CVD among the population of Kaunas city (Lithuania).

Methods: We present the results from a Kaunas cohort study on the access to and use of green spaces, the association with cardiovascular risk factors and other health-related variables, and the risk of cardiovascular mortality and morbidity. A random sample of 5,112 individuals aged 45-72 years was screened in 2006-2008. During the mean 4.41 years follow-up, there were 83 deaths from CVD and 364 non-fatal cases of CVD among persons free from CHD and stroke at the baseline survey. Multivariate Cox proportional hazards regression models were used for data analysis.

Results: We found that the distance from people’s residence to green spaces was not related to the prevalence of health-related variables. However, the prevalence of cardiovascular risk factors and the prevalence of diabetes mellitus were significantly lower among park users than among non-users. During the follow up, an increased risk of non-fatal and fatal CVD combined was observed for those who lived ≥629.61 m from green spaces (3rd tertile of distance to green space) (hazard ratio (HR) = 1.36), and the risk for non-fatal CVD–for those who lived ≥347.81 m (2nd and 3rd tertile) and were not park users (HR = 1.66) as compared to men and women who lived 347.8 m or less (1st tertile) from green space. Men living further away from parks (3rd tertile) had a higher risk of non-fatal and fatal CVD combined, compared to those living nearby (1st tertile) (HR = 1.51). Compared to park users living nearby (1st tertile), a statistically significantly increased risk of non-fatal CVD was observed for women who were not park users and living farther away from parks (2nd and 3rd tertile) (HR = 2.78).

Conclusion: Our analysis suggests public health policies aimed at promoting healthy lifestyles in urban settings could produce cardiovascular benefits.


Research reflective of the specific knowledge, skills, and abilities required to fulfill the job of a horticultural therapist is lacking. Past research indicated a majority of horticultural therapists agreed that a certification test is necessary for the advancement of horticultural therapy as a profession. The goals of this project are to identify the knowledge, skills, and abilities currently used and/or performed by horticultural therapists, as well as to use data to develop a generalized horticultural therapist job description based on current practice, to understand how the profession has changed since previous research was conducted, and to collect data to develop a certification exam. Job descriptions of horticulture-related occupations from the Department of Labor, therapeutic recreation job analysis components from the National Council for Therapeutic Recreation Certification (NCTRC), previous horticultural therapy job analysis information, and a concept analysis of membership-solicited job descriptions were used to construct a knowledge, skills, and ability survey. The web-based survey was sent to 227 current professionally registered
members of the American Horticultural Therapy Association (AHTA). The questionnaire consisted of 95 items. A Likert-scale rating system was used by respondents to rate the importance of each item in their current profession. Eighty-five responses were acquired for a response rate of 37%. Survey respondents rated all statements of job knowledge, skills, and abilities presented at least "moderately important" for professional practice. The job task analysis is foundational to the establishment of future training requirements and in the development of a certification exam for horticultural therapy.


This study evaluated adapted gardening as an activity for people with advanced Huntington's disease (HD) and explored its therapeutic aspects. Visitors and staff completed a questionnaire and participated in structured interviews to capture further information, whereas a pictorial questionnaire was designed for residents with communication difficulties. Staff reported that gardening was a constructive, outdoor activity that promoted social interaction, physical activity including functional movement and posed cognitive challenges. Half the staff thought the activity was problem free and a third used the garden for therapy. Visitors used the garden to meet with residents socially. Despite their disabilities, HD clients enjoyed growing flourishing flowers and vegetables, labelling plants, being outside in the sun and the quiet of the garden. The garden is valued by all three groups. The study demonstrates the adapted method of gardening is a stimulating and enjoyable activity for people with advanced HD.


Background: It is widely believed that contact with the natural environment can improve physical and mental health. Urban green spaces may provide city residents with these benefits; however, there is a lack of empirical field research on the health benefits of urban parks.

Methods: This field experiment was performed in May. Seventeen males aged 21.2 +/- 1.7 years (mean +/- standard deviation) were instructed to walk predetermined 15-minute courses in an urban park and a nearby city area (control). Heart rate and heart rate variability (HRV) were measured to assess physiological responses. The semantic differential (SD) method, Profile of Mood States (POMS), and State-Trait Anxiety Inventory (STAI) were used to measure psychological responses. Results: Heart rate was significantly lower while walking in the urban park than while walking in the city street. Furthermore, the urban park walk led to higher parasympathetic nervous activity and lower sympathetic nervous activity compared with the walk through the city street. Subjective evaluations were generally in accordance with physiological reactions, and significantly higher scores were observed for the 'comfortable', 'natural', and 'relaxed' parameters following the urban park walk. After the urban park walk, the score for the 'vigor' subscale of the POMS was significantly higher, whereas that for negative feelings such as 'tension-anxiety' and 'fatigue' was significantly lower. The score for the anxiety dimension of the STAI was also significantly lower after the urban park walk. Conclusions: Physiological and psychological results from this field experiment provide evidence for the physiological and psychological benefits of urban green spaces. A brief spring-time walk in an urban park shifted sympathetic/parasympathetic balance and improved mood state.

Urbanization is presenting a growing problem for biodiversity conservation, notably by increasingly isolating over half of the world's population from the experience of nature. This separation of people from nature is an important environmental issue, as it could fundamentally influence the way people value nature and their willingness to conserve it. Here we provide the first experimental study that jointly explores how urban biodiversity can be enhanced and how these changes may influence some aspects of people-biodiversity interactions. We significantly increased the diversity of flowers, birds and pollinators in small public gardens (Paris, France) by providing additional resources (i.e., planting flower-meadows and placing nesting-boxes). Semi-structured interviews were conducted in situ with 1116 regular garden users before and after the manipulation. Close-ended questionnaires were completed exploring the respondents' biodiversity perception and their sensitivity to the changes in biodiversity. Our results highlight a people-biodiversity paradox between people's perceptions and biodiversity awareness. Respondents expressed a strong preference for a rich diversity of species (excluding insects) and related this diversity to their well-being in the gardens. However, they did not notice the diversity of species. Respondents underestimated species richness and only noticed the changes in native flower richness in those gardens where advertisement and public involvement were organized. More experimental interdisciplinary studies are needed to further explore the people-biodiversity interactions. This would help expose the role that urban biodiversity plays in people's daily life and the importance of this interaction for raising public support for general conservation policies.


Introduction: Social and therapeutic horticulture has been shown to be a useful intervention for a wide range of vulnerable groups, including those with a mental health problem and/or learning or physical disabilities. However, there is still a need for additional research that examines evidence of its effectiveness.

Method: This study analysed scores in four areas (social interaction, communication, motivation, and task engagement) collected as part of routine assessment during a programme of social and therapeutic horticulture. The sample comprised a heterogeneous group of participants and included a range of vulnerable people, predominantly those with a learning disability or a mental health problem.

Findings: Scores for social interaction were significantly higher after 90 days of participation. This effect appeared to be most evident in participants with a learning disability.

Conclusion: Social and therapeutic horticulture provides the opportunity for social interaction. Increased scores relating to social interaction suggest that the programme was effective in promoting such interaction and that it may, therefore, promote social inclusion among vulnerable and isolated groups.


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This review of the scientific literature set out to demonstrate the strength of evidence for the benefits of gardening and food growing for physical and mental health and wellbeing. It shows that to improve physical health, regular involvement in gardening or community food growing projects, or formal horticultural therapy, can:

- Increase overall levels of physical activity and fitness, burn more calories and hence contribute to healthy weight management and reducing the risk of obesity.
- Increase healthy fruit and vegetable consumption, for adults that grow food, and among schoolchildren participating in food-growing activities at school – as well as improving young people’s attitudes to healthy eating.
- Reduce physical pain, and help with rehabilitation or recovery from surgery or other medical interventions.
- Help people cope with physically challenging circumstances, such as intensive cancer treatment or learning how to live with chronic conditions such as asthma or severe allergies.

..to improve mental health, for people with acute or persistent mental health problems, or especially difficult personal circumstances, regular involvement in gardening or community food-growing projects, or formal horticultural therapy, can:

- Contribute to improved social interactions and community cohesion.
- Reduce the occurrence of episodes of stress, and the severity of stress and associated depression.
- Reduce reliance on medication, self-harming behaviour, and visits to psychiatric services, whilst also improving alertness, cognitive abilities and social skills.
- Alleviate symptoms of dementia and Alzheimer’s disease, such as agitation and aggressive behaviour, which can in turn improve circumstances for carers.
- Provide productive manual activity and beneficial social interaction for people tackling drug and alcohol dependency.
- Help people manage the distress associated with mentally challenging circumstances, such as making the end of life more peaceful, sociable and enjoyable for hospice patients.


Despite growing literature supporting the importance of home gardens (HG) as biodiversity hotspots, knowledge of patterns of their contribution to conservation of threatened
species and crop wild relatives (CWR) across climate and culture in Africa is still limited. This investigation was conducted across three climatic zones to assess the floristic diversity of home gardens and the extent to which they contribute to conservation of threatened species and CWR. Overall, 240 home gardens were sampled and their floristic diversity assessed. The ecological importance of recorded species was determined per climatic zone using the importance value index (IVI). A cluster analysis was performed to group the species according to their IVI-values and a principal component analysis helped to identify the most important species. 285 species were inventoried throughout the study area. Home garden species’ diversity globally declined from the drier to the wetter zone but was highest in the transition zone. The average number of species found per HG was 10.1 and varied weakly across zones (9.07, Guineo-Congolean zone; 10.77, Sudano-Guinean zone; and 10.53, Sudanian zone). The most important home gardens species in the Sudanian, the Sudano-Guinean and the Guineo-Congolean zones were respectively: Abelmoschus esculentus (L.) Moench and Hibiscus asper Hook.f.; Solanum lycopersicum L. and Zea mays L.; Ipomoea aquatica Forssk. and Senna occidentalis (L.) Link. They were mainly vegetables and used as food and/or medicinal plant species. Twenty CWR and twelve threatened species were recorded and were also mainly used for food and medicinal purposes. Thorough research on socioeconomic factors supporting possession of HG and choice of managed species as well as indigenous management strategies of HG and dynamic of traditional knowledge related to HG may help to deeply assess home gardens’ effectiveness in biodiversity conservation.


Biophilia discussed on the similarity of human intrinsic values that bonded mankind with the environment. This paper aimed to investigate the similarity trait of experts and non-experts in assessing the aesthetic quality of ecological landscape. Thus, selected visual aspects are tested to identify the visual concepts that represent the emotional attachment of both groups. Therefore, 5 photographs of ecological landscapes have been used in a conducted survey of 51 experts and 126 non-experts. By using Different Item Functioning (DIF) analysis, the results indicate that complexity, naturalness and legibility are the dominant visual concepts endorsed by both groups.


Modeled atmospheric pollution removal by trees based on eddy flux, leaf, and chamber studies of relatively few species may not scale up to adequately assess landscape-level air pollution effects of the urban forest. A land use regression (LUR) model (R2 = 0.70) based on NO2 measured at 144 sites in Portland, Oregon (USA), after controlling for roads, railroads, and elevation, estimated every 10 ha (20%) of tree canopy within 400 m of a site was associated with a 0.57 ppb decrease in NO2. Using BenMAP and a 200 m resolution NO2 model, we estimated that the NO2 reduction associated with trees in Portland could result in significantly fewer incidences of respiratory problems, providing a $7 million USD benefit annually. These in-situ urban measurements predict a significantly higher reduction of NO2 by urban trees than do existing models. Further studies are needed to maximize the potential of urban trees in improving air quality.

There is growing evidence to support the notion that plants can play an important role in providing a higher quality living environment. This study conducted a series of experiments to investigate the effects of characteristics, such as colour, odour and size of plants on human comfort, which was evaluated by a satisfaction survey and physiological measurements. Different kinds of plants with different levels of colour (green, tint and multicolour), odour (no odour, slight scent and strong scent) and size (small, medium and large) were chosen for the experiment design. A survey of participants' satisfaction degree as well as measurements from electroencephalogram (EEG), electrocardiogram (ECG), oxyhaemoglobin saturation, fingertip blood flow, skin resistance and respiration rate were utilized to illustrate the response of participants to the environments either with different plants or without plants. The results demonstrated that an interior office with plants was preferred over an office without plants. The environments with green, slightly scented and small plants were reported as the most favourite conditions. The EEG and oxyhaemoglobin saturation showed significant changes when plant conditions varied. These outcomes provided design strategies for incorporating the plants into the interior office spaces and also provided the physiological variables to evaluate human comfort in the outside environment.


This paper develops the concept of therapeutic place experiences by considering the role of activity. Research of community gardening finds that particular tasks are therapeutic and exhibit the characteristics of flow, but those who lack influence over their community gardening are less likely to benefit from flow as their sense of control is reduced. The notion of emplaced flow is proposed to locate individual experiences amongst socio-spatial factors which limit self-determinacy and therefore affect wellbeing. Emplacing flow prompts critical reflection on who is excluded from therapeutic place experiences, and whether sites offering momentary escape have an enduring impact on wellbeing.


Objective Although physical activity occurs in leisure, transport, occupational and domestic domains of life, the contribution of house and garden work (HGW) to the association between total physical activity and well-being is not clear. The aim was to describe the contribution of HGW to total physical activity (TPA) in association with well-being in younger, mid-aged and older women.

Design Younger (25-30 years), mid-aged (50-55 years) and older (76-81 years) participants in the Australian Longitudinal Study on Women's Health completed a mailed survey with questions about leisure, transport and house and garden activities. Well-being was assessed using the physical and mental components scores of the SF-36. Cross-sectional associations between the physical activity variables and well-being were modelled using General Additive Modelling.

Results Correlations between HGW and leisure/transport activity (LTA) were low (r<0.3, p<0.001). Positive curvilinear associations were found between LTA and physical and mental
well-being in all three cohorts, and between HGW and physical and mental well-being in mid-aged and older women. In the younger women, an inverse relationship was found between HGW and well-being. When HGW and LTA were summed (TPA), the associations between TPA and well-being were attenuated compared with those for LTA alone and well-being.

Conclusions: In mid-aged and older women, relationships between HGW and well-being were similar to, but weaker than seen for LTA and well-being. In young women, well-being declined with increasing HGW. Summing HGW to LTA led to attenuated relationships, suggesting that domains of physical activity should not be summed when studying relationships with well-being.


There is growing evidence to suggest that exposure to natural environments can be associated with mental health benefits. Proximity to greenspace has been associated with lower levels of stress (Thompson et al., 2012) and reduced symptomology for depression and anxiety (Beyer et al., 2014), while interacting with nature can improve cognition for children with attention deficits (Taylor and Kuo, 2009) and individuals with depression (Berman et al., 2012). A recent epidemiological study has shown that people who move to greener urban areas benefit from sustained improvements in their mental health (Alcock et al., 2014). In this paper we critically review evidence indicating that such mental health benefits are associated with the so-called “restorative” properties of natural environments. In particular we focus on the claim that interaction with (or just passive perception of) natural scene content can be linked to the restoration of limited-capacity attentional resources, in comparison to similar exposure to urban or built scene content.


Examine whether there are unique patterns of brain activation associated with exposure to photographic sky compositions (representing nature stimuli) as compared with other positive, negative, and neutral images. The positive impact of nature images on health outcomes traditionally has been measured using behavioral and physiological indicators. However, there is a lack of understanding of the underlying neural mechanism that explains this positive influence. A combination of behavioral responses and functional magnetic resonance imaging (fMRI) technology was used to address research questions. Ten participants belonging to five age groups were subjected to short (25 seconds) exposures of 32 images while their brain activation was monitored via the BOLD response. In a separate run, participants were subjected to extended exposures (12 minutes) of a sky composition and an image of a traditional ceiling. The results show that the activation patterns produced by sky compositions and positive images were quite similar as compared to negative or neutral images. However, sky compositions also produced some unique areas of activation, including those associated with spatial cognition, the expanse of space, circadian rhythm, and perceived motion. In the extended exposure condition, sky compositions tended to activate regions associated with dreaming, while traditional ceiling images activated regions that are related to face processing and potentially visual hallucinations. Nature stimuli, with a combination of vegetation and sky, may produce unique beneficial effects not present in general positive stimuli. Evidence-based design, hospital, healing environments, outcomes, patient-centered care.

A body of evidence shows that both physical activity and exposure to nature are connected to improved general and mental health. Experimental studies have consistently found short term positive effects of physical activity in nature compared with built environments. This study explores whether these benefits are also evident in everyday life, perceived over repeated contact with nature. The topic is important from the perspectives of city planning, individual well-being, and public health. National survey data (n = 2,070) from Finland was analysed using structural regression analyses. Perceived general health, emotional well-being, and sleep quality were regressed on the weekly frequency of physical activity indoors, outdoors in built environments, and in nature. Socioeconomic factors and other plausible confounders were controlled for.

Emotional well-being showed the most consistent positive connection to physical activity in nature, whereas general health was positively associated with physical activity in both built and natural outdoor settings. Better sleep quality was weakly connected to frequent physical activity in nature, but the connection was outweighed by other factors. The results indicate that nature provides an added value to the known benefits of physical activity. Repeated exercise in nature is, in particular, connected to better emotional well-being.


The objective of this study was to determine the exercise intensities of 10 gardening tasks for men and women in their 20s. Fifteen university students [(mean +/- SD) age 24.7 +/- 1.4 years and body mass index 23.5 +/- 4.1 kg.m(-2)] participated in this study. On two occasions, the subjects completed 10 gardening tasks in a high tunnel and a grassy area with weeds located near the high tunnel in Cheongju, Chungbuk, South Korea. They performed five gardening tasks randomly ordered on each occasion. Subjects did each gardening task for 5 minutes and then sat and rested in a chair for 5 minutes before the next task. Each subject wore a portable telemetric calorimeter and respired into the facemask during the gardening tasks and resting periods to measure their oxygen uptake. The subjects also wore a heart rate monitor under their breast to record heart rate data during the gardening tasks and resting periods via radiotelemetry. The 10 gardening tasks performed by the subjects were determined to be moderate- to high-intensity physical activities [3.5 +/- 0.5 to 6.3 +/- 1.2 metabolic equivalents (MET)]. In conclusion, the exercise intensity of gardening tasks should be useful information for developing garden exercise programs that meet the recommended physical activity for health benefits in adults.


This study investigated the exercise intensity and energy expenditure involved in two gardening activities (planting transplants and sowing seeds in a garden plot) and four common physical activities (running, skipping rope, walking, and throwing a ball) in children. Eighteen children aged 11 to 13 years (mean age, 12.3 +/- 0.7 years) participated in this study. The children made two visits to a high tunnel in Cheongju, Chungbuk, South Korea and performed
randomly selected activities. Each activity was performed for 10 min, with a 5-min rest period between activities. The children wore a Cosmed K4b2 (Cosmed K4b2; Cosmed, Rome, Italy), which is a portable calorimetric monitoring system, to measure indicators of metabolic cost such as oxygen uptake and energy expenditure. The children's heart rates during the activities were measured by radiotelemetry (Polar T 31; FitMed, Kempele, Finland). We found that the two gardening and four physical activities performed by the 11-13 years old children in this study were moderate- to high-intensity physical activities [i.e., 5.4 +/- 0.7 to 9.1 +/- 1.4 metabolic equivalents (METs)]. Running (9.1 +/- 1.4 METs) and skipping rope (8.8 +/- 1.1 METs) were high-intensity physical activities, whereas walking (6.1 +/- 0.9 METs), planting transplants (5.8 +/- 1.1 METs), throwing a ball (5.6 +/- 1.1 METs), and sowing seeds (5.4 +/- 0.7 METs) were moderate-intensity physical activities. Running and skipping rope were significantly more intense than the other activities (P < 0.0001). The gardening tasks such as planting transplants and sowing seeds in a garden plot showed similar exercise intensities and energy costs as walking and throwing a ball. This study indicates that gardening can be used as a physical activity intervention to provide health benefits similar to more common physical activities such as walking and running.


This paper presents findings from real life situations, a longitudinal single case study on the role of natural environments in nature-based rehabilitation (NBR) for individuals with stress-related mental disorders, at the Alnarp Rehabilitation Garden in Sweden. A sample of 43 former clients voluntarily participated in semi-structured interview, and the data were analyzed according to interpretative phenomenological analysis (IPA). Three main superordinate themes were identified as the three phases of NBR—Prelude, Recuperating and Empowerment—explaining and illuminating the role of the natural environments in each phase. An explanatory model of NBR in this context is presented including the three phases of NBR, IRP supportive occupations and a pyramid of supporting environments. A new component of supportive environments was identified and herby named, Social quietness, an important component facilitating personal and intimate engagement with the natural environments.


The aim of this study was to describe and assess changes in participants' experiences of everyday occupations after nature-based vocational rehabilitation (NBVR), to assess changes regarding symptoms of severe stress and the rate of return to work and possible association with experiencing the occupational value of everyday occupations. The NBVR was carried out by a transdisciplinary rehabilitation team and took place in a specially designed rehabilitation garden. The study had a longitudinal and mixed-method approach. Data concerning experiences of everyday occupations (Oval-pd), self-assessed occupational competence (OSA-F), health status (EQ-VAS, SCI-93), and sense of coherence (SOC-13) were collected before and after the intervention, and a one-year follow-up was carried out regarding returning to work. Semi-
structured interviews were performed 12 weeks after the intervention. Significant changes were measured regarding perceived occupational values in daily life, symptoms of severe stress, and returning to work. Both the return to work rate and symptoms of severe stress were significantly associated with changed experience of everyday occupation. In the interviews, participants explained that they now had a slower pace of everyday life and that everyday occupations were more often related to nature and creativity. This could be interpreted as nature-based rehabilitation inducing changes through meaningful occupations in restorative environments, leading to a positive change in perceived values of everyday occupations.


Resilience is a natural capacity to recover from adversity, sustain well-being, and grow from the experience. To enhance resilience in a high-stress, post-disaster context, we argue that it is vital to introduce positive stimuli to buffer the effects of negative stimuli. We review empirical evidence for the positive effects of various forms of contact with green space and contend that community gardening has considerable potential for bolstering individual and community resilience in disaster zones. We propose that creating an extensive network of community gardens as part of a disaster preparedness plan would yield multi-level benefits and bolster resilience capacity before it is acutely needed, and we suggest that community gardens established after a disaster has occurred adopt targeted aims in order to maximize benefits.

Nowak, D. J., et al. (2014). "Tree and forest effects on air quality and human health in the United States." Environmental Pollution 193(0): 119-129.

Trees remove air pollution by the interception of particulate matter on plant surfaces and the absorption of gaseous pollutants through the leaf stomata. However, the magnitude and value of the effects of trees and forests on air quality and human health across the United States remains unknown. Computer simulations with local environmental data reveal that trees and forests in the conterminous United States removed 17.4 million tonnes (t) of air pollution in 2010 (range: 9.0–23.2 million t), with human health effects valued at 6.8 billion U.S. dollars (range: $1.5–13.0 billion). This pollution removal equated to an average air quality improvement of less than one percent. Most of the pollution removal occurred in rural areas, while most of the health impacts and values were within urban areas. Health impacts included the avoidance of more than 850 incidences of human mortality and 670,000 incidences of acute respiratory symptoms.


Principles of lean office management increasingly call for space to be stripped of extraneous decorations so that it can flexibly accommodate changing numbers of people and different office functions within the same area. Yet this practice is at odds with evidence that office workers’ quality of life can be enriched by office landscaping that involves the use of plants that have no formal work-related function. To examine the impact of these competing approaches, 3 field experiments were conducted in large commercial offices in The Netherlands and the U. K. These examined the impact of lean and "green" offices on subjective perceptions of air quality, concentration, and workplace satisfaction as well as objective measures of productivity. Two studies were longitudinal, examining effects of interventions over subsequent
weeks and months. In all 3 experiments enhanced outcomes were observed when offices were enriched by plants. Implications for theory and practice are discussed.


Bangladesh has a number of aboriginal groups distributed throughout the various hilly and forested regions of the country. Although some degree of modernization is creeping in, the various aboriginals still rely on their aboriginal medicinal practitioners (AMPs) for treatment of various ailments. The AMPs usually administer various formulations of plants for treatment of diseases. Because this practice has continued for centuries, and because of the forested regions of the aboriginal habitats, the AMPs have an extensive knowledge of plants and their specific uses.


Chronic stress and little physical activity play an increasing role in dominant civilization diseases. The positive contribution of nature to health has been examined in a multitude of studies. The ambition of this study is to review the present state of international research on exposure to forests and its specific effects on human health, particularly stress-reducing effects. The review focuses on research in Asia and German-speaking countries (GSC) in Europe, distinguishing between forest benefits for physical and mental well-being. Considering the objective of the EU Forest Action Plan (FAP) to contribute to quality of life by improving the social dimensions of forests, it also examines and compares the forest strategies and programmes of GSC. With regard to plan implementation at national levels, attention is drawn to preventive health care aspects. The results are discussed and challenges, especially for forestry in GSC, are deduced.


Million Trees LA (MTLA) is one of several large-scale mayoral tree planting initiatives in the United States, striving to create more livable cities through urban forestry. This study combined field sampling of tree survival and growth with numerical modeling of future benefits to assess performance of MTLA plantings. From 2006 to 2010 MTLA planted a diverse mix of 91,786 trees. Survivorship rates of 79.8%, 90.7%, and 77.1% for street, park and yard trees were relatively high compared to other studies. Growth rates averaged 0.99 and 1.1 cm DBH per year for street and yard trees. They were similar to rates for the same species in Claremont, California, U.S., and trees in other subtropical urban forests. Projected over 40 years, the amounts of CO2 stored per tree planted per year (20.1 kg), avoided emissions (27.7 kg), rainfall interception (1.5 m3), and air conditioning savings (47.4 kWh) exceeded estimates from a previous assessment. One reason is that MTLA has planted more larger-stature trees than anticipated. Avoided CO2 emissions from energy savings were relatively large because trees were judiciously located for building shade. Park tree plantings were projected to store the most CO2 (42.0 kg per tree per year) because of their large-stature and high survival rate. Although MTLA has not reached its goal of planting 1 million trees, early results suggest that it is achieving success in terms of tree survival, growth and performance. Continued success will
depend on proper tree care practices, strategically selecting and locating new trees, monitoring threats, and adapting to challenges that arise.


Topics relating to mental health promotion systematically lack research that documents the importance of physical environment qualities in the development of public health policies. At the present time, several emerging research lines regarding restorative environments (RE) and psychological restoration (PR) may contribute to the conceptual and operational definition of relevant environmental qualities promoting mental health. PR relates to the recovery of people's cognitive resources and psychophysiological responses when exposed to environments with restorative qualities. The present study documents the application of an ecological social model regarding the impact of urban nature on PR in a housing context. We posed the objective to document possible restoration effects of variables related to Urban Nature-UN (for example, views of nature from housing windows, indoor plants and gardens; proximity to outdoor green areas) and Psychological Transaction Processes with the Environment - PTRAPE (activities in nature and perception of environmental restoration of housing) on emotional and cognitive indicators of PR. To achieve this goal, we carried out a study with 120 individual home interviews (mean age of 45.73 years, 63 men and 57 women) in the metropolitan area of Mexico City. The structural equations model showed that UN has both direct and indirect effects on emotional and cognitive dimension of PR. This theoretical, conceptual, and methodological approach provides a conceptual platform to carry out innovative research with relevant empirical implications for mental health promotion.


The present study evaluated images of environments in three categories with different affective and restorative valences through two computerized assessments. A non-verbal computerized response scale and the Mexican Scale of Environmental Restoration Perception were employed. 104 students assessed the affective qualities of 117 images (47 natural, 37 urban with nature, and 33 built-up without nature) according to pleasure and activation dimensions. Then 96 students assessed 54 images with high and low valence for their restorative quality. Natural images were found to generate positive affective reactions of liking and activation and high restorative quality. Affective responses to urban with nature environments tended to be positive with moderate restorative quality. Built-up without nature environments were perceived as less pleasant and had low restorative quality. However, among built-up without nature environments, some settings with striking architectural qualities evoked positive affective valences.


What is the influence of street network design on public health? While the literature linking the built environment to health outcomes is vast, it glosses over the role that specific street network characteristics play. The three fundamental elements of street networks are: street network density, connectivity, and configuration. Without sufficient attention being paid to these
individual elements of street network design, building a community for health remains a guessing game. Our previous study found more compact and connected street networks highly correlated with increased walking, biking, and transit usage; while these trends suggest a health benefit, this study seeks to strengthen that connection.

Using a multilevel, hierarchical statistical model, this research seeks to fill this gap in the literature through a more robust accounting of street network design. Specifically, we ask the following: what is the influence of the three fundamental measures of street networks on obesity, diabetes, high blood pressure, heart disease, and asthma? We answer this question by examining 24 California cities exhibiting a range a street network typologies using health data from the California Health Interview Survey.

We control for the food environment, land uses, commuting time, socioeconomic status, and street design. The results suggest that more compact and connected street networks with fewer lanes on the major roads are correlated with reduced rates of obesity, diabetes, high blood pressure, and heart disease among residents. Given the cross-sectional nature of our study, proving causation is not feasible but should be examined in future research. Nevertheless, the outcome is a novel assessment of streets networks and public health that has not yet been seen but will be of benefit to planners and policy-makers.


Aim We investigated whether objectively measured access to urban green spaces is associated with behavioural problems in 10-year old children living in Munich and its surrounding areas. Methods Behavioural problems were assessed in the GINIplus and LISAplus 10-year follow-up between 2006 and 2009 using the Strengths and Difficulties Questionnaire. Access to green spaces was defined using the distance from a child's residence to the nearest urban green space. Associations between access to urban green spaces and behavioural problems were assessed using proportional odds and logistic regression models in 1932 children with complete exposure, outcome and covariate data. Results The distance between a child's residence and the nearest urban green space was positively associated with the odds of hyperactivity/inattention, especially among children with abnormal values compared to children with borderline or normal values (odds ratio (OR) = 1.20 (95% confidence interval (CI) = 1.01–1.42) per 500 m increase in distance). When stratified by sex, this association was only statistically significant among males. Children living further than 500 m away from urban green spaces had more overall behavioural problems than those living within 500 m of urban green spaces (proportional OR = 1.41 (95% CI = 1.06–1.87)). Behavioural problems were not associated with the distance to forests or with residential surrounding greenness. Conclusion Poor access to urban green spaces was associated with behavioural problems in 10-year old children. Results were most consistent with hyperactivity/inattention problems.


Recent ecosystem service models have placed biodiversity as a central factor in the processes that link the natural environment to health. While it is recognized that disturbed ecosystems might negatively affect human well-being, it is not clear whether biodiversity is
related to or can promote “good” human health and well-being. The aim of this study was to systematically identify, summarize, and synthesize research that had examined whether biodiverse environments are health promoting. The objectives were twofold: (1) to map the interdisciplinary field of enquiry and (2) to assess whether current evidence enables us to characterize the relationship. Due to the heterogeneity of available evidence a narrative synthesis approach was used, which is textual rather than statistical. Extensive searches identified 17 papers that met the inclusion criteria: 15 quantitative and 2 qualitative. The evidence was varied in disciplinary origin, with authors approaching the question using different study designs and methods, and conceptualizations of biodiversity, health, and well-being. There is some evidence to suggest that biodiverse natural environments promote better health through exposure to pleasant environments or the encouragement of health-promoting behaviors. There was also evidence of inverse relationships, particularly at a larger scale (global analyses). However, overall the evidence is inconclusive and fails to identify a specific role for biodiversity in the promotion of better health. High-quality interdisciplinary research is needed to produce a more reliable evidence base. Of particular importance is identifying the specific ecosystem services, goods, and processes through which biodiversity may generate good health and well-being.


Background: Community gardening is defined by its shared nature; gardeners work collectively to manage a garden for shared benefit. Although communal gardening activities, and recognition of their perceived benefits have a long history, it is in recent years that interest has developed in assessing the potential of the approach to address many of the threats to health and wellbeing faced by global populations. Community gardening may address chronic and non-communicable disease through the provision of opportunities for physical activity, improved nutrition and reduced stress. Participation in the gardening activities may improve wellbeing through increased social contact, culturally valued activities and mitigation of food poverty. The benefits of community gardening are argued to extend beyond the participants themselves through more coherent and cohesive communities, improved physical environments and the sharing of the products of the labour. While there are many claims made and an emerging body of research, no previous systematic review has sought to identify and synthesise the evidence in a global context.

Methods: The objectives of the mixed method systematic review are to understand the health and wellbeing impacts of active participation in community gardening. Both quantitative and qualitative evidence will be sought using a broad and diverse search strategy to address the four review questions:

1) does active involvement in community gardening lead to improved health or wellbeing;
2) if so, how does active involvement in community gardening affect health and wellbeing;
3) are there different impacts for different population groups (for instance according to age, socio-economic status or sex); and
4) do different types of community gardening (for example producing vegetables or a flower garden) or in different contexts have different types of impacts?

A theoretical framework, informed by an initial theory of change model, will illustrate the outcomes of participation and any mechanisms of action (i.e. how such impacts are achieved). The synthesis will be sensitive to factors which may affect the impacts, such as the context of the activities, the demographics of participants, and the implementation and specifics of the community gardening interventions.


Green roofs are an increasingly popular urban greening strategy in North American cities. Most green roofs have been sedum-based, but there has been a recent trend to mimic the native habitat of a region in prairie-style green roofs. While this supports ecological restoration goals, it also conflicts with ambiguous responses by urbanites to the aesthetics of ‘wild’ and ‘messy’ nature in the city. Though green roofs are transforming downtown central business districts, there has been little research on office workers’ perceptions of green roofs, or on how they may influence their health, well-being, and experience of central business districts. Furthermore, while recent research has looked at aesthetic perceptions of green roofs, there is scant qualitative work that explains why urbanites may have these preferences, or cultural and contextual factors influencing these perceptions. While not uncontroversial, green roofs make an excellent lens through which to explore the human relationship to nature in cities due to their lack of existing symbolism, challenge of the nature/city divide, and mimicking of native habitat. This paper explores office workers’ perceptions of green roofs in Toronto and Chicago, two cities known for their leadership in green roof implementation. Using a phenomenological analysis of fifty-five semi-structured interviews, this paper examines (a) office workers’ perceptions of green roofs; (b) how their lived experience influences their perceptions of aesthetics and urban nature, and (c) design implications for a more sustainable city. Results show that while ‘wilder’ prairie-style green roofs are not always well-liked, they are more likely to be associated with fascination, creative thinking, and calm well-being than sedum green roofs. Green roofs were also linked to an ethic of care and restoration, and may provide ‘loose fit’ places for respite and better health for office workers.


Horticultural therapy is defined as the process of utilising fruits, vegetables, flowers and plants facilitated by a trained therapist or healthcare provider, to achieve specific treatment goals or to simply improve a person's well-being. It can be used for therapy or rehabilitation programs for cognitive, physical, social, emotional, and recreational benefits, thus improving the person's body, mind and spirit. Between 5% to 15% of people with schizophrenia continue to experience symptoms in spite of medication, and may also develop undesirable adverse effects, horticultural therapy may be of value for these people. To evaluate the effects of horticultural therapy for people with schizophrenia or schizophrenia-like illnesses compared with standard care or other additional psychosocial interventions. Search methods We searched the Cochrane Schizophrenia Group Trials Register (January 2013) and supplemented this by contacting relevant study
authors, and manually searching reference lists. Selection criteria We included one randomised controlled trial (RCT) comparing horticultural therapy plus standard care with standard care alone for people with schizophrenia. Data collection and analysis We reliably selected, quality assessed and extracted data. For continuous outcomes, we calculated a mean difference (MD) and for binary outcomes we calculated risk ratio (RR), both with 95% confidence intervals (CI). We assessed risk of bias and created a 'Summary of findings' table using the GRADE (Grades of Recommendation, Assessment, Development and Evaluation) approach. Main results We included one single blind study (total n = 24). The overall risk of bias in the study was considered to be unclear although the randomisation was adequate. It compared a package of horticultural therapy which consisted of one hour per day of horticultural activity plus standard care with standard care alone over two weeks (10 consecutive days) with no long-term follow-up. Only two people were lost to follow-up in the study, both in the horticultural therapy group (1 RCT n = 24, RR 5.00 95% CI 0.27 to 94.34, very low quality evidence). There was no clear evidence of a difference in Personal Wellbeing Index (PWI-C) change scores between groups, however confidence intervals were wide (1 RCT n = 22, MD -0.90 95% CI -10.35 to 8.55, very low quality evidence). At the end of treatment, the Depression Anxiety Stress Scale (DASS21) change scores in horticultural therapy group were greater than that in the control group (1 RCT n = 22, MD -23.70 CI -35.37 to -12.03, very low quality evidence). The only included study did not report on adverse effects of interventions. Based on the current very low quality data, there is insufficient evidence to draw any conclusions on benefits or harms of horticultural therapy for people with schizophrenia. This therapy remains unproven and more and larger randomised trials are needed to increase high quality evidence in this area.


Despite increasing attention toward forest therapy as an alternative medicine, very little evidence continues to be available on its therapeutic effects. Therefore, this study was focused on elucidating the health benefits of forest walking on cardiovascular reactivity. Methods. Within-group comparisons were used to examine the cardiovascular responses to walking in forest and urban environments. Forty-eight young adult males participated in the two-day field research. Changes in heart rate variability, heart rate, and blood pressure were measured to understand cardiovascular reactivity. Four different questionnaires were used to investigate the changes in psychological states after walking activities. Results. Forest walking significantly increased the values of ln(HF) and significantly decreased the values of ln(LF/HF) compared with the urban walking. Heart rate during forest walking was significantly lower than that in the control. Questionnaire results showed that negative mood states and anxiety levels decreased significantly by forest walking compared with urban walking. Conclusion. Walking in the forest environment may promote cardiovascular relaxation by facilitating the parasympathetic nervous system and by suppressing the sympathetic nervous system. In addition, forest therapy may be effective for reducing negative psychological symptoms.


A mega-earthquake and tsunami struck the northeastern coast of Japan, and many survivors were forced to evacuate to temporary housing due to rising radiation levels. The aims
of this study were to investigate the prevalence of symptoms of post-traumatic stress disorder (PTSD), depression, and poor general health among survivors, to test the predictive roles of resilience on mental and physical health, and to examine the predictive sociodemographic factors on resilience.

Methods: Two hundred and forty-one evacuees (men/women: 116/125) from Hirono, Fukushima participated in the study. They were asked to complete the Connor-Davidson Resilience Scale, the Zung Self-Rating Depression Scale, the Impact of Events Scale-Revised, and a demographic questionnaire.

Results: Among all participants, 53.5% exhibited the clinically concerning symptoms of PTSD, and among them 33.2% indicated clinical PTSD symptoms. Additionally, 66.8% reported symptoms of depression, and among them 33.2% showed mildly depressive symptoms, while 19.1% and 14.5% demonstrated moderate and severe depressive symptoms, respectively. Resilience was a significant buffer for depression, PTSD, and general health. Additionally, employment status, eating/exercise habits, and drinking habits predicted resilience.

Conclusion: The results indicated that depression and PTSD are prevalent among the survivors of massive earthquakes, tsunamis, and accidents from nuclear power plants. However, the results also showed that some survivors managed to endure the traumatic events relatively well, and resilience was a significant protective factor in dealing with such events. Therefore, it is crucial to assist survivors in improving their resilience by providing job opportunities and encouraging a healthy lifestyle.


Chronic stress adversely affects the body, and stress and negative emotions affect the development and progression of diseases. This study focuses on horticultural therapy (HT) as a method of stress reduction. Although previous studies have reported that HT has many benefits, the effects of HT in relation to differences in the intervention style have not been investigated. The purpose of this study was to clarify whether there is a difference in the effect due to the difference in intervention style in HT. The participants were divided into three groups, a group intervention (GI group; n=15), an individual intervention (II group; n=15), and a control group (C group; n=15). The GI and II groups underwent four weeks of a horticultural intervention, whereas the C group was provided with a gardening kit by an experimenter. The individuals in the C group cared for the plants by themselves for 15 min per day for one month. The GI group showed significant improvement in the WHO Quality of Life 26 (WHO-QOL26) subscore, the Emotional Intelligence Scale (EQS) subscore, the General Health Questionnaire (GHQ) score, and salivary cortisol level, as compared with the II group. These findings suggest that a group HT intervention might be more effective than an individual intervention.


In the near future, three years will have passed since the Great East Japan Earthquake. Despite the passage of time, several residents living of the Pacific coast of Tohoku continue to suffer from mental and physical repercussions of the event. In other words, numerous survivors of the Great East Japan Earthquake continue to live with emotional trauma and stress. Previous studies suggest that mental health problems among natural disaster survivors are most
pronounced within a specified period after the event [1]. Although recovery among survivors is progressing incrementally in the disaster area of Tohoku, one may argue that availability of medium- to long-term psychological care for these people is important. Immediately following the earthquake, our research team provided horticultural therapy as a medium- to long-term psychological support to the survivors. The motivation behind this study is based on previous research suggesting that women are more susceptible to experiencing anxiety in post-disaster environments than men [2], that women are more likely to be diagnosed with Post-Traumatic Stress Disorder (PTSD) than men after experiencing natural disasters [3], and that weak social support is associated with a higher susceptibility to PTSD.

Horticultural Therapy (HT) is a psychological care method for treating PTSD that was developed in the United States for psychological care and social rehabilitation of disabled soldiers and war veterans diagnosed with PTSD following World War II [2]. Previous studies have suggested that HT and exposure to nature can have cognitive [4,5], psychological [6,7], social [8], and physical [9] benefits. Since the earthquake, our research group has reported psychological effects of horticultural therapy on women living in the disaster areas [10,11]. The motivation behind this study is based on previous research suggesting that women are more susceptible to experiencing anxiety in post-disaster environments than men [2], that women are more likely to be diagnosed with Post-Traumatic Stress Disorder (PTSD) than men after experiencing natural disasters [3], and that weak social support is associated with a higher susceptibility to PTSD.

In addition, the intervention effect on the intervention group was sustained for a certain period in both groups. These findings suggest that horticultural therapy has an effect on earthquake-related stress symptoms among women living in the disaster area, and that this effect may endure for a prolonged period. However, these studies were not conducted in the disaster areas, but in an experimental format in which intervention participants were studied in research facilities.

Based on these results, we are currently conducting an empirical intervention study in the coastal regions of the disaster areas of Miyagi Prefecture, where earthquake damage was considerable. Currently, the disaster areas of Tohoku are undergoing a period of rebuilding. However, for practical reasons rebuilding has progressed slowly, and limited reproduction within the disaster areas will become a serious future issue as victims move away from the vicinity. The purpose of this study is to understand the effect of horticultural therapy as a means of rebuilding local communities in disaster areas, and to establish a system of horticultural therapy as a regional community support that is available to these communities. This study has recently begun and the results have not yet been obtained; however, in the near future, it will provide information to the current state of knowledge in this field.

We believe that HT may prove to be an effective intervention strategy for earthquake-related stress. We hope to spread awareness about HT as a source of psychological support for medium- to long-term natural disaster-related stress.


The evidence concerning the relative importance of physical activity, restorative experiences, and social interaction as mediators between exposure to nature and well-being has been inconsistent. We investigated whether there is a relationship between the average time used for nature-based recreation and emotional well-being and whether it is mediated through restorative experiences, social company and the perceived duration of the most recent nature-based recreation visit.
A sample of 3060 Finnish people (38.3% response rate) aged 15–74 years participated in a survey using an internet and a mail questionnaire. Multiple mediation analysis using bootstrapping revealed an association between the self-reported participation in nature-based recreation and emotional well-being through restorative experiences when adjusting for age, gender, household income, the level of leisure time physical activity, and the frequency of active transportation. The amount of social company or the duration of the most recent nature-based recreation visit did not mediate the association between the average time spent on nature-based recreation and emotional well-being.

The result accords with the evidence of the restorative and well-being effects of nature exposure but more evidence of causality and studies comparing different mediators in different population groups are needed.


This study was conducted to provide a job analysis for, and assess the job performance of horticultural therapists, as well as examine future educational needs. To this end, a chart developed using the DACUM method was chosen as the appropriate tool for the job analysis of horticultural therapists (Study 1). Based on the chart, a survey using an evaluation form was produced to investigate the current level of job performance and future required level of horticultural therapists (Study 2). A total of 8 duties and 45 tasks were classified to examine job performance, based on analysis of the DACUM Council (Study 1). These duties include A. Decide execution organization for horticultural therapy (HT) program, B. Diagnose and assess clients before starting the HT program, C. Plan HT program, D. Develop HT program, E. Prepare to implement HT program for each session, F. Implement HT program for each session, G. Implement overall assessment for HT program, and H. Develop oneself as a horticultural therapist. Their duties were broken down further into five to eight tasks per duty, totaling 45 tasks. Based on the horticultural therapist job performance sheet developed through this process, an assessment of the current job level of horticultural therapists was performed and future required level were examined (Study 2). The evaluation forms were sent to 779 horticultural therapists with level 1 or 2 certification via email or mail delivery. The analysis of 242 questionnaires (31.1%) revealed that horticultural therapists with level 1 certificates have a significantly higher job performance level for 34 of the 45 tasks. Regarding future required level, 20 out of 45 tasks were assessed as higher for level 1 horticultural therapists than level 2. In addition, a Borich formula was utilized to identify the priority of educational needs for the 45 horticultural therapist tasks. The results revealed the following top three tasks: H1. Receive feedback from the supervisor for the horticultural therapy program; Al. Distribute promotional materials about the horticultural therapy program; and H2. Submit a grant proposal for horticultural therapy program to organizations such as welfare foundations. The results of this study are anticipated to facilitate understanding and improve work conditions for current horticultural therapists or horticultural therapists-in-training. In addition, institutions that train horticultural therapists will be able to use this as basic research to develop a practical training curriculum.

For older elementary school students, amicable peer relationships are important to meeting developmental challenges, such as socialization. Thus, in this study, the effectiveness of a school gardening program to promote positive social relationships among elementary school students was assessed. The participants in this study were fifth and sixth grade students from four elementary schools in Wonju, South Korea. The experimental and control groups consisted of 123 students each (total 246) from fifth and sixth grade classrooms. The gardening program included a range of activities, such as sowing seeds and harvesting produce, and was designed to improve peer status, peer relations, and sociality. The program was embedded in the school curriculum; sessions were 90 minutes per week for 10 weeks from 16 April through 25 June 2012. The results revealed the school gardening program brought about meaningful differences in both persistence of friendship (P = 0.04) and adaptability between friends (P = 0.03), which were subcategories of peer relationships, in the experimental group. There were also significant improvements in sociality (P< 0.001) and its various subcategories, especially in law-abiding (P< 0.001) and collaboration (P< 0.001). Finally, the peer status results showed that there was significantly a greater increase in the peer status after the school gardening program, but there was no significant change in the control group. In conclusion, the school gardening program for elementary school students had a positive influence on peer relationships, sociality, and peer status. Implementing a garden program in schools will effectively contribute to the improvement of social relationships among elementary school students.


Green exercise is activity in the presence of nature. Evidence shows it leads to positive short and long-term health outcomes. This multistudy analysis assessed the best regime of dose(s) of acute exposure to green exercise required to improve self-esteem and mood (indicators of mental health). The research used meta-analysis methodology to analyze 10 UK studies involving 1252 participants. Outcomes were identified through a priori subgroup analyses, and dose–responses were assessed for exercise intensity and exposure duration. Other subgroup analyses included gender, age group, starting health status, and type of habitat. The overall effect size for improved self-esteem was $d = 0.46$ (CI 0.34–0.59, $p < 0.00001$) and for mood $d = 0.54$ (CI 0.38–0.69, $p < 0.00001$). Dose responses for both intensity and duration showed large benefits from short engagements in green exercise, and then diminishing but still positive returns. Every green environment improved both self-esteem and mood; the presence of water generated greater effects. Both men and women had similar improvements in self-esteem after green exercise, though men showed a difference for mood. Age groups: for self-esteem, the greatest change was in the youngest, with diminishing effects with age; for mood, the least change was in the young and old. The mentally ill had one of the greatest self-esteem improvements. This study confirms that the environment provides an important health service.


Green spaces in the living environment may provide a meeting place and support social contacts. When people get older they, in general, are less mobile and have more limited activity spaces. At the same time they are faced with smaller social networks due to social and health
related changes. Green spaces in their direct living environment are therefore important to support their needs. The aim of this study was to better understand the nature of the relationship between various types of green spaces in the direct living environment and the extent and nature of social contacts of the aging generation, taking into account socio-demographics and other physical and social environmental characteristics. Data for this study were obtained from a survey about living surroundings from a national representative sample of 1501 persons in the age category of 60 years and over in the Netherlands conducted in 2009. The survey included both subjective and objective measurements of the direct living environment of the respondents. Specifically, a Bayesian belief network was used to formulate and estimate the direct and indirect relationships between the selected variables. Results show that social contacts among neighbors are mainly influenced by the availability of trees and grass and the perceived level of green. Green spaces support social contacts in the neighborhood. However, the safety and maintenance of the green spaces are also important; high quality green spaces support social contacts between neighbors and strengthen communities for the aging population.


To summarize the evidence from randomized controlled trials (RCTs) on the effects of horticultural therapy (HT). Studies were eligible if they were RCTs. Studies included one treatment group in which HT was applied. We searched the following databases from 1990 up to August 20, 2013: MEDLINE via PubMed, CINAHL, Web of Science, Ichushi-Web, GHL, WPRIM, and PsycINFO. We also searched all Cochrane Database and Campbell Systematic Reviews up to September 20, 2013.

Four studies met all inclusion criteria. The language of all eligible publications was English and Korean. Target diseases and/or symptoms were dementia, severe mental illness such as schizophrenia, bipolar disorder, and major depression, frail elderly in nursing home, and hemiplegic patients after stroke. These studies showed significant effectiveness in one or more outcomes for mental health and behavior. However, our review especially detected omissions of the following descriptions: method used to generate randomization, concealment, blinding, and intention-to-treat analysis. In addition, the results of this study suggested that the RCTs conducted have been of relatively low quality. Although there was insufficient evidence in the studies of HT due to poor methodological and reporting quality and heterogeneity, HT may be an effective treatment for mental and behavioral disorders such as dementia, schizophrenia, depression, and terminal-care for cancer.


Operation of small-scale biomass power plants might cause some health impacts. This research aimed to assess physical, mental and social health impacts using public perceptions. Data were collected using a questionnaire interview and focus-group discussion. Two rice-husk power plants were selected for study cases. Three hundred and ninety local people were interviewed using a questionnaire and 45 community representatives participated in 6 focus-group discussions. From this survey, the top three health impacts based on public perception were frustration with having to clean their houses often because of dust from the power plant, the power plant increased local air pollution and air pollutants from the power plant irritated the
respiratory system. Only half of the respondents believed that the power plant affected the community economically and increased their family income. In conclusion, operation of biomass power plants may cause health impacts to nearby residents. Further study to objectively quantify the impacts is recommended.


Background: Several epidemiological studies have investigated the effect of the quantity of green space on health outcomes such as self-rated health, morbidity and mortality ratios. These studies have consistently found positive associations between the quantity of green and health. However, the impact of other aspects, such as the perceived quality and average distance to public green, and the effect of urban green on population health are still largely unknown.

Methods: Linear regression models were used to investigate the impact of three different measures of urban green on small-area life expectancy (LE) and healthy life expectancy (HLE) in The Netherlands. All regressions corrected for average neighbourhood household income, accommodated spatial autocorrelation, and took measurement uncertainty of LE, HLE as well as the quality of urban green into account.

Results: Both the quantity and the perceived quality of urban green are modestly related to small-area LE and HLE: an increase of 1 SD in the percentage of urban green space is associated with a 0.1-year higher LE, and, in the case of quality of green, with an approximately 0.3-year higher LE and HLE. The average distance to the nearest public green is unrelated to population health.

Conclusions: The quantity and particularly quality of urban green are positively associated with small-area LE and HLE. This concurs with a growing body of evidence that urban green reduces stress, stimulates physical activity, improves the microclimate and reduces ambient air pollution. Accordingly, urban green development deserves a more prominent place in urban regeneration and neighbourhood renewal programmes.


Background: In recent years, the physiological relaxing effect brought by nature is becoming clear; however, many workers find it difficult to be exposed to nature in their working environment. Exposure to fresh flowers represents an opportunity to incorporate nature into their working lives. In this study, we examined the effects of exposure to roses on physiological and psychological variables (heart rate variability, pulse rate, and subjective responses) in office workers.

Results: The experimental site was Mizuho Information & Research Institute, Inc., in the Tokyo metropolitan area. Thirty-one male office workers were included in the present study. The subjects were exposed to thirty unscented pink roses (Rosa, Dekora) arranged in a cylindrical glass vase for 4 min. In the control condition, the subjects were not exposed to flowers. After the experiments, the subjects completed a questionnaire. The order of exposure was counterbalanced among subjects. Among subjects exposed to roses, the high-frequency component of heart rate variability was significantly higher than in controls. Similarly, ‘comfortable,’ ‘relaxed’ and ‘natural’ feelings were more common in subjects exposed to roses.
Conclusions: Data from this study support the presence of physiological and psychological relaxing effects of being exposed to flowers on office workers.


In recent years, the physiological relaxing effect brought by nature is becoming clear; however, many workers find it difficult to be exposed to nature in their working environment. Exposure to fresh flowers represents an opportunity to incorporate nature into their working lives. In this study, we examined the effects of exposure to roses on physiological and psychological variables (heart rate variability, pulse rate, and subjective responses) in office workers.


The Millennium Ecosystem Assessment and other commentators have warned about the impacts that biodiversity decline will have on human health. There is no doubting that the natural world provides mankind with the majority of the resources required to sustain life and health. Many species provide food, fuel, medicines; with the potential for many more (as of yet) undiscovered uses for various species. Despite this, there have been very few attempts to actually investigate relationships between biodiversity (i.e. number of species, rather than the ability of specific species to provide health benefits) and human health. This paper reviews the available evidence and demonstrates that while the links between biodiversity and health seem intuitive, they are very difficult to prove. Socio-economics has a huge influence on health status and the exploitation of natural resources (leading to eventual biodiversity loss) tends to have a positive economic effects. More direct effects of biodiversity on health include the diversity of the internal microbiome, the effect of natural diversity on our mental health and well-being (although this has large social aspects with many people feeling fearful in very diverse environments). Still to be elucidated are the tipping points where the level of global biodiversity loss is such that human health can no longer be sustained.


Background: Extreme heat is a leading weather-related cause of illness and death in many locations across the globe, including subtropical Australia. The possibility of increasingly frequent and severe heat waves warrants continued efforts to reduce this health burden, which could be accomplished by targeting intervention measures toward the most vulnerable communities. We sought to quantify spatial variability in heat-related morbidity in Brisbane, Australia, to highlight regions of the city with the greatest risk. We also aimed to find area-level social and environmental determinants of high risk within Brisbane.

Methods: We used a series of hierarchical Bayesian models to examine city-wide and intracity associations between temperature and morbidity using a 2007–2011 time series of geographically referenced hospital admissions data. The models accounted for long-term time trends, seasonality, and day of week and holiday effects.

Results: On average, a 10°C increase in daily maximum temperature during the summer was associated with a 7.2% increase in hospital admissions (95% CI: 4.7, 9.8%) on the following
Positive statistically significant relationships between admissions and temperature were found for 16 of the city’s 158 areas; negative relationships were found for 5 areas. High-risk areas were associated with a lack of high income earners and higher population density.

Conclusions: Geographically targeted public health strategies for extreme heat may be effective in Brisbane, because morbidity risk was found to be spatially variable. Emergency responders, health officials, and city planners could focus on short- and long-term intervention measures that reach communities in the city with lower incomes and higher population densities, including reduction of urban heat island effects.


To what extent does the density of the tree cover in a city relate to the amount of social capital among neighbors? To address this question, we linked social survey data (N = 361) from the Baltimore Ecosystem Study with socioeconomic, urban form, and green space data at the census block group level using a geographic information system. We found a systematically positive relationship between the density of urban tree canopy at the neighborhood block group level and the amount of social capital at the individual level (r = .241, p < .01). Multiple regression analyses showed that tree canopy added a 22.72% increase in explanatory power to the model for social capital. This research adds a new variable—neighborhood tree canopy—to the typologies of green space that affect human social connection. Trees are a relatively inexpensive and easy intervention to enhance the strength of social ties among neighbors.


Numerous studies have found evidence for the restorative effects of nature, in which exposure to natural elements can improve both well-being and cognitive performance. The present study investigated whether the restorative effects of nature could be captured within the context of a university learning environment. Undergraduate students were split into two groups and listened to a short lecture. One group was taught within an environment that lacked any natural presence (the “artificial” condition) whereas the other group was taught within a classroom containing some simple natural elements (the “nature-infused” condition). Knowledge retention and mood were assessed. At the end of the lecture, participants in the nature-infused environment scored significantly higher on the test of knowledge than those in the artificial environment. This trend persisted 1 week later but was nonsignificant. Mood was not affected. These findings indicate that incorporating nature into learning environments could have a beneficial effect on student knowledge retention, at least over short periods of time. Key Words: Restorative effects of nature—Learning environments—Memory—Mood—Classroom.


Urbanization, resource exploitation, and lifestyle changes have diminished possibilities for human contact with nature in many societies. Concern about the loss has helped motivate research on the health benefits of contact with nature. Reviewing that research here, we focus on nature as represented by aspects of the physical environment relevant to planning, design, and policy measures that serve broad segments of urbanized societies. We discuss difficulties in defining “nature” and reasons for the current expansion of the research field, and we assess available reviews. We then consider research on pathways between nature and health involving
air quality, physical activity, social cohesion, and stress reduction. Finally, we discuss methodological issues and priorities for future research. The extant research does describe an array of benefits of contact with nature, and evidence regarding some benefits is strong; however, some findings indicate caution is needed in applying beliefs about those benefits, and substantial gaps in knowledge remain.


Natural environments offer a high potential for human well-being, restoration and stress recovery in terms of allostatic load. A growing body of literature is investigating psychological and physiological health benefits of contact with Nature. So far, a synthesis of physiological health outcomes of direct outdoor nature experiences and its potential for improving Public Health is missing. We were interested in summarizing the outcomes of studies that investigated physiological outcomes of experiencing Nature measuring at least one physiological parameter during the last two decades. Studies on effects of indoor or simulated Nature exposure via videos or photos, animal contact, and wood as building material were excluded from further analysis. As an online literature research delivered heterogeneous data inappropriate for quantitative synthesis approaches, we descriptively summarized and narratively synthesized studies. The procedure started with 1,187 titles. Research articles in English language published in international peer-reviewed journals that investigated the effects of natural outdoor environments on humans by were included. We identified 17 relevant articles reporting on effects of Nature by measuring 20 different physiological parameters. We assigned these parameters to one of the four body systems brain activity, cardiovascular system, endocrine system, and immune function. These studies reported mainly direct and positive effects, however, our analyses revealed heterogeneous outcomes regarding significance of results. Most of the studies were conducted in Japan, based on quite small samples, predominantly with male students as participants in a cross-sectional design. In general, our narrative review provided an ambiguous illustration of the effects outdoor nature exerted on physiological parameters. However, the majority of studies reported significant positive effects. A harmonizing effect of Nature, especially on physiological stress reactions, was found across all body systems. From a Public Health perspective, interdisciplinary work on utilizing benefits of Nature regarding health promotion, disease prevention, and nature-based therapy should be optimized in order to eventually diminish given methodological limitations from mono-disciplinary studies.

Hajat, S., et al. (2014). "Climate change effects on human health: projections of temperature-related mortality for the UK during the 2020s, 2050s, and 2080s." J Epidemiol Community Health 68.

Background The most direct way in which climate change is expected to affect public health relates to changes in mortality rates associated with exposure to ambient temperature. Many countries worldwide experience annual heat-related and cold-related deaths associated with current weather patterns. Future changes in climate may alter such risks. Estimates of the likely future health impacts of such changes are needed to inform public health policy on climate change in the UK and elsewhere.

Methods: Time-series regression analysis was used to characterise current temperature-mortality relationships by region and age group. These were then applied to the local climate and
population projections to estimate temperature-related deaths for the UK by the 2020s, 2050s and 2080s. Greater variability in future temperatures as well as changes in mean levels was modelled.

Results: A significantly raised risk of heat-related and cold-related mortality was observed in all regions. The elderly were most at risk. In the absence of any adaptation of the population, heat-related deaths would be expected to rise by around 257% by the 2050s from a current annual baseline of around 2000 deaths, and cold-related mortality would decline by 2% from a baseline of around 41 000 deaths. The cold burden remained higher than the heat burden in all periods. The increased number of future temperature-related deaths was partly driven by projected population growth and ageing.

Conclusions: Health protection from hot weather will become increasingly necessary, and measures to reduce cold impacts will also remain important in the UK. The demographic changes expected this century mean that the health protection of the elderly will be vital.


The term “nervios” is referred as a folk illness recognized by Mexican Traditional Medicine, and also widely reported across many countries in Latin America. "Nervios" are characterized by a "state of bodily and mental unrest", which decreases the ability to achieve daily goals. The causes are varied; in fact, any situation that alters the emotional state or mood is interpreted as a possible triggering agent. Depression and anxiety are psychiatric disorders, which share symptoms, or can be included in the same group of disorders with "nervios". The therapies are designed to reassure health, i.e. "calm the nerves". For this propose, the oral administration of plants infusions is common. In this review we compile information regarding the plants used for the treatment of "nervios" in Mexico, along with those for which reports of anxiolytic or/and antidepressive activity exist. We found 92 plant species used in folk medicine for the treatment of "nervios", among these, sixteen have been studied experimentally. The most studied plant is Galphimia glauca Cav., Malpighiaceae, which current clinical studies have validated its efficacy in patients, and their active components, the triterpenes galphimine A, B, and C, identified. Interestingly only nine plants were found to be reported in folk medicine for the treatment of sadness or/and depression, but their antidepressant activity has not been investigated. However, among the plants used in folk medicine for treatment of "nervios", several, as Litsea glaucescens Kunth, Lauraceae, have been proven to show antidepressant activity in experimental models, and some of their active compounds have been determined. These species could be a potential source of compounds with activity in the central nervous system.


Urban policymakers and sustainable food activists have identified urban agriculture as an important strategy for confronting a host of urban problems, including food insecurity, health disparities, access to urban green space and community economic revitalisation. Much recent work on urban agriculture has examined community and school gardens, but little research has been undertaken on home gardens as a solution to urban problems. This article examines a home-gardening programme in San Jose, California, La Mesa Verde, asking whether some of the
benefits found in community gardens can be found in home gardens. Specifically, we look at financial, health and community benefits, examining the potential of home gardens to become forces for broader social change. We ask whether gardens can become agents of cultural preservation, self-determination, particularly for recent immigrants who use these spaces to build identities and work towards collective action and self-determination.


To provide a review on the benefits associated with the use of sensory gardens and horticultural activities in dementia care. Background. Maintaining quality of life is important in dementia care. Sensory gardens and horticultural activities are increasingly used in dementia care, yet their benefits are uncertain. A modified scoping review with descriptive analysis of selected empirical studies. Methods. Systematic searches in Amed, CINAHL, MEDLINE, ISI Web of Science, Embase and Scopus were used. Search terms were the free-text concepts 'healing garden', 'horticultural therapy', 'restorative garden' and 'wander garden' which were combined with dementia and Alzheimer. Sixteen studies were included with included participants ranging from eight to 129 participants. Research designs were case studies (n = 2), survey (n = 1), intervention studies with pretest/post-test design (n = 11) and randomised controlled studies (n = 2). Of these 16 studies, eight examined the benefits of sensory gardens, seven examined horticultural therapy or therapeutic horticulture and one examined the use of plants indoors. This study offers a review of the research addressing benefits of sensory gardens, therapeutic horticulture, horticultural therapy and other purposeful use of plants in dementia care. The reported findings are mainly on issues related to behaviour, affect and well-being. The findings are in general mutually supportive, however, with some contradictory findings. In addition, sleep pattern, well-being and functional level seem to improve. Conclusions. These types of nonpharmacological interventions may improve well-being and affect and reduce the occurrence of disruptive behaviour. Additionally, the use of psychotropic drugs, incidents of serious falls, sleep and sleep pattern also seem to improve. Relevance to clinical practice. To further improve the use of the existing or planned gardens, an educational programme for staff that also includes skill training is recommended.


To examine the role of gardening as a component of resettled African refugees' food environment. This was a qualitative study that collected data using in-depth interviews from 13 gardeners who were purposively sampled to include those participating in community and home gardens. The interviews were transcribed verbatim and thematic analysis was used to identify themes in the data.

Thematic analysis of the interviews revealed three emerging themes: food provision (access, availability and affordability), enhanced wellbeing (mental and physical) and barriers encountered in the food environment (limited knowledge on crop seasonality, size of garden and cost of manure). By having access to a vegetable garden, participants were able to access healthy foods and utilise familiar and culturally acceptable foods.
Through gardening, the resettled refugees' traditional foods are not only made available but easily accessible at little or no cost ensuring households are able to make healthy food choices. The pillars of food security food availability, access, utilisation and stability are enhanced through gardening, making community and home gardens an important component of the resettled refugees' food environment.


Eighty participants took part in a 5-day intervention Qi Gong study to enhance well-being and were randomised to either positive or body focus and either high or low hand position. The high hand position improved negative affect and was reported more intrinsically motivating but was unrelated to perceived effort. Positive focus produced better positive affect. For all groups combined, intrinsic motivation and effort predicted all three outcomes. The association between expectancy and perceived benefit was mediated via intrinsic motivation and perceived effort. Results support motivational concordance and positive focus as mechanisms of benefit but not response expectancy.


It is increasingly recognized that plants are highly sensitive organisms that perceive, assess, learn, remember, resolve problems, make decisions and communicate with each other by actively acquiring information from their environment. However, the fact that many of the sophisticated behaviours plants exhibit reveal cognitive competences, which are generally attributed to humans and some non-human animals, has remained unappreciated. Here, I will outline the theoretical barriers that have precluded the opportunity to experimentally test such behavioural/cognitive phenomena in plants. I will then suggest concrete alternative approaches to cognition by highlighting how (i) the environment offers a multitude of opportunities for decision-making and action and makes behaviours possible, rather than causing them; (ii) perception in itself is action in the form of a continuous flow of information; (iii) all living organisms viewed within this context become agents endowed with autonomy rather than objects in a mechanistically conceived world. These viewpoints, combined with recent evidence, may contribute to move the entire field towards an integrated study of cognitive biology.


This study explored the role of relative quantity of green space in urban English neighbourhoods in predicting parent-reported emotional and behavioural problems from early to middle childhood (ages 3, 5, 7) and in buffering the effects of multiple risk factors (neighbourhood disadvantage, family poverty and adverse life events) on child adjustment. We modelled data from 6384 Millennium Cohort Study children using multilevel growth curve modelling. Neighbourhood green space was measured with the percentage of green space within a standard small area. We found that access to garden and use of parks and playgrounds were related to fewer conduct, peer and hyperactivity problems. Neighbourhood green space was generally unrelated to child adjustment, but poor children in urban neighbourhoods with more greenery had fewer emotional problems from age 3 to 5 than their counterparts in less green
neighbourhoods. Neighbourhood green space may promote emotional well-being in poor urban children in early childhood.


Introduction Roadside vegetation provides numerous environmental and psychological benefits to drivers. Previous studies have shown that natural landscapes can effectively lower crash rates and cause less frustration and stress to the driver. However, run-off-the-road crashes resulting in a collision with a tree are twice as likely to result in a fatality, reinforcing the need to examine the placement of vegetation within the clear zone. Method This study explores the relationship between the size of the clear zone and the presence of roadside vegetation on vehicle speed and lateral position. A static evaluation, distributed electronically to 100 licensed drivers, was utilized to gather speed selections for both real and virtual roads containing four combinations of clear zone sizes and roadside vegetation densities. A case study was included in the static evaluation to investigate the presence of utility poles near the edge of the road on speed selection. Validation of the static evaluation was performed by a field data collection on the same roadways shown to participants in the evaluation. Results The speeds observed in the field for roadways with medium clear zone/dense vegetation or large clear zone/spare vegetation correlated with the speeds chosen by static evaluation participants. Further field data were obtained on vehicle speeds and lateral positions for additional roads demonstrating the same clear zone size/vegetation density combinations. Practical application This study successfully demonstrates the relationship between clear zone design and driver behavior, which could improve clear zone design practices and thus roadway safety.


As interest grows in the contribution of ecosystem services to poverty alleviation, we present a new conceptual framework, synthesizing insights from existing frameworks in social–ecological systems science and international development. People have differentiated abilities to benefit from ecosystem services, and the framework places emphasis on access to services, which may constrain the poorest more than aggregate availability. Distinctions are also made between categories of ecosystem service in their contribution to wellbeing, provisioning services and cash being comparatively easy to control. The framework gives analytical space for understanding the contribution of payments for ecosystem services to wellbeing, as distinct from direct ecosystem services. It also highlights the consumption of ecosystem services by external actors, through land appropriation or agricultural commodities. Important conceptual distinctions are made between poverty reduction and prevention, and between human response options of adaptation and mitigation in response to environmental change. The framework has applications as a thinking tool, laying out important relationships such that an analyst could identify and understand these in a particular situation. Most immediately, this has research applications, as a basis for multidisciplinary, policy-relevant research, but there are also applications to support practitioners in pursuing joint policy objectives of environmental sustainability and poverty alleviation.

This paper discusses the importance of environmental aesthetics and scenic beauty of current roadside vegetation in the highways, and the necessity for the contribution of users (motorists) preferences in the integration of scenic beauty of roadside vegetation into its management plans. The results of a questionnaire survey of motorist’s opinion on the landscape aesthetics and quality of some highways in Tehran city are presented with their analyses. Findings of the research indicate the roadside vegetation as the most important elements of highway scenic beauty for the majority of users. High-rise building, historic or cultural landmarks, farmlands, street lighting and advertisement boards found with lower level of importance to the passengers. A strong positive tendency of respondents found towards variety of vegetation types instead of a uniform composition. The most preferred combination of plant types of road were preferred were: trees in the background, grass and flowering herbs in the foreground and shrubs in the middle. In our case study, dissatisfaction with vegetation type and combination was reported lower among those who travelled once or twice a month or longer, compare to those who travelled the site more frequently in a daily or weekly basis. This indicates that for less frequent users the roadside vegetation was reported almost satisfactory, as their personal cognition of a route is less affected by their prior knowledge. However, the preferences of motorists who used the highway more frequently, showed a great tendency with planting design patterns of trees in background and shrubs in the foreground.


There are a high number of indoor ornamental plants that can purify the air in living spaces. These plants acts as micro filters and removes some toxic substances emanated by various building materials, heating system, air conditioning system, but also from different indoor accessories. Numerous studies in this area show that employees in offices without plants can suffer various allergies, irritations, hypersensitivity, asthma, drowsiness, and eye problems. Also, it is known that the presence of plants can positively affect mood and health of employees. Based on the literature review, this article presents the most effective ornamental plants with direct action on improving the air from indoors.


Birth weight is extensively investigated as an outcome of interacting with greenery in mothers’ living environment, because it is one of the major causes for neonatal and infant mortality, as well as a correlate of some adverse effects in childhood and beyond. Conversely, in modern urban-ecological systems the access to greenery is limited. The aim of this study was to answer the question whether green spaces and generally greenery in the living environment of pregnant women are associated with the birth weight of their infants and what the direction of that effect is. MEDLINE, EMBASE and the Internet were searched for relevant publications in English and Spanish. Eight studies were identified and included in the analyses (total n = 214 940). We report quality effects meta-analyses based on correlation and standardized regression coefficients as estimates of effect size. Neighbourhood greenness within 100-m buffer was
weakly and positively associated with birth weight. The pooled correlation coefficient was 0.049 (95% CI: 0.039, 0.059) and the pooled standardized regression coefficient was 0.001 (95% CI: −0.001, 0.003). There was, however, considerable heterogeneity between the studies. Using more sensitive measures for greenness and taking into account green space functionality and quality, adjusting for environmental exposures, and assessing individual attitudes towards nature, might yield clearer picture, higher statistical power and more precise results in future research. Our findings endorse the emphasis put on urban forestry and landscape management as closely related to public health and propose a more naturalistic, humanitarian and person-centered approach in future studies.


There is increasing evidence of a positive relation between green spaces in people's living environment and self-reported indicators of physical and mental health. However, to this moment health anxiety has not been contextualized in the light of the restorative and anxiolytic experiences of urban nature nor has it been studied in reference to the awareness of nature experiences. We aimed to determine whether "awareness of nature experiences" was a significant modifier of the beneficial effects of interaction of older citizens with urban green spaces. This construct represents the purposeful and conscious interaction with nature, a specific behaviour pre-formed as a cognitive representation of the "self" in a natural context, providing an internal replica of the previously experienced external natural world which guides people when they choose to visit an urban park. A cross-sectional interview study was conducted amongst 97 elderly visitors of "Tzar Simeon Garden" Park in Plovdiv, Bulgaria. After controlling for "awareness of nature experiences", hierarchical multiple regression model accounted for 94% of the variance in health anxiety. The independent variables "appreciation of bird songs", "appreciation of vegetation", "weekly visits to the park" and "years of visiting the park" remained significant, but their power decreased, and "age" became non-significant predictor. The overall predictive capacity of the model rose significantly after "awareness of nature experiences" was added. In conclusion, health anxiety among Bulgarian elderly adults is somewhat higher than in other similar populations but still does not exceed acceptable levels. The actual interaction and experiences of the park were predictors of health anxiety independent from confounding factors. Their power, however, was to some extent dependent on individual "awareness of nature experiences", which had unique contribution to the model. (C) 2014 Elsevier GmbH. All rights reserved.


Noise pollution is one of the four major pollutions in the world. Little evidence exists about the actual preventive benefits of psychological noise attenuation by urban green spaces, especially from the perspective of environmental medicine and, to the best of our knowledge, there is not a systematic analysis on this topic. The aim of this review was to systematically evaluate whether there is conclusive scientific evidence for the effectiveness of urban green spaces as a psychological buffer for the negative impact of noise pollution on human health and to promote an evidence-based approach toward this still growing environmental hazard.
MEDLINE and EMBASE databases were searched for experimental and epidemiological studies published before June 04, 2013 in English and Spanish. Data was independently extracted in two step process by the authors. Due to the heterogeneity of the included studies qualitative assessment was performed. We found moderate evidence that the presence of vegetation can generally reduce the negative perception of noise (supported with an electroencephalogram test in one of the experimental studies; consistent with the data from two epidemiological studies; one experiment found no effect and one was inconclusive about the positive effect). This review fills a gap in the literature and could help researchers further clarify the proper implementation of urban green spaces as a psychological buffer in areas with population exposed to chronic noise pollution.


Physical and mental health issues associated with military service persist as challenges for many veterans. This study draws on existing research showing the value of engaging in nature-based recreation to examine the effects of such experiences on veterans specifically. Four organizations, offering 12 different programs each lasting 4-7 d, were included in the study. Ninety-eight veterans were recruited and surveyed 1wk before, 1 wk after, and approximately 1 mo after participating in these extended group-based outdoor experiences. In addition to background information, the survey instrument assessed changes in psychological well-being, social functioning, and life outlook. The results showed significant improvements in each of these domains 1 wk after the outdoor experience. Some improvements persisted over the next month, but to a lesser degree. The positive changes were particularly strong for veterans who initially reported more severe ongoing health issues. Overall, the findings suggest that extended group-based nature recreation experiences that bring veterans together can have significant positive effects on veterans struggling with serious health problems.


A growing range of studies have begun to document the health and well-being benefits associated with contact with nature. Most studies rely on generalized self-reports following engagement in the natural environment. The actual in-situ experience during contact with nature, and the environmental features and factors that evoke health benefits have remained relatively unexplored. Smartphones offer a new opportunity to monitor and interact with human subjects during everyday life using techniques such as Experience Sampling Methods (ESM) that involve repeated self-reports of experiences as they occur in-situ. Additionally, embedded sensors in smartphones such as Global Positioning Systems (GPS) and accelerometers can accurately trace human activities. This paper explores how these techniques can be combined to comprehensively explore the perceived health and well-being impacts of contact with nature. Custom software was developed to passively track GPS and accelerometer data, and actively prompt subjects to complete an ESM survey at regular intervals throughout their visit to a provincial park in Ontario, Canada. The ESM survey includes nine scale questions concerning moods and emotions, followed by a series of open-ended experiential questions that subjects provide recorded audio responses to. Pilot test results are used to illustrate the nature, quantity and
quality of data obtained. Participant activities were clearly evident from GPS maps, including especially walking, cycling and sedate activities. From the ESM surveys, participants reported an average of 25 words per question, taking an average of 15 s to record them. Further qualitative analysis revealed that participants were willing to provide considerable insights into their experiences and perceived health impacts. The combination of passive and interactive techniques is sure to make larger studies of this type more affordable and less burdensome in the future, further enhancing the ability to understand how contact with nature enhances health and well-being.


Background: Green spaces have been associated with both health benefits and risks in children; however, available evidence simultaneously investigating these conflicting influences, especially in association with different types of greenness, is scarce.

Objectives: We aimed to simultaneously evaluate health benefits and risks associated with different types of greenness in children, in terms of sedentary behavior (represented by excessive screen time), obesity, current asthma, and allergic rhinoconjunctivitis.

Methods: We conducted a cross-sectional study of a population-based sample of 3,178 school-children (9–12 years old) in Sabadell, Spain, in 2006. Information on outcomes and covariates was obtained by questionnaire. We measured residential surrounding greenness as the average of satellite-derived Normalized Difference Vegetation Index (NDVI) in buffers of 100 m, 250 m, 500 m, and 1,000 m around each home address. Residential proximity to green spaces was defined as living within 300 m of a forest or a park, as separate variables. We used logistic regression models to estimate associations separately for each exposure–outcome pair, adjusted for relevant covariates.

Results: An interquartile range increase in residential surrounding greenness was associated with 11–19% lower relative prevalence of overweight/obesity and excessive screen time, but was not associated with current asthma and allergic rhinoconjunctivitis. Similarly, residential proximity to forests was associated with 39% and 25% lower relative prevalence of excessive screen time and overweight/obesity, respectively, but was not associated with current asthma. In contrast, living close to parks was associated with a 60% higher relative prevalence of current asthma, but had only weak negative associations with obesity/overweight or excessive screen time.

Conclusion: We observed two separable patterns of estimated health benefits and risks associated with different types of greenness.


Maternal residential proximity to roads has been associated with adverse pregnancy outcomes. However, there is no study investigating mediators or buffering effects of road-adjacent trees on this association. We investigated the association between mothers’ residential proximity to major roads and term low birth weight (LBW), while exploring possible mediating roles of air pollution (PM2.5, PM2.5–10, PM10, PM2.5 absorbance, nitrogen dioxide, and nitrogen oxides), heat, and noise and buffering effect of road-adjacent trees on this association.
Methods: This cohort study was based on 6438 singleton term births in Barcelona, Spain (2001–2005). Road proximity was measured as both continuous distance to and living within 200 m from a major road. We assessed individual exposures to air pollution, noise, and heat using, respectively, temporally adjusted land-use regression models, annual averages of 24-hour noise levels across 50 m and 250 m, and average of satellite-derived land-surface temperature in a 50-m buffer around each residential address. We used vegetation continuous fields to abstract tree coverage in a 200-m buffer around major roads. Results: Living within 200 m of major roads was associated with a 46% increase in term LBW risk; an interquartile range increase in heat exposure with an 18% increase; and third-trimester exposure to PM2.5, PM2.5–10, and PM10 with 24%, 25%, and 26% increases, respectively. Air pollution and heat exposures together explained about one-third of the association between residential proximity to major roads and term LBW. Our observations on the buffering of this association by road-adjacent trees were not consistent between our 2 measures of proximity to major roads. Conclusion: An increased risk of term LBW associated with proximity to major roads was partly mediated by air pollution and heat exposures.


The potential benefit of urban vegetation in reducing heat related mortality in the city of Melbourne, Australia is investigated using a two-scale modelling approach. A meso-scale urban climate model was used to quantify the effects of ten urban vegetation schemes on the current climate in 2009 and future climates in 2030 and 2050. The indoor thermal performance of five residential buildings was then simulated using a building simulation tool with the local meso-climates associated with various urban vegetation schemes. Simulation results suggest that average seasonal summer temperatures can be reduced in the range of around 0.5 and 2 °C if the city were replaced by vegetated suburbs and parklands, respectively. With the limited buildings and local meso-climates investigated in this study, around 5e28% and 37e99% reduction in heat related mortality rate have been estimated by doubling the city’s vegetation coverage and transforming the city into parklands respectively.


This paper investigates how green schoolyards can reduce stress and promote protective factors for resilience in students. It documents student responses to green schoolyards in Maryland and Colorado in the United States under three conditions: young elementary school children’s play in wooded areas during recess; older elementary school children’s use of a naturalized habitat for science and writing lessons; and high school students’ involvement in gardening. Drawing on ethnographic observations and interviews, it describes how the natural areas enabled students to escape stress, focus, build competence, and form supportive social groups. These findings have implications for theories of resilience and restoration and school interventions for stress management.

This chapter examines children’s affinity for the natural world, benefits for children from contact with nature, and how programs for ecological restoration and caring for plants and animals can promote young people’s resilience and recovery after conflict and disasters. Masten (2001, p. 228) defines resilience in childhood as ‘good outcomes in spite of threats to adaptation or development’. It is not a special attribute that makes some children invulnerable to adversity, but what Masten calls the ‘ordinary magic’ that happens when children manage to find essential resources for healthy development even in difficult circumstances. The literature on resilience has emphasized the importance of caring social relationships and supportive institutions like effective schools, not recognizing that children can draw strength and healing from the natural world as well. Most of the literature on helping children affected by war and natural disasters also neglects this potential. This chapter demonstrates the value of children’s relationships with nature and the importance of integrating healing green spaces into programs to help children recover after disasters and conflict.


Research suggests that contact with nature can be beneficial, for example leading to improvements in mood, cognition, and health. A distinct but related idea is the personality construct of subjective nature connectedness, a stable individual difference in cognitive, affective, and experiential connection with the natural environment. Subjective nature connectedness is a strong predictor of pro-environmental attitudes and behaviors that may also be positively associated with subjective well-being. This meta-analysis was conducted to examine the relationship between nature connectedness and happiness. Based on 30 samples (n = 8523), a fixed-effect meta-analysis found a small but significant effect size (r = 0.19). Those who are more connected to nature tended to experience more positive affect, vitality, and life satisfaction compared to those less connected to nature. Publication status, year, average age, and percentage of females in the sample were not significant moderators. Vitality had the strongest relationship with nature connectedness (r = 0.24), followed by positive affect (r = 0.22) and life satisfaction (r = 0.17). In terms of specific nature connectedness measures, associations were the strongest between happiness and inclusion of nature in self (r = 0.27), compared to nature relatedness (r = 0.18) and connectedness to nature (r = 0.18). This research highlights the importance of considering personality when examining the psychological benefits of nature. The results suggest that closer human-nature relationships do not have to come at the expense of happiness. Rather, this meta-analysis shows that being connected to nature and feeling happy are, in fact, connected.


Green space is now widely viewed as a health-promoting characteristic of residential environments, and has been linked to mental health benefits such as recovery from mental fatigue and reduced stress, particularly through experimental work in environmental psychology. Few population level studies have examined the relationships between green space and mental health. Further, few studies have considered the role of green space in non-urban settings. This study contributes a population-level perspective from the United States to examine the relationship between environmental green space and mental health outcomes in a study area that
includes a spectrum of urban to rural environments. Multivariate survey regression analyses examine the association between green space and mental health using the unique, population-based Survey of the Health of Wisconsin database. Analyses were adjusted for length of residence in the neighborhood to reduce the impact of neighborhood selection bias. Higher levels of neighborhood green space were associated with significantly lower levels of symptomology for depression, anxiety and stress, after controlling for a wide range of confounding factors. Results suggest that “greening” could be a potential population mental health improvement strategy in the United States.


Positive effects of exposure to nature have been reported for stress, mood, and executive functioning. In the present research we investigated whether viewing natural scenes can also improve self-regulation. In line with recent theoretical propositions these replenishing effects were investigated in a typical ego-depletion paradigm. In two studies we found indications for beneficial effects of a short exposure to nature on lower order self-regulation (e.g., controlling impulses), but not on a higher-order executive functioning task. Furthermore, we found beneficial effects on mood and heart rate variability, a physiological measure related to exertion of self-control and stress. Importantly, beneficial effects of nature emerged even when participants had not been previously depleted, which challenges the current postulation that nature mostly has restorative benefits. We propose that nature might also have buffering or 'instorative' effects.


Physical settings can play a role in coping with stress; in particular experimental research has found strong evidence between exposure to natural environments and recovery from physiological stress and mental fatigue, giving support to both Stress Recovery Theory and Attention Restoration Theory. In fact, exposure to natural environments protects people against the impact of environmental stressors and offer physiological, emotional and attention restoration more so than urban environments. Natural places that allow the renewal of personal adaptive resources to meet the demands of everyday life are called restorative environments. Natural environments elicit greater calming responses than urban environments, and in relation to their vision there is a general reduction of physiological symptoms of stress. Exposure to natural scenes mediates the negative effects of stress reducing the negative mood state and above all enhancing positive emotions. Moreover, one can recover the decrease of cognitive performance associated with stress, especially reflected in attention tasks, through the salutary effect of viewing nature. Giving the many benefits of contact with nature, plans for urban environments should attend to restorativeness.


The benefits of visual exposure to natural environments for human well-being in areas of stress reduction, mood improvement, and attention restoration are well documented, but the
effects of natural environments on impulsive decision-making remain unknown. Impulsive decision-making in delay discounting offers generality, predictive validity, and insight into decision-making related to unhealthy behaviors. The present experiment evaluated differences in such decision-making in humans experiencing visual exposure to one of the following conditions: natural (e.g., mountains), built (e.g., buildings), or control (e.g., triangles) using a delay discounting task that required participants to choose between immediate and delayed hypothetical monetary outcomes. Participants viewed the images before and during the delay discounting task. Participants were less impulsive in the condition providing visual exposure to natural scenes compared to built and geometric scenes. Results suggest that exposure to natural environments results in decreased impulsive decision-making relative to built environments.


Just like humans, plants have recently been recognized as meta-organisms, possessing a distinct microbiome and revealing close symbiotic relationships with their associated microorganisms (Berg et al., 2013; Mendes et al., 2013). Each plant harbor specific species to a certain degree but also cosmopolitan and ubiquitous microbial strains; the majority of them fulfill important host as well as ecosystem functions (rev. in Berg and Smalla, 2009). In addition to the microbe-rich rhizosphere, which has been studied extensively, the phyllosphere is of special interest for the study of indoor microbiomes due to its large and exposed surface area and its remarkable microbial diversity (Lindow and Leveau, 2002; Lindow and Brandl, 2003; Redford et al., 2010; Meyer and Leveau, 2012; Vorholt, 2012; Rastogi et al., 2013). In addition to the majority of beneficial and neutral inhabitants, all plant-associated microbiomes contain plant as well as human pathogens (Berg et al., 2005; Mendes et al., 2013). A broad spectrum of plant pathogens is well-known from disease outbreaks. Human pathogens belong mainly to the so called opportunistic or facultative human pathogens such as Burkholderia cepacia, Pseudomonas aeruginosa or Stenotrophomonas maltophilia, which cause diseases only in patients with predisposition or in hospital (Berg et al., 2005; Ryan et al., 2009).

Microbiomes of humans and plants are currently intensively studied using the same methods and addressing similar scientific questions (Ramírez-Puebla et al., 2013). However, knowledge about the microbiomes' interaction, microbial dynamics and exchange in a certain biotope or even indoor environment is very much limited. Although the composition and function of plant microbiomes is well-studied, there is still little to no information regarding their overlap, interaction with -and impact on other microbiomes or the microbiome-harborring hosts. Information is available about the connection of soil and rhizosphere microbial diversity, which share a selective sub-set (Smalla et al., 2001). The root-soil interface is the selection site for plant-associated bacteria by root exudates, which acts as chemo-attractants as well as repellents to which bacteria respond (Badri and Vivanco, 2009). In addition, plant defense signaling play a role in this process (Doornbos et al., 2012). For the phyllosphere we know that there is only a part of residents, while a substantial part of bacteria is shared with the air microbiome (Lindow and Brandl, 2003). Based on these data, a strong interaction and exchange of rhizosphere and phyllosphere microbiomes with other microbiomes is obvious. However, this opinion paper focuses on the question, if there is also a connection from plant–to indoor microbiomes as well as an impact on human health.

This article presents the first outline of a quality evaluation tool (QET) to be used in the process of designing outdoor environments in healthcare settings, e.g., healthcare gardens. Theory triangulation is used to integrate theories and evidence from selected research on people's health/well-being and the outdoor environment. The results first present the theoretical principles underlying the tool and justifying its practical construction. Then, 19 environmental qualities constituting the backbone of the practical tool are presented, including six qualities based on the need to be comfortable in the outdoor environment and 13 qualities based on the need for access to nature and surrounding life. Furthermore, this work presents suggestions of how the tool might include concepts dealing with how users can become involved in the design process, as well as general design guidelines corresponding to the various needs and wishes users may have. The paper ends with a discussion that, among other things, relates the QET to evidence-based design, salutogenesis and pathogenesis.


This essay examines the assumptions of green space use underpinning much existing green space and health research. It considers opportunities to move the field forward through exploring two often overlooked aspects of individual agency: the influence of shifting life circumstances on personal wellbeing priorities and place practices, and the role of personal orientations to nature in shaping how green space wellbeing opportunities are perceived and experienced. It suggests such efforts could provide more nuanced insights into the complex, personal factors that define and drive individual choices regarding the use of green spaces for wellbeing over time, thereby strengthening our understanding of the salutogenic potential (and limits) of green spaces.


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Background: Epidemiological studies on green space and health have relied almost exclusively on cross-sectional designs, restricting understanding on how this relationship could vary across the life course.
Methods: We used multilevel linear regression to analyse variation in minor psychiatric morbidity over nine annual waves of the British Household Panel Survey (1996–2004). The sample was restricted to residents of urban areas who remained within their neighbourhoods for at least 12 months. The 12-item General Health Questionnaire and confounders were reported for 29,626 male and 35,781 female observations (person-years). This individual-level dataset was linked to a measure of green space availability within each ward of residence. Regression models included age, gender, employment status, household tenure, marital status, education, smoking status and household income.

Results: When not considering age, green space was associated with better mental health among men, but not women. Interaction terms fitted between age and green space revealed variation in the association between green space and mental health across the life course and by gender. For men, the benefit of more green space emerged in early to mid-adulthood. Among older women, a curvilinear association materialised wherein those with a moderate availability of green space had better mental health.

Conclusions: These findings illustrate how the relationship between urban green space and health can vary across the life course, and they highlight the need for longitudinal studies to answer why green space may be better for health at some points in the life course than others.


Background: An inequitable distribution of parks and other ‘green spaces’ could exacerbate health inequalities if people on lower incomes, who are already at greater risk of preventable diseases, have poorer access.

Methods: The availability of green space within 1 kilometre of a Statistical Area 1 (SA1) was linked to data from the 2011 Australian census for Sydney (n = 4.6 M residents); Melbourne (n = 4.2 M); Brisbane (n = 2.2 M); Perth (n = 1.8 M); and Adelaide (n = 1.3 M). Socioeconomic circumstances were measured via the percentage population of each SA1 living on < $21,000 per annum. Negative binomial and logit regression models were used to investigate association between the availability of green space in relation to neighbourhood socioeconomic circumstances, adjusting for city and population density.

Results: Green space availability was substantively lower in SA1s with a higher percentage of low income residents (e.g. an incidence rate ratio of 0.82 (95% confidence interval (95% CI) 0.75, 0.89) was observed for SA1s containing ≥20% versus 0-1% low income residents). This association varied between cities (p < 0.001). Adelaide reported the least equitable distribution of green space, with approximately 20% greenery in the most affluent areas versus 12% availability in the least affluent. Although Melbourne had a smaller proportion of SA1s in the top quintile of green space availability (13.8%), the distribution of greenery was the most equitable of all the cities, with only a 0.5% difference in the availability of green space between SA1s containing 0-1% low income households versus those with ≥20%. Inequity of access, however, was reported across all cities when using logit regression to examine the availability of at least 20% (odds ratio 0.74, 95% CI 0.59, 0.93) or 40% (0.45, 0.29, 0.69) green space availability in the more disadvantaged versus affluent neighbourhoods.

Conclusion: Affirmative action on green space planning is required to redress the socioeconomic inequity of access to this important public health resource.

OBJECTIVE: Lifestyle interventions for type 2 diabetes mellitus (T2DM) are best positioned for success if participants live in supportive neighborhood environments. Deprived neighborhoods increase T2DM risk. Parks and other “green spaces” promote active lifestyles and therefore may reduce T2DM risk. We investigated association between neighborhood green space and the risk of T2DM in a large group of adult Australians.

RESEARCH DESIGN AND METHODS: Multilevel logit regression was used to fit associations between medically diagnosed T2DM and green space exposure among 267,072 participants in the 45 and Up Study. Green space data were obtained from the Australian Bureau of Statistics, and exposure was calculated using a 1-km buffer from a participant’s place of residence. Odds ratios (ORs) were controlled for measures of demographic, cultural, health, diet, active lifestyles, socioeconomic status, and neighborhood circumstances.

RESULTS: The rate of T2DM was 9.1% among participants in neighborhoods with 0–20% green space, but this rate dropped to approximately 8% for participants with over 40% green space within their residential neighborhoods. The risk of T2DM was significantly lower in greener neighborhoods, controlling for demographic and cultural factors, especially among participants residing in neighborhoods with 41–60% green space land use (OR 0.87; 95% CI 0.83–0.92). This association was consistent after controlling for other explanatory variables and did not vary according to neighborhood circumstances.

CONCLUSIONS: People in greener surroundings have a lower risk of T2DM. Planning, promoting, and maintaining local green spaces is important in multisector initiatives for addressing the T2DM epidemic.


Background: Green space is widely hypothesised to promote physical activity. Few studies, however, examine whether this is the case for walking and moderate-to-vigorous physical activity (MVPA). We investigated to what extent neighbourhood green space was associated with weekly participation and frequency of walking and MVPA in a large cross-sectional survey of Australian adults 45 years and older.

Methods: Logit and negative binomial regression were used to estimate the degree of association between walking, MVPA and neighbourhood green space in a sample of 203 883 adults from the Australian 45 and Up Study. Walking and MVPA were measured using the Active Australia Survey. Green space was measured as a percentage of the total land-use within 1 km radius of residence. We controlled for a range of individual and neighbourhood characteristics.

Results: 86.6% of the sample walked and 85.8% participated in MVPA at least once a week. These rates fell steeply with age. Compared with residents of neighbourhoods containing 0–20% green space, those in greener areas were significantly more likely to walk and participate in MVPAs at least once a week (trend for both p<0.001). Among those participating at least once a week, residents of neighbourhoods containing 80%+ green space participated with a greater frequency of walking (incidence rate ratio (IRR) 1.09, 95% CI 1.05 to 1.13) and MVPA (IRR 1.10, 95% CI 1.05 to 1.15).
Conclusions: Our findings suggest that the amount of green space available to adults in middle-to-older age within their neighbourhood environments could help to promote walking and MVPA.


Although there is growing consensus that population-level improvements in cardiovascular health depend upon environments that promote healthy lifestyles, evidence to support large-scale investments in neighborhood greenery to tackle obesity is inconsistent and has not focused on adults in middle-to-old age who experience the greatest burden of chronic health problems. Multilevel linear and multinomial logit regression models were fitted to investigate association between body mass index and an objective measure of green space in a sample of 246 920 Australian adults aged 45 years and older (The 45 and Up Study). Proximity to green space was constructed using catchment areas of 1 km radius around each participant. Women with over 80% proximity to green space had relative risk ratios of 0.90 (95% confidence interval: 0.83, 0.97) for overweight and 0.83 (0.74, 0.94) for obese. No similarly protective association was found for men. These results were consistent after controlling for moderate-to-vigorous physical activity (MVPA) and sitting time, each of which was favorably associated with green space proximity in men and women. Large-scale investments to enhance green spaces may promote MVPA and reduce sedentary behavior in middle-to-older-aged adults, but the impact on obesity may not benefit everyone to the same extent.


The lifestyle horticulture industry can best be described as a “living green industry”. It involves the production, sale, management and maintenance of plants used for environmental, recreational and leisure purposes. In Australia, this specialised sector of horticulture has become one of the more profitable and rapidly growing primary industries since World War II. This paper discusses the significance of the Australian lifestyle horticulture industry in terms of its environmental, aesthetic, social and recreational values in the urban environment where 87% of Australians live, work and play, as well as the impact of these commodities and services on the health and well-being of those communities. The industry also generates substantial direct and indirect economic benefits. However, the few available statistics from which the size of the industry can be assessed are, at best, unreliable. While these do indicate that the lifestyle horticulture industry is one of the largest agricultural industry groupings, they grossly underestimate the full value of lifestyle horticulture activities in Australia. As a result, the commodities and services associated with the lifestyle horticulture industry have been poorly recognised and undervalued by the wider agricultural sector. Governments at all levels, as well as the community at large, can be said to take the value and benefits from the lifestyle horticulture industry for granted. Greater discussion needs to take place between the government, industry and community to increase teaching, research and extension funding into the lifestyle
horticulture industry that contributes so much to Australia's livelihood, lifestyle and quality of life.

**Alcock, I., et al. (2014).** "Longitudinal effects on mental health of moving to greener and less green urban areas." Environmental Science & Technology 48(2): 1247-1255.

Despite growing evidence of public health benefits from urban green space there has been little longitudinal analysis. This study used panel data to explore three different hypotheses about how moving to greener or less green areas may affect mental health over time. The samples were participants in the British Household Panel Survey with mental health data (General Health Questionnaire scores) for five consecutive years, and who relocated to a different residential area between the second and third years (n = 1064; observations = 5320). Fixed-effects analyses controlled for time-invariant individual level heterogeneity and other area and individual level effects. Compared to premove mental health scores, individuals who moved to greener areas (n = 594) had significantly better mental health in all three postmove years (P = .015; P = .016; P = .008), supporting a “shifting baseline” hypothesis. Individuals who moved to less green areas (n = 470) showed significantly worse mental health in the year preceding the move (P = .031) but returned to baseline in the postmove years. Moving to greener urban areas was associated with sustained mental health improvements, suggesting that environmental policies to increase urban green space may have sustainable public health benefits.

**Behe, B. K., Campbell, B. L., Khachatryan, H., Hall, C. R., Dennis, J. H., Huddleston, P. T., & Fernandez, R. T. (2014).** "Incorporating eye tracking technology and conjoint analysis to better understand the green industry consumer."

Plants are often merchandised with minimal packaging; thus, consumers have only the plant (intrinsic cue) or information signs (extrinsic cues) on which to assess the product and base their purchase decision. Our objective was to segment consumers based on their preferences for certain plant display attributes and compare their gaze behavior when viewing plant displays. Using conjoint analysis, we identified three distinct consumer segments: plant-oriented (73%), production method-oriented (11%), and price-oriented (16%) consumers. Using eye tracking technology, we show that subjects spent more visual attention to cues in the horticultural retail displays that were relatively more important to them. For example, plant-oriented consumers were the fastest segment to fixate on the plants and looked at the plants for longer amounts of time compared with the other segments. Production method-oriented consumers looked at the labeling related to production method for a longer duration, whereas the price-oriented consumer looked at the price sign the longest. Findings suggest that retailers should carefully consider the type of information included on retail signage and the visual impact it has on different consumers.


We examined the association of participation in community gardening with healthy body weight. We examined body mass index (BMI) data from 198 community gardening participants in Salt Lake City, Utah, in relationship to BMI data for 3 comparison groups: neighbors, siblings, and spouses. In comparisons, we adjusted for gender, age, and the year of the BMI measurement.
Both women and men community gardeners had significantly lower BMIs than did their neighbors who were not in the community gardening program. The estimated BMI reductions in the multivariate analyses were -1.84 for women and -2.36 for men. We also observed significantly lower BMIs for women community gardeners compared with their sisters (-1.88) and men community gardeners compared with their brothers (-1.33). Community gardeners also had lower odds of being overweight or obese than did their otherwise similar neighbors. The health benefits of community gardening may go beyond enhancing the gardeners’ intake of fruits and vegetables. Community gardens may be a valuable element of land use diversity that merits consideration by public health officials who want to identify neighborhood features that promote health.


This study assessed whether exercising whilst viewing natural or built scenes affected self-esteem (SE) and mood in adolescents. Twenty-five adolescents participated in three exercise tests on consecutive days. A graded exercise test established the work rate equivalent to 50% heart rate reserve for use in subsequent constant load tests (CLTs). Participants undertook two 15-min CLTs in random order viewing scenes of either natural or built environments. Participants completed Rosenberg’s SE scale and the adolescent profile of mood states questionnaire pre- and post-exercise. There was a significant main effect for SE (F(1)=6.10; P<0.05) and mood (F(6)=5.29; P<0.001) due to exercise, but no effect of viewing different environmental scenes (P>0.05). Short bouts of moderate physical activity can have a positive impact on SE and mood in adolescents. Future research should incorporate field studies to examine the psychological effects of contact with real environments.


When planning and developing a state-specific agricultural product brand and marketing campaign, it is important to consider potential consumers’ perceptions of terminology, messages, and attitudes toward the product. This qualitative study explores Florida consumer perceptions of green industry terminology, such as “plant,” “garden,” “landscape,” and “home landscape” as well as plant characteristics important to consumer purchase. Participants in all six of the Florida-based focus groups utilized in this study did not feel that a brand was important to plant purchase. Given the findings in of the study, recommendations for marketing an agricultural product of this nature include using the word “plant” over “garden;” achieving the plant characteristics deemed to be the most important to plant purchases (healthy-looking, quality, and “makes me feel good”) with the product; and emphasizing these characteristics in a well-targeted marketing campaign.


Exposure to natural environments can help restore depleted emotional and cognitive resources. However, investigation of the relative impacts of different natural environments among large samples is limited. Using data from 4255 respondents drawn from Natural
England's Monitoring Engagement with the Natural Environment survey (2009–2011), we investigated feelings of restoration (calm, relaxed, revitalized and refreshed) recalled by individuals after visits to different natural environments within the last week. Controlling for demographic and visit characteristics we found that of the broad environmental categories, coastal visits were associated with the most restoration and town and urban parks with the least. In terms of specific environmental types two “green space” locations (woodlands/forests and hills/moorland/mountains) were associated with levels of restoration comparable to coastal locations. Urban playing fields were associated with the least restoration. Restoration was positively associated with visit duration (a potential dose–response effect), and visits with children were associated with less restoration than visits alone. There was little evidence that different activities (e.g. walking, exercising) were associated with differences in restoration. The data may improve our understanding of the “cultural eco-system services” provided by different natural environments and help decision makers keen to invest scare resources in those environments most associated with psychological benefits.


Abundant evidence affirms that contact with nature can promote physical and mental health, but the relationship appears to be contingent on multiple factors. We address the possibility that having paid work related to a natural environment constrains the psychological restoration that can be realized in such environments. Using data from a cross-sectional survey administered to a national probability sample of Swiss adults (N=1678), we tested a multiple-mediator regression model in which having an occupational relationship to forests is assumed to affect the degree to which a person reports experiencing restoration with visits to forests, as mediated by experiences of being away and fascination and by familiarity with the forest. The results indicate that having a forest profession was associated with greater familiarity, which was in turn associated with greater reported restoration. At the same time, however, this positive indirect association was more than offset by a lower sense of being away during forest visits, which was itself a positive predictor of reported restoration. Fascination did predict reported restoration, but it was not associated with forest profession. The pattern of associations held after adjustment for different characteristics, like age, gender, level of employment, and intensity of forest visitation. The results illustrate that the restorative value of nature experience is contingent on occupational engagement with the natural environment, and they indicate some pathways through which occupational engagement can affect restoration. Landscape professionals can use these results to articulate more nuanced arguments regarding access to natural environments for restoration purposes.


An important barrier to enduring behavioural change is the human tendency to discount the future. Drawing on evolutionary theories of life history and biophilia, this study investigates whether exposure to natural versus urban landscapes affects people's temporal discount rates. The results of three studies, two laboratory experiments and a field study reveal that individual discount rates are systematically lower after people have been exposed to scenes of natural environments as opposed to urban environments. Further, this effect is owing to people placing
more value on the future after nature exposure. The finding that nature exposure reduces future discounting—as opposed to exposure to urban environments—conveys important implications for a range of personal and collective outcomes including healthy lifestyles, sustainable resource use and population growth.


The present study investigated the physiological and psychological effects of viewing urban forest landscapes on 48 young male urban residents. Four forested areas and four urban areas located in central and western Japan were used as the test sites. We found that in the forested areas, the subjects exhibited (i) significantly lower diastolic blood pressure, (ii) significantly higher parasympathetic nervous activity, but significantly lower sympathetic nervous activity, and (iii) significantly lower heart rate. The forest landscapes (iv) obtained better scores in subjective ratings, and (v) induced significantly less negative and more vigorous moods. Taken as whole, these findings suggest that even a short-term viewing of forests has relaxing effects. We have thus concluded that the approach taken in this study is useful in exploring the influences of urban green space on humans, as well as contributing to the planning and design of a healthy environment for urban residents.


The ‘Vascular Depression’ hypothesis posits that cerebrovascular disease may predispose, precipitate, or perpetuate some geriatric depressive syndromes. This hypothesis stimulated much research that has improved our understanding of the complex relationships between late-life depression (LLD), vascular risk factors, and cognition. Succinctly, there are well-established relationships between late-life depression, vascular risk factors, and cerebral hyperintensities, the radiological hallmark of vascular depression. Cognitive dysfunction is common in late-life depression, particularly executive dysfunction, a finding predictive of poor antidepressant response. Over time, progression of hyperintensities and cognitive deficits predicts a poor course of depression and may reflect underlying worsening of vascular disease. This work laid the foundation for examining the mechanisms by which vascular disease influences brain circuits and influences the development and course of depression. We review data testing the vascular depression hypothesis with a focus on identifying potential underlying vascular mechanisms. We propose a disconnection hypothesis, wherein focal vascular damage and white matter lesion location is a crucial factor influencing neural connectivity that contributes to clinical symptomatology. We also propose inflammatory and hypoperfusion hypotheses, concepts that link underlying vascular processes with adverse effects on brain function that influence the development of depression. Testing such hypotheses will not only inform the relationship between vascular disease and depression but also provide guidance on the potential repurposing of pharmacological agents that may improve late-life depression outcomes.


Objective: This study examined prospective relationships of green space attributes with adults initiating or maintaining recreational walking.
Methods: Postal surveys were completed by 1036 adults living in Adelaide, Australia, at baseline (two time points in 2003–04) and follow-up (2007–08). Initiating or maintaining recreational walking was determined using self-reported walking frequency. Green space attributes examined were perceived presence, quality, proximity, and the objectively-measured area (total and largest) and number of green spaces within a 1.6km buffer drawn from the center of each study neighborhood. Multilevel regression analyses examined the odds of initiating or maintaining walking separately for each green space attribute.

Results: At baseline, participants were categorized into non-regular (n=395), regular (n=286), and irregular walkers (n=313). Among non-regular walkers, 30% had initiated walking, while 70% of regular walkers had maintained walking at follow-up. No green space attributes were associated with initiating walking. However, positive perceptions of the presence of and proximity to green spaces and the total and largest areas of green space were significantly associated with a higher likelihood of walking maintenance over four years.

Conclusion: Neighborhood green spaces may not assist adults to initiate walking, but their presence and proximity may facilitate them to maintain recreational walking over time.


Nearly 90% of people’s lives are lived indoors, and their health is affected by the concentrations of CO2 in these spaces. Carbon dioxide concentrations can rapidly change based on human activity in indoor living spaces. Indoor plants and the concentration of CO2 in the local environment are factors that influence most people. Plants, depending on the ambient light and temperature conditions, and which are necessary to perform photosynthesis or respiration, directly affect the concentration of CO2 in the local environment. Furthermore, indoor plants influence the level of CO2 in the local environment but have not been researched enough in recent years concerning their specific effects. This study attempts to determine the effects of indoor plants on the concentration of CO2 in an indoor environment under certain light conditions. Five indoor plants were placed in a glass-walled compartment in order to measure the amount of CO2. The glass compartment used in the study was positioned in a way to prevent direct sunlight yet provide an illuminated environment. The plants were placed into this airtight compartment with a glass wall, which had a volume of approximately 0.5 m3 (0.7 m x 0.7 m x 1 m). The measurements of CO within the compartment were set to measure CO2 once every five minutes. The study found that all plants reduced the concentration of CO2 to a certain extent during the day.

Singhal, V., et al. (2013). Workplace Green Space for Health and Happiness: Case of RSPCB, Jaipur, Rajasthan, India. Jaipur, Rajasthan, India, Rajasthan State Pollution Control Board.

"Stress and stress-related diseases are increasingly becoming major health challenges with an enormous cost for individuals, organizations and communities. Workplace is both a source of livelihoods and a major contributor of stress and related illnesses. Green spaces in the office environment have been found to reduce stress and enhance productivity. Even a view of greenery through the office window or a small stroll in the office garden can help uplift mood and cheerfulness. Indeed, access to natural elements in urban systems has been found to promotes physical health, relaxation, positive emotions, tranquillity, revitalization, satisfaction, cognitive fitness and psychological well-being. Thus, provisioning of green space in the
workplace can contribute to health and happiness of workers. Interestingly, workplace green spaces are among the least studied types of urban green infrastructure. In our recently-assembled database of globally published research on urban green spaces comprising of 15765 papers, there are just about a few papers on workplace green space. With this understanding, we developed a small workplace green space in the campus of Rajasthan State Pollution Control Board, Jaipur. This document provides a practitioner perspective on the process and a pictorial representation of the green space today. Benefits of urban green spaces are wide-ranging including physical and psychological health, social cohesion, climate change mitigation, pollution abatement, biodiversity conservation and provisioning of the ecosystem goods and service to urban inhabitants. Workplace green space at RSPCB is an interesting example of connecting science to decision-making aimed at creating multifunctional landscapes to enhance urban resilience and human well-being. We hope, in coherence with substantial scientific evidence, that the RSPCB workplace green space provides health and happiness to both employees and visitors. People who have to stay indoors for a long time, such as office workers, are likely to benefit from green space by going outside and feeling the atmosphere for as short a period. The workplace green space provides employees the experience of serenity, wilderness, and intimate contact with nature at arm's length."


Objectives: On March 11, 2011, Japan experienced the largest earthquake in its history. The undersea earthquake launched a tsunami that inundated much of Japan's eastern coastline and damaged nuclear power plants, precipitating multiple reactor meltdowns. We examined open-source disaster situation reports, news accounts, and disaster-monitoring websites to gather event-specific data to conduct a trauma signature analysis of the event.

Methods: The trauma signature analysis included a review of disaster situation reports; the construction of a hazard profile for the earthquake, tsunami, and radiation threats; enumeration of disaster stressors by disaster phase; identification of salient evidence-based psychological risk factors; summation of the trauma signature based on exposure to hazards, loss, and change; and review of the mental health and psychosocial support responses in relation to the analysis.

Results: Exposure to this triple-hazard event resulted in extensive damage, significant loss of life, and massive population displacement. Many citizens were exposed to multiple hazards. The extremity of these exposures was partially mitigated by Japan's timely, expert-coordinated, and unified activation of an evidence-based mental health response.

Conclusions: The eastern Japan disaster was notable for its unique constellation of compounding exposures. Examination of the trauma signature of this event provided insights and guidance regarding optimal mental health and psychosocial responses. Japan orchestrated a model response that reinforced community resilience.


Ecosystems provide many of the material building blocks for human well-being. Although quantification and appreciation of such contributions have rapidly grown, our dependence upon cultural connections to nature deserves more attention. We synthesize multidisciplinary peer-reviewed research on contributions of nature or ecosystems to human well-being mediated through nontangible connections (such as culture). We characterize these connections on the basis of the channels through which such connections arise (i.e., knowing, perceiving, interacting with, and living within) and the components of human well-being they affect (e.g., physical, mental and spiritual health, inspiration, identity). We found enormous variation in the methods used, quantity of research, and generalizability of the literature. The effects of nature on mental and physical health have been rigorously demonstrated, whereas other effects (e.g., on learning) are theorized but seldom demonstrated. The balance of evidence indicates conclusively that knowing and experiencing nature makes us generally happier, healthier people. More fully characterizing our intangible connections with nature will help shape decisions that benefit people and the ecosystems on which we depend.


The objective of the present paper was to review the literature investigating the potential relationship between fruit and vegetables (FV) and psychological well-being. The rising prevalence of mental ill health is causing considerable societal burden. Inexpensive and effective strategies are therefore required to improve the psychological well-being of the population, and to reduce the negative impact of mental health problems. A growing body of literature suggests that dietary intake may have the potential to influence psychological well-being. For example, studies have suggested that particular dietary constituents, including vitamins and minerals, might be beneficial to psychological health. However, in order to better reflect normal dietary intake, health-based research has increasingly begun to focus on whole foods and dietary patterns, rather than individual nutrients. One food group that has received increasing attention with regard to psychological health is FV. This is probably a result of the strong evidence base, which exists in relation to their protective association with a number of chronic diseases, as well as the fact that they are a rich source of some of the nutrients which have been linked to psychological health. While some promising findings exist with regards to FV intake and psychological well-being, overall, results are inconsistent. Possible reasons for this, such as methodological issues related to study design and the measurement of psychological well-being and FV intake, are discussed within this review. Based on the predominantly observational nature of existing literature, the present paper concludes that future well-designed randomised controlled trials are required to investigate the relationship further.


Epidemiological studies suggest that living close to the natural environment is associated with long-term health benefits including reduced death rates, reduced cardiovascular disease, and reduced psychiatric problems. This is often attributed to psychological mechanisms, boosted by exercise, social interactions, and sunlight. Compared with urban environments, exposure to green spaces does indeed trigger rapid psychological, physiological, and endocrinological effects.
However, there is little evidence that these rapid transient effects cause long-term health benefits or even that they are a specific property of natural environments. Meanwhile, the illnesses that are increasing in high-income countries are associated with failing immunoregulation and poorly regulated inflammatory responses, manifested as chronically raised C-reactive protein and proinflammatory cytokines. This failure of immunoregulation is partly attributable to a lack of exposure to organisms (“Old Friends”) from mankind’s evolutionary past that needed to be tolerated and therefore evolved roles in driving immunoregulatory mechanisms. Some Old Friends (such as helminths and infections picked up at birth that established carrier states) are almost eliminated from the urban environment. This increases our dependence on Old Friends derived from our mothers, other people, animals, and the environment. It is suggested that the requirement for microbial input from the environment to drive immunoregulation is a major component of the beneficial effect of green space, and a neglected ecosystem service that is essential for our well-being. This insight will allow green spaces to be designed to optimize health benefits and will provide impetus from health systems for the preservation of ecosystem biodiversity.


Contact with green space in the environment has been associated with mental health benefits, but the mechanism underpinning this association is not clear. This study extends an earlier exploratory study showing that more green space in deprived urban neighbourhoods in Scotland is linked to lower levels of perceived stress and improved physiological stress as measured by diurnal patterns of cortisol secretion. Salivary cortisol concentrations were measured at 3, 6 and 9 h post awakening over two consecutive weekdays, together with measures of perceived stress. Participants (n = 106) were men and women not in work aged between 35-55 years, resident in socially disadvantaged districts from the same Scottish, UK, urban context as the earlier study. Results from linear regression analyses showed a significant and negative relationship between higher green space levels and stress levels, indicating living in areas with a higher percentage of green space is associated with lower stress, confirming the earlier study findings. This study further extends the findings by showing significant gender differences in stress patterns by levels of green space, with women in lower green space areas showing higher levels of stress. A significant interaction effect between gender and percentage green space on mean cortisol concentrations showed a positive effect of higher green space in relation to cortisol measures in women, but not in men. Higher levels of neighbourhood green space were associated with healthier mean cortisol levels in women whilst also attenuating higher cortisol levels in men. We conclude that higher levels of green space in residential neighbourhoods, for this deprived urban population of middle-aged men and women not in work, are linked with lower perceived stress and a steeper (healthier) diurnal cortisol decline. However, overall patterns and levels of cortisol secretion in men and women were differentially related to neighbourhood green space and warrant further investigation.


Local availability of green space has been associated with a wide range of health benefits. Possible causative mechanisms underpinning the green space and health relationship include the
provision of physical activity opportunities, the stress-relieving effects of nature and the facilitation of social contacts. This study sought to investigate whether urban green space was related to individual-level health outcomes, and whether levels of physical activity were likely to be a mediating factor in any relationships found.

Cross-sectional analysis of anonymized individual health survey responses. Neighbourhood-level green space availability was linked to 8157 respondents to the New Zealand Health Survey 2006/07 on the basis of their place of residence. Adjusted multilevel models were constructed for four health outcomes which are plausibly related to green space via physical activity: cardiovascular disease; overweight; poor general health; and poor mental health (Short Form 36). The greenest neighbourhoods had the lowest risks of poor mental health [odds ratio (OR) 0.81, 95% confidence interval (CI) 0.66-1.00]. Cardiovascular disease risk was reduced in all neighbourhoods with >15% green space availability (e. g. OR 0.80, 95% CI 0.64 - 0.99 for those with 33-70% green space). However, a dose-response relationship was not found. Green space availability was not related to overweight or poor general health. Overall, levels of physical activity were higher in greener neighbourhoods, but adjustment for this only slightly attenuated the green space and health relationships.

Neighbourhood green space was related to better cardiovascular and mental health in a New Zealand Health Survey, independent of individual risk factors. Although physical activity was higher in greener neighbourhoods, it did not fully explain the green space and health relationship.


Exercising in natural, green environments creates greater improvements in adult's self-esteem than exercise undertaken in urban or indoor settings. No comparable data are available for children. The aim of this study was to determine whether so called 'green exercise' affected changes in self-esteem; enjoyment and perceived exertion in children differently to urban exercise. We assessed cardiorespiratory fitness (20 m shuttle-run) and self-reported physical activity (PAQ-A) in 11 and 12 year olds (n = 75). Each pupil completed two 1.5 mile timed runs, one in an urban and another in a rural environment. Trials were completed one week apart during scheduled physical education lessons allocated using a repeated measures design. Self-esteem was measured before and after each trial, ratings of perceived exertion (RPE) and enjoyment were assessed after completing each trial. We found a significant main effect (F (1,74), = 12.2, p<0.001), for the increase in self-esteem following exercise but there was no condition by exercise interaction (F (1,74), = 0.13, p = 0.72). There were no significant differences in perceived exertion or enjoyment between conditions. There was a negative correlation (r = -0.26, p = 0.04) between habitual physical activity and RPE during the control condition, which was not evident in the green exercise condition (r = -0.07, p = 0.55). Contrary to previous studies in adults, green exercise did not produce significantly greater increases in self-esteem than the urban exercise condition. Green exercise was enjoyed more equally by children with differing levels of habitual physical activity and has the potential to engage less active children in exercise.

Influence of urban green spaces on human was evaluated with subjective questionnaires as well as physiological measurements. Five sample plots vary in color, size and scent of major plants and one no-vegetation area located in Shanghai Botanical Garden, China were chosen. 249 questionnaires on subjective satisfaction evaluation were collected; in addition to 64 visitors took the measurement of physiological parameters like Electroencephalogram (EEG) and Electrocardiogram (ECG). Questionnaire results show that color is one of the most important factors which affect the overall satisfaction of people with their vegetation environment. The way how people perceive vegetation environment was probed by PCA analysis. Age difference analysis show children and elder people presented higher satisfaction with vegetation environment than adults. Significant negative correlation between the ratio of low-frequency to high-frequency (LF/HF) values in heart rate variability (HRV) analysis and satisfaction values indicated HRV may be an effective parameter for green spaces influence evaluation. (C) 2013 Elsevier GmbH. All rights reserved.


The present research note is an extension of previous study which used a survey method to investigate barriers to garden visitation in five children’s hospitals in Texas. In previous study, we found that lack of shade and comfortable seats will significantly reduce duration of garden visitation for staff, and inadequate shade significantly reduces duration and frequency of garden visitation for visitors and patients.

With the findings from previous study, we used scores from garden shade maps in conjunction with scores from available hospital garden audit tools (which measured quality of garden seats, plants, lay-out, and amenities for children, and location) to evaluate the same five hospital gardens. Through an exploratory data analysis strategy, the gardens were scored and ranked based on their design characteristics, reported garden use, and observed garden use. The general agreement observed between these rankings suggested that quality of design, can influence levels of physical activity in pediatric hospital gardens.


This study used electromyographic analysis to investigate specific upper limb and hand muscle activation during 15 common horticultural activities. A total of 30 Korean adults between the ages of 20 and 30 years, with an average age of 24.8 years, were recruited from Konkuk University, Seoul, South Korea. Electromyographic measurements were made using a portable four-channel electromyograph. Bipolar surface electromyography (EMG) electrodes were attached to six upper limb muscles (i.e., upper trapezius, triceps—long head, biceps brachialis, flexor carpi ulnaris, flexor carpi radialis, and brachioradialis) and two hand muscles (i.e., thenar eminence and hypothenar eminence) on the dominant hand. These eight muscles that were selected play a major role in the operation of upper limbs and hand muscles for upper body low-impact activities. Each participant did the 15 horticultural activities on one occasion with two separate sessions. Each activity was performed for 60 seconds followed by a 15-second rest period sitting at a table on a height-adjusted chair between each activity. All eight muscles measured were used together during most of 15 horticultural activities. Upper trapezius, thenar eminence, and hypothenar eminence had higher muscle activity than the other muscles. Triceps—long head displayed very low EMG values compared with the other muscles. The
EMG data will facilitate developing scientific and research-based gardening intervention and/or horticultural therapy programs for improving physical health and physical rehabilitation.


This study investigated the associations between the accessibility, greenness, size, and type (active vs. passive) of public open spaces (POS) and clinical risk markers for cardiometabolic diseases and whether such associations could be explained (mediated) by physical activity and psychological well-being. Adult participants (n = 3754) provided clinical, self-reported, and residential location data. Cardiometabolic risk was defined as the sum of six anthropometric and biochemical risk markers. POS accessibility was defined as the number and proportion of POS within a 1000-m road distance from participants’ residences. Greenness, size and type were respectively defined as the median Normalised Difference Vegetation Index, median size, and proportion of POS with a sporting land use for all accessible POS. Physical activity and psychological well-being were self-reported. Associations were tested using Poisson regression models accounting for spatial clustering of observations and participants’ age, gender, education, income and area-level socioeconomic disadvantage. The number and proportion of POS were not found to be statistically significantly related to cardiometabolic health; however, greenness, size, and type (active) of available POS were inversely related to cardiometabolic risk. The association between POS and cardiometabolic health was partially mediated by physical activity. Psychological well-being was not implicated in the associations tested. These results suggest that the characteristics, not the number or proportion, of locally accessible POS are related to cardiometabolic health and, to some degree, physical activity. Maintaining or improving the quality of locally available POS might be a more effective urban design strategy to support cardiometabolic health than efforts to increase the accessibility of POS.


This study aims to find whether proximity to urban green spaces is associated with human mental health. A cross-sectional examination of the relationship between access to urban green spaces and counts of anxiety/mood disorder treatments amongst residents (aged 15 years and over) in Auckland City, New Zealand.

Anxiety/mood disorder treatment counts by three age groups were aggregated to 3149 small area units in Auckland. Six measures of green space access were derived using GIS techniques involving total green spaces and useable green spaces. Negative binomial regression models have been fitted to test the relationship between access to green space and area-level anxiety/mood disorder treatment counts, adjusted for age and area-level deprivation. Anxiety/mood disorder treatment counts were associated with three green space measures. The proportion of both total and useable green space within 3 km and distance to nearest useable green space all indicated a protective effect of increased access to green space against anxiety/mood disorder treatment counts. Access to total and useable green space within 300 m did not exhibit significant associations.

This study found that decreased distance to useable green space and increased proportion of green space within the larger neighbourhood were associated with decreased anxiety/mood disorder treatment counts in an urban environment. This suggests the benefits of green space on
mental health may relate both to active participation in useable green spaces near to the home and observable green space in the neighbourhood environment.


Urban particulate air pollution is a serious health issue. Trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on PM2.5 concentrations and human health are modeled for 10 U.S. cities. The total amount of PM2.5 removed annually by trees varied from 4.7 tonnes in Syracuse to 64.5 tonnes in Atlanta, with annual values varying from $1.1 million in Syracuse to $60.1 million in New York City. Most of these values were from the effects of reducing human mortality. Mortality reductions were typically around 1 person yr 1 per city, but were as high as 7.6 people yr 1 in New York City. Average annual percent air quality improvement ranged between 0.05% in San Francisco and 0.24% in Atlanta. Understanding the impact of urban trees on air quality can lead to improved urban forest management strategies to sustain human health in cities.


Eye tracking was used to investigate the task of assessing how likely it is that one would be able to rest and recover in small urban spaces and how it affects the view pattern. We assess which environmental components, for example, flowers and trees, participants look at when evaluating restoration likelihood. Further, we compare number of fixations in restorative and non-restorative park photos. Photos were selected based on ratings of low and high likelihood of restoration. Participants were asked to imagine themselves in need of restoration. Photos were presented for 10 seconds each. In contrast to studies adapting a free viewing approach, the present study shows that image properties such as contrast and colour did not attract attention; instead participants looked at components that were of importance for assessing restoration likelihood. The components participants looked at the most were trees, followed by benches and bushes. This presents new information on people's view patterns in relation to the task of rating restoration likelihood. In addition, relations between the park components at which participants looked the most and the ratings on restoration likelihood were explored. As expected, we found a positive correlation between grass and restoration likelihood. The relations were negative for all other variables, although not significant. The negative relations were rather unexpected, and possible explanations for them are discussed. Finally, we analysed the association between number of fixations and restoration likelihood ratings, and no correlation was found.


This study reports on children's observed responses to natural features introduced in the redevelopment of a childcare centre garden. Using an action research approach, the redevelopment was based on the preferences of the director, staff and 18 three- to four-year-olds, as expressed through interviews, conversations, photographs and drawings. Adults and children overwhelmingly preferred natural elements. The kindergarten teacher and assistant observed children's responses to the implementation of features including a teepee, mulch, greeneries, flowers, and loose organic materials. In follow-up interviews, they reported positive child
responses including: richer imaginative play; increased physical activity; calmer, more focused play; and positive social interactions. These findings provide further evidence of the importance of providing children with naturalized outdoor play spaces.


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Psycho-oncological care, including spiritual care, is essential for cancer patients. Integrated medicine, a therapy combining modern western medicine with various kinds of complementary and alternative medicine, can be appropriate for the spiritual care of cancer because of the multidimensional characteristics of the spirituality. In particular, therapies that enable patients to establish a deeper contact with nature, inspire feelings of life and growth of plants, and involve meditation may be useful for spiritual care as well as related aspects such as emotion. The purpose of the present study was to examine the effect of spiritual care of cancer patients by integrated medicine in a green environment.

The present study involved 22 cancer patients. Integrated medicine consisted of forest therapy, horticultural therapy, yoga meditation, and support group therapy, and sessions were conducted once a week for 12 weeks. The spirituality (the Functional Assessment of Chronic Illness Therapy-Spiritual well-being), quality of life (Short Form-36 Health Survey Questionnaire), fatigue (Cancer Fatigue Scale), psychological state (Profile of Mood States, short form, and State-Trait Anxiety Inventory) and natural killer cell activity were assessed before and after intervention.

In Functional Assessment of Chronic Illness Therapy-Spiritual well-being, there were significant differences in functional well-being and spiritual well-being pre- and postintervention. This program improved quality of life and reduced cancer-associated fatigue. Furthermore, some aspects of psychological state were improved and natural killer cell activity was increased. It is indicated that integrated medicine performed in a green environment is potentially useful for the emotional and spiritual well-being of cancer patients.

Background Little is known about the neighbourhood characteristics of workplaces, the extent to which they are independently and synergistically correlated with residential environments, and their impact on health. Methods This study investigated cross-sectional relationships between home and workplace neighbourhood environments with body mass index (BMI) in 1503 working participants of the Multi-Ethnic Study of Atherosclerosis with mean age 59.6 (SD=7.4). Neighbourhood features were socioeconomic status (SES), social environment (aesthetic quality, safety and social cohesion) and physical environment (walking environment, recreational facilities and food stores) derived from census data, locational data on businesses and survey data. Paired t tests and correlations compared environments overall and by distance between locations. Cross-classified multilevel models estimated associations with BMI. Results Home neighbourhoods had more favourable social environments while workplaces had more favourable SES and physical environments. Workplace and home measures were correlated (0.39–0.70), and differences between home and workplaces were larger as distance increased. Associations between BMI and neighbourhood SES and recreational facilities were stronger for home environment (p≤0.05) but did not significantly differ for healthy food, safety or social cohesion. Healthy food availability at home and work appeared to act synergistically (interaction p=0.01). Conclusions Consideration of workplace environment may enhance our understanding of how place affects BMI.


The potential of a Large Eddy Simulation (LES) model to reliably predict near-field pollutant dispersion is assessed. To that extent, detailed time-resolved numerical simulations of coupled flow and dispersion are conducted for a street canyon with tree planting. Different crown porosities are considered. The model performance is assessed in several steps, ranging from a qualitative comparison to measured concentrations, over statistical data analysis by means of scatter plots and box plots, up to the calculation of objective validation metrics. The extensive validation effort highlights and quantifies notable features and shortcomings of the model, which would otherwise remain unnoticed. The model performance is found to be spatially non-uniform. Closer agreement with measurement data is achieved near the canyon ends than for the central part of the canyon, and typical model acceptance criteria are satisfied more easily for the leeward than for the windward canyon wall. This demonstrates the need for rigorous model evaluation. Only quality-assured models can be used with confidence to support assessment, planning and implementation of pollutant mitigation strategies.


The present study aimed to investigate whether there is an association between type of living environment (urban versus rural) and anxiety, depression and psychosis in the Scottish population. Methods: Data were obtained from the Scottish Neighbourhood Statistics database on Scottish Index of Multiple Deprivation and urban-rural classifications for 6505 data zones across Scotland. Multiple regression was used to test the association between prescriptions for psychotropic medication for anxiety, depression and psychosis, and type of living environment according to urban-rural classification, controlling for a range of socio-economic factors.
Urban-rural classification significantly predicted poorer mental health both before (beta=-.29) and after (beta=-.20) controlling for a large number of socio-economic variables, with more urban areas having higher rates of prescription for psychotropic medication for anxiety, depression and psychosis. The current study focussed on macro-level variables and did not include individual level data. As such, the study did not include data on individual diagnoses, but instead used drug prescriptions for anxiety, depression and psychosis as a proxy for level of affective disorders within data zones. Conclusion: More urban living environments in Scotland are associated with higher rates of prescription for psychotropic medication for anxiety, depression and psychosis.


A survey was used to investigate gardeners' and nongardeners' nutritional attitudes, fruit and vegetable consumption, and nutritional knowledge. The survey was posted for 4 months on one of the largest online resources for Master Gardeners. During the 4 months, 402 responses were gathered. Additionally, identical "paper/pencil" format surveys were distributed to garden, church, and social and community groups with approximate to 400 responses received. In each group of participants, respondents differentiated themselves as gardeners or nongardeners by responding positively or negatively to the survey question, "do you garden?" No statistically significant relationships were found relating fruit and vegetable consumption to either income level or educational attainment status in the overall sample. Results indicated statistically significant differences in comparisons between gardeners and nongardeners with regards to nutritional attitudes and their consumption of fruit and vegetables where gardeners had more positive nutritional attitude scores and increased consumption of fruit and vegetables. However, no statistically significant differences were found between gardeners' and nongardeners' nutritional knowledge.


Links between wellbeing and environmental factors are of growing interest in psychology, health, conservation, economics, and more widely. There is limited evidence that green or natural environments are positive for physical and mental health and wellbeing. We present a new and unique primary research study exploring the relationship between momentary subjective wellbeing (SWB) and individuals' immediate environment within the UK. We developed and applied an innovative data collection tool: a smartphone app that signals participants at random moments, presenting a brief questionnaire while using satellite positioning (GPS) to determine geographical coordinates. We used this to collect over one million responses from more than 20,000 participants. Associating GPS response locations with objective spatial data, we estimate a model relating land cover to SWB using only the within-individual variation, while controlling for weather, daylight, activity, companionship, location type, time, day, and any response trend. On average, study participants are significantly and substantially happier outdoors in all green or natural habitat types than they are in urban environments. These findings are robust to a number of alternative models and model specifications. This study provides a new line of evidence on links between nature and wellbeing, strengthening existing evidence of a positive relationship between SWB and exposure to green or natural environments in daily life. Our results have informed the UK National Ecosystem Assessment (NEA), and the novel geo-
located experience sampling methodology we describe has great potential to provide new insights in a range of areas of interest to policymakers.


Dealing with stress and stress-related diseases is an increasing problem in both developed and developing countries and has an enormous cost for individuals, companies, and societies. A positive relationship between access to a green outdoor environment at work, and decreased stress has been found in previous studies, and this relationship is in line with a vast body of research in other contexts. The aim of this study is to investigate whether access to a green outdoor environment at work is related to employees’ perceived level of stress and attitude toward the workplace. The study is based on data from a questionnaire answered by 439 randomly selected individuals in Sweden. The questionnaire addressed the respondents’ level of stress and workplace attitude, and the characteristics and accessibility of the outdoor environment at the respondents’ workplace. The results showed significant relationships between physical and visual access to workplace greenery, and a positive workplace attitude and decreased level of stress for male respondents. For female respondents, a significant relationship between physical and visual access to workplace greenery and a positive workplace attitude was found, but not between access to workplace greenery and level of stress. Furthermore, a positive workplace attitude was related to decreased levels of stress for female respondents, but not for male respondents. These findings support existing research which suggests that the workplace outdoor environment is an asset for employees’ wellbeing and level of stress, and they indicate that gender plays a central role in realizing the benefits of such environments.


Background: Despite increasing attention and a growing volume of research data, little physiological evidence is available on the benefits of horticultural activity and the different effects on individuals. Therefore, the aim of the present study was to investigate the physiological effects of horticultural activity and to examine how differences in personality alter these effects. Results: The effects of transplanting real flowers (horticultural activity) and handling artificial flowers (control activity) on human physiological activity were compared. On the first day, eight participants engaged in horticultural activity and another eight in the control activity. On the second day, participants switched roles. Participants' physiological conditions during each activity were assessed by measuring the heart rate and heart rate variability (HRV). Psychological responses, which were measured using a semantic differential rating scale, showed that the horticultural activity promoted comfortable, soothed, and natural feelings, compared to the control activity. Analysis of physiological responses using two-way repeated measures analysis of variance (ANOVA) revealed that sympathetic nervous activity significantly decreased in the late time period (11 to 15 minutes) of horticultural activity only in the type A group. Conclusions: This study supports the fact that the horticultural activity can enhance psychological and physiological relaxation effects, although these physiological effects can differ among individuals with different personalities.

Increasing heat will be a significant problem for Central European cities in the future. Shading devices are discussed as a method to mitigate heat stress on citizens. To analyze the physical processes, which are characteristic of shading in terms of urban human-biometeorology, experimental investigations on the thermal effects of shading by a building and shading by tree canopies were conducted in Freiburg (Southwest Germany) during typical Central European summer weather. Urban human-biometeorology stands for the variables air temperature $T_a$, mean radiant temperature $T_{mrt}$, and physiologically equivalent temperature PET, that is the human-biometeorological concept to assess the thermal environment which was applied. The measuring setup consists of specific human-biometeorological stations, which enable the direct or indirect determination of $T_a$, $T_{mrt}$, and PET. With respect to both shading devices, the $T_a$ reduction did not exceed $2^\circ C$, while PET as a measure for human heat stress was lowered by two thermal sensation steps according to the ASHRAE scale. As $T_{mrt}$ has the role of a key variable for outdoor thermal comfort during Central European summer weather, all radiant flux densities relevant to the determination of $T_{mrt}$ were directly measured and analyzed in detail. The results show the crucial significance of the horizontal radiant flux densities for $T_{mrt}$ and consequently PET.


To assess and compare costs associated with diabetes and lesser degrees of glucose intolerance in Australia. The Australian Diabetes, Obesity and Lifestyle study collected data on the use of health services and health related expenditure in 2004-2005. Complications data were collected through physical examination and biochemical tests or questionnaire. Data were available on 6101 participants. Age- and sex-adjusted direct healthcare costs, direct non-healthcare costs and government subsidies were estimated according to glucose tolerance status.

Annual direct per person costs were A$1898 for those with normal glucose tolerance to A$4390 for those with known diabetes. Costs were substantially higher in people with diabetes and both micro- and macrovascular complications. The total annual cost of diabetes in 2005 for Australians aged $\geq$30 years was A$10.6$ billion (A$4.4$ billion in direct costs; A$6.2$ billion in government subsidies) which equates to A$14.6$ billion in 2010 dollars. Total annual excess cost associated with diabetes in 2005 was A$4.5$ billion (A$2.2$ billion in direct costs; A$2.3$ billion in government subsidies).

The excess cost of diabetes to individuals and government is substantial and is greater in those with complications. Costs could potentially be reduced by preventing the development of diabetes or its complications.


A high percentage of fresh flowers sold are consumed as gifts in many countries, such as Taiwan, Japan, and the United States. As gift consumption is so important for the sales of fresh flowers, consumer behavior in floral gift giving is investigated in this research. This study explored the consumer decision to purchase fresh flowers as a romantic gift for Valentine's Day based on 1) relationship stage, 2) affection, and 3) satisfaction with the relationship. The
statistical results, based on the data of 366 valid questionnaires collected from a self-administered questionnaire survey, showed that the relationship stage of "personality need fulfillment," the affection of "passion," and relationship satisfaction significantly influenced the consumer decision of whether to purchase fresh flowers as romantic Valentine's Day gifts. Consumers were more likely to buy their intimate partners fresh flowers when they perceived their personality need, such as the need of being loved, was fulfilled in the relationship. When strongly passionate about that relationship, they tended to give fresh flowers in conjunction with other gifts. However, when consumers were more satisfied with their romantic relationships, they were less likely to buy their intimate partners fresh flowers. The study results have valuable implications for florists' business alliances and advertising campaign development for promoting floral gifts efficiently.


A growing body of evidence investigates whether access to greenspace, such as parks and woodland, is beneficial to well-being. Potential health benefits of greenspace exposure include opportunity for activities within the space and psychological benefits of viewing and interacting with nature. However, empirical research evidence on the effects of greenspace exposure shows mixed findings. Hence we suggest that the key questions of “if, why and how?” greenspace influences health remain largely unanswered. We argue that researchers have inadequately considered the causal pathways which drive the relationship. In particular, an improved understanding is needed of potential mediators and moderators. In this paper we draw on social-ecological theories and a review of the literature to develop a novel theoretical framework which summarises current knowledge about hypothetical causal pathways between access to greenspace and health outcomes. The framework highlights how mediators – such as use of greenspace and perceptions of the living environment – drive associations between access and both physical and psychological health outcomes. We propose key moderators based on evidence that associations between greenspace and health differ by demographic factors such as gender, ethnicity and socio-economic status, living context, greenspace type and climate. We discuss the evidence for how and why these factors act as moderators and consider the implications which arise from this improved understanding of the relationship between greenspace and health. In conclusion, we discuss how the framework can be used to inform planning of research studies, and how it may be developed in the future as more evidence emerges.


Despite the passage of time, some people who experienced the Great East Japan Earthquake are still living with the emotional trauma and stress. We provided horticultural therapy as an intervention to 39 elderly women with earthquake stress living in the affected areas of the coastal areas of the Great East Japan Earthquake. The participants were divided into two groups, an intervention group (n=20) and a control group (n=19). The intervention group underwent eight weeks of horticultural intervention. On the other hands, the control group underwent eight weeks of stress control education. After two months of horticultural therapy intervention, the Clinician-Administered PTSD Scale (CAPS) total score, Geriatric Depression Scale (GDS) score, the Posttraumatic Growth Inventory (PTGI-J) score, and the WHO Quality of
Life 26 (WHO-QOL26) score in the intervention group improved significantly, and salivary cortisol level in the intervention group also improved significantly. After follow up, CAPS score, GDS score, PTGI-J score, and WHO-QOL26 score (psychological QOL score, social QOL score, environmental QOL score, and global QOL score), and salivary cortisol level in the intervention group was improved or almost the same as the post-intervention scores in the intervention group. These findings suggest that horticultural therapy has an effect on the symptoms of earthquake stress in elderly women, and that this effect may sustain.


Background: In recent years, the physiological relaxing effect brought by nature is becoming clear; however, many workers find it difficult to be exposed to nature in their working environment. Exposure to fresh flowers represents an opportunity to incorporate nature into their working lives. In this study, we examined the effects of exposure to roses on physiological and psychological variables (heart rate variability, pulse rate, and subjective responses) in office workers.

Results: The experimental site was Mizuho Information & Research Institute, Inc., in the Tokyo metropolitan area. Thirty-one male office workers were included in the present study. The subjects were exposed to thirty unscented pink roses (Rosa, Dekora) arranged in a cylindrical glass vase for 4 min. In the control condition, the subjects were not exposed to flowers. After the experiments, the subjects completed a questionnaire. The order of exposure was counterbalanced among subjects. Among subjects exposed to roses, the high-frequency component of heart rate variability was significantly higher than in controls. Similarly, ‘comfortable,’ ‘relaxed’ and ‘natural’ feelings were more common in subjects exposed to roses.

Conclusions: Data from this study support the presence of physiological and psychological relaxing effects of being exposed to flowers on office workers.


Numerous studies have reported on the healing powers of plants and nature, but there have not been so many instances of experimental research. In particular, there are very few psychological and physiological studies using tactile stimuli. This study examines the psychological and physiological effects of touching plant foliage by using an evaluation profile of the subjects’ impressions and investigating cerebral blood flow. The subjects were 14 young Japanese men aged from 21 to 27 years (mean ± standard deviation: 23.6 ± 2.4). With their eyes closed, the subjects touched four different tactile samples including a leaf of natural pothos (Epipremnum aureum). The physiological indices were compared before and after each stimulus. Psychological indices were obtained using a 'semantic differential' method. The fabric stimulus gave people 'soft' and 'rough' impressions, 'kind', 'peaceful' and 'pleasant' feelings psychologically, and a sense of physiological calm. On the other hand, the metal stimulus gave people 'cold', 'smooth' and 'hard' impressions and an image of something 'artificial'. The metal stimulus caused a stress response in human cerebral blood flow although its evaluation in terms of 'pleasant or unpleasant' was neutral. There were no remarkable differences between the stimuli of natural and artificial pothos compared with other types of stimulus psychologically. However,
only the natural pothos stimulus showed a sense of physiological calm in the same appearance as the fabric stimulus. This study shows that people experience an unconscious calming reaction to touching a plant. It is to be concluded that plants are an indispensable element of the human environment.


The emergence of urban green governance has given prominence to the role of trees in sustainable cities. Earlier ideas of trees as urban adornment and providers of amenity are giving way to understanding of the urban forest as green infrastructure. Urban trees are taking on the normative resonance of ‘nature’ previously reserved in sustainability discourse for nonurban environments. Yet a governing consensus that urban trees are good is not necessarily accepted by all. Despite extensive research on tree benefits, little is known about social resistance to urban trees. In Australia, anecdotal evidence suggests that many tree lovers perceive a countervailing force of tree haters who are responsible for tree injury and death through acts of revenge, scapegoating, displaced emotion and sheer loathing. This perception frames dislike of trees as social deviance rather than as a legitimate expression of complex intersubjective aspirations and concerns. In investigating the existence or otherwise of anti-arboREAL forces, we report on a survey of residents in six eastern Australian cities that explored motivations underlying tree planting and removal. Rather than rejecting trees outright, most respondents expressing negative attitudes towards trees did so in the context of espousing the value of the ‘right tree’ in the ‘right place’. The chief motivations for the removal of healthy trees were aesthetic and lifestyle preferences, linked to wider cultural dynamics of individuation and commodification, followed by moral considerations, linked to wider cultural dynamics related to nativism. The findings suggest that to reduce the turnover of private trees, advocates of the urban forest have to expand their engagement with residents beyond a current focus on technical discourses of tree services and regulatory controls. This expanded engagement needs to account for the full range of subjective factors that influence tree preferences.


There is mounting empirical evidence that interacting with nature delivers measurable benefits to people. Reviews of this topic have generally focused on a specific type of benefit, been limited to a single discipline, or covered the benefits delivered from a particular type of interaction. Here we construct novel typologies of the settings, interactions and potential benefits of people-nature experiences, and use these to organise an assessment of the benefits of interacting with nature. We discover that evidence for the benefits of interacting with nature is geographically biased towards high latitudes and Western societies, potentially contributing to a focus on certain types of settings and benefits. Social scientists have been the most active researchers in this field. Contributions from ecologists are few in number, perhaps hindering the identification of key ecological features of the natural environment that deliver human benefits. Although many types of benefits have been studied, benefits to physical health, cognitive performance and psychological well-being have received much more attention than the social or spiritual benefits of interacting with nature, despite the potential for important consequences arising from the latter. The evidence for most benefits is correlational, and although there are several experimental studies, little as yet is known about the mechanisms that are important for
delivering these benefits. For example, we do not know which characteristics of natural settings (e.g., biodiversity, level of disturbance, proximity, accessibility) are most important for triggering a beneficial interaction, and how these characteristics vary in importance among cultures, geographic regions and socio-economic groups. These are key directions for future research if we are to design landscapes that promote high quality interactions between people and nature in a rapidly urbanising world.


This study estimates possible reductions in heat-related mortality in the District assuming the installation of urban heat island reduction measures and determines if the number of days with weather conditions that are historically associated with high mortality will decrease significantly using cooling strategies. The study team identified four actual multi-day heat events, calculated excess mortality during those events, and modeled the impact of increased surface reflectance and increased vegetative cover on meteorological conditions and expected mortality. The study found that a 10-percentage point increase in urban surface reflectivity could reduce the number of deaths during heat events by an average of 6%. Adding a 10% increase vegetative cover to the increases in reflectivity yielded an average 7% reduction in mortality during heat events. During the decades between 1948 and 2011, an average of 285 people died of heat-related causes (Kalkstein et al., 2011). A 6–7% decrease in mortality would save approximately 20 lives per decade. In addition, an even larger reduction would be expected in hospital admissions from heat-related illness, although this was not a specific finding of this analysis. Changes in temperature and humidity (as measured by dew point temperature) in both scenarios were relatively minor, yet were significant enough to contribute to the reduction of deaths. The District, given its current policy landscape and development, could achieve the increases in reflectivity and vegetation used in this study. Increasing District-wide roof reflectivity by 10 percentage points is achievable by converting dark grey roofs to white roofs on approximately 25 percent of the District’s buildings. Assuming the average roof lasts 20 years, the District could achieve this with end-of-life roof replacements in slightly more than 5 years. Achieving the same increase in reflectivity for pavements would require the conversion of 50 percent of District pavements from dark asphalt to a slightly lighter option like grey concrete. A significantly smaller percentage of pavements would need to be converted if cool coatings were applied where feasible.


Green roofs may provide environmental, aesthetic, and social benefits. Their environmental benefits have been the subject of considerable research in the past decade; the aesthetic and social aspects, however, have received less attention. Some authors have questioned the visual appeal of some green roof designs. Nonetheless, little research has examined aesthetic reactions toward green roofs or attitudes concerning them. We conducted visitor surveys at seven green roofs in the Northeastern US to assess visitors’ aesthetic reactions to different types of green roofs, determine general attitudes toward green roofs, and assess values concerning benefits and costs associated with them. Attitudes toward green roofs were positive with higher importance being placed on green roof benefits than costs. Aesthetic
reactions were, in general, positive. Aesthetic reactions to roofs dominated by stoloniferous grasses were more negative than to either sedum-dominated or mixed perennial roofs. Principle component analysis showed that negative aesthetic reactions were associated primarily with a perception of messiness. Furthermore, respondents felt that the grass-dominated roofs blended less well with the building and surrounding landscape. Aesthetic reactions were positively correlated with attitudes and importance placed on the benefits of green roofs. Positive visitor reactions to sedum-dominated extensive roofs is a favorable result for the green roof industry as these are the most common type of green roof and this suggests that there is high promotion potential if more of these roofs are designed to be visible from street level.


The number of researches on the effect of indoor plants to improve the quality of the workplace has increased. However, the results were varied. These differences in results might be caused by differences in the method adopted by each researcher, such as differences in the task, in acclimatization time, in work duration, in the number of plants, the size of plants and also the arrangement of plants. The objective of the present study is to investigate the effects of the number of plants on human productivity, stress and attention. In the present study, subjects were instructed to conduct a word searching task in a room with different numbers of plants on each condition. The results showed that there was no significant difference in productivity, stress and attention among four conditions. Significant differences were found in the subject's perception of friendliness, comfort, freshness, and cleanliness of the workplace.


In recent years, numerous environmental psychology studies have demonstrated that contact with nature as opposed to urban settings can improve an individual's mood, can lead to increased levels of vitality, and can offer an opportunity to recover from stress. According to Attention Restoration Theory (ART) the restorative potential of natural environments is situated in the fact that nature can replenish depleted attentional resources. This replenishment takes place, in part, because nature is deemed to be a source of fascination, with fascination being described as having an "attentional", an "affective" and an "effort" dimension. However, the claim that fascination with nature involves these three dimensions is to a large extent based on intuition or derived from introspection-based measurement methods, such as self-reports. In three studies, we aimed to more objectively assess whether these three dimensions indeed applied to experiences related to natural environments, before any (attentional) depletion has taken place. The instruments that were used were: (a) the affect misattribution procedure (Study 1), (b) the dot probe paradigm (Study 2) and (c) a cognitively effortful task (Study 3). These instrument were respectively aimed at verifying the affective, attentional and effort dimension of fascination. Overall, the results provide objective evidence for the claims made within the ART framework, that natural as opposed to urban settings are affectively positive (cfr., affective dimension) and that people have an attentional bias to natural (rather than urban) environments (cfr., attentional dimension). The results regarding the effort dimension are less straightforward, and suggest that this dimension only becomes important in sufficiently difficult cognitive tasks.

The French Alzheimer Plan 2008–2012 anticipates the implementation of new Units specialized in cognitive rehabilitation and psycho-behavioral therapy of Alzheimer’s disease (AD) patients. Conceived for AD and other dementia patients of all ages, their objectives are to propose a cognitive rehabilitation program, to prevent or treat psycho-behavioral crises, and to provide support and educational therapy to the family and professional caregivers, in order to ease the patient’s return to his or her previous way of life. Studies on green spaces and healing gardens in health-care settings have revealed objective and measurable improvements in the patient’s well-being. The Plan officially stipulates for the first time the need to make healing gardens an integral part of these Units, but it does not provide specific recommendations or criteria for implementing such gardens. Although green spaces and gardens are available in many French Care Units, they are rarely specifically adapted to the needs of AD patients. In Nancy, the Art, Memory and Life garden, a specific concept guided by a neuropsychological approach, was developed and complemented by an artistic vision based on cultural invariants. The main objective of this article is to describe the various steps of the process that led to the creation of this garden: the collection of experiences and information by a pilot group, surveys of patients, visitors, and caregivers before and after establishment of the garden, and implementation of a multi-professional group project. The specifications, the organizational criteria, the therapeutic project, and the criteria for the conception of such a garden stemming from our clinical experience with the Art, Memory and Life garden in Nancy, are described herein. We also present the first assessment following the implementation of the project.


Some studies indicate that a large part of the beneficial effect of physical activity on mortality is confined to a threshold effect of participation. Self-reported physical activity was investigated in relation to all-cause mortality in the Danish Diet, Cancer and Health cohort, including 29,129 women and 26,576 men aged 50-64 years at baseline 1993-1997. Using Cox proportional hazards models we investigated the associations between mortality rate and leisure time physical activity by exploring 1) participation (yes/no) in each type of activity; 2) a simple dose-response relationship with hours spent on each activity, supplemented with indicators of participation in each activity; and 3) inflexion or nonmonotonic dose-response relationships using linear splines. A total of 2696 women and 4044 men died through March 2010. We found lower mortality with participation in sports (for women, mortality rate ratio = 0.75, 95% confidence interval = 0.69-0.81; for men, 0.78, 0.73-0.84), cycling (for women, 0.77, 0.71-0.84; for men, 0.90, 0.84-0.96), or gardening (for women, 0.84, 0.78-0.91; for men, 0.73, 0.68-0.79) and in men participating in do-it-yourself activity (0.77, 0.71-0.84). A weak adverse dose response was seen for walking and gardening, but the association was small (1-2% increase in mortality per additional hour). We found no signs of inflexion or nonmonotonic dose-response relationships using linear splines. Mortality was lower with participation in specific leisure time physical activities, but not with more time spent on those activities. This could suggest that avoiding a sedative lifestyle is more important than a high volume of activity. Nonparticipation in these types of physical activity may be considered as risk factors.
To better understand how fragrance may enhance human health, this study examined psychophysiological responses to Japanese plum blossom fragrance. Although previous studies used essential oils or fragrance components, the present study measured the effects of floral scent naturally diffused by the plant itself to simulate the way we generally experience natural scent in everyday life. Subjects were Japanese males (n = 26), and the data collected included cerebral and autonomic nervous system activities, semantic differential (SD) scale, and profile of mood states (POMS). Exposure to the fragrance significantly activated the sympathetic nervous system and the cerebral areas related to movement, speech, and memory. SD scale and POMS results showed the fragrance evoked cheerful, exciting, and active images and changed mood states by enhancing vigor while suppressing feelings of depression. These findings indicate that contact with a floral scent such as plum blossom fragrance can improve mood states and may foster the brain functions of memory, speech, and movement, potentially leading to improvements in emotional health, depression, and memory disorders.


Socioeconomic factors influencing consumer demand for nursery products and landscape projects were investigated using consumer survey data collected from North Carolina in 2008. Tobit models were estimated for censored dependent variables, budget expenditure shares on nursery products, and landscape spending. The most significant factors influencing the share of income spent on nursery products were age and household income. The elderly and baby boomers tend to spend less on bedding plants, perennials, and outdoor hardscapes than Generations X and Y. The income elasticities suggest that the amount spent on outdoor living projects is sensitive to changes in household income, whereas spending in vegetable plants and chemicals is less responsive to income.

Objective: We examined the distribution of heat risk–related land cover (HRRLC) characteristics across racial/ethnic groups and degrees of residential segregation. Block group–level tree canopy and impervious surface estimates were derived from the 2001 National Land Cover Dataset for densely populated urban areas of the United States and Puerto Rico, and linked to demographic characteristics from the 2000 Census. Racial/ethnic groups in a given block group were considered to live in HRRLC if at least half their population experienced the absence of tree canopy and at least half of the ground was covered by impervious surface (roofs, driveways, sidewalks, roads). Residential segregation was characterized for metropolitan areas in the United States and Puerto Rico using the multigroup dissimilarity index.

Results: After adjustment for ecoregion and precipitation, holding segregation level constant, non-Hispanic blacks were 52% more likely (95% CI: 37%, 69%), non-Hispanic Asians 32% more likely (95% CI: 18%, 47%), and Hispanics 21% more likely (95% CI: 8%, 35%) to live in HRRLC conditions compared with non-Hispanic whites. Within each racial/ethnic group, HRRLC conditions increased with increasing degrees of metropolitan area-level segregation. Further adjustment for home ownership and poverty did not substantially alter these results, but adjustment for population density and metropolitan area population attenuated the segregation effects, suggesting a mediating or confounding role.

Conclusions: Land cover was associated with segregation within each racial/ethnic group, which may be explained partly by the concentration of racial/ethnic minorities into densely populated neighborhoods within larger, more segregated cities. In anticipation of greater frequency and duration of extreme heat events, climate change adaptation strategies, such as planting trees in urban areas, should explicitly incorporate an environmental justice framework that addresses racial/ethnic disparities in HRRLC.


Urban woodland vegetation provides people with many aesthetic, ecological and psychological benefits, but can also generate problems concerning people's perception of safety. This paper reviews existing knowledge about perceived personal safety in relation to vegetation, particularly woodland vegetation, in urban green spaces such as parks and residential areas. Individual and social factors, but also vegetation character, maintenance and design, proved to be important for perceived personal safety. Vegetation-related aspects identified as being of particular importance include landscape design, possibilities for overview and control, vegetation density, and vegetation character and maintenance. Vegetation of an open character with low density undergrowth might have positive effects on perceived personal safety without reducing other benefits. Issues for future research include context-based studies to consider several aspects of vegetation and their interactions.

With increasing interest in the use of urban green space to promote human health, there is a need to understand the extent to which park users conceptualize these places as a resource for health and well-being. This study sought to examine park users’ own reasons for and benefits from green space usage and compare these with concepts and constructs in existing person-environment-health theories and models of health. Conducted in 13 public green spaces in Sheffield, UK, we undertook a qualitative content analysis of 312 park users’ responses to open-ended interview questions and identified a breadth, depth and salience of visit motivators and derived effects. Findings highlight a discrepancy between reasons for visiting and derived effects from the use of urban green space. Motivations emphasized walking, green space qualities, and children. Derived effects highlighted relaxation, positive emotions within the self and towards the place, and spiritual well-being. We generate a taxonomy of motivations and derived effects that could facilitate operationalization within empirical research and articulate a conceptual framework linking motivators to outcomes for investigating green space as a resource for human health and well-being.


Positive emotional well-being is fundamentally important to general health status, and is linked to many favorable health outcomes. There is societal interest in understanding determinants of emotional well-being in adolescence, and the natural environment represents one potential determinant. Psychological and experimental research have each shown links between exposure to nature and both stress reduction and attention restoration. Some population studies have suggested positive effects of green space on various indicators of health. However, there are limited large-scale epidemiological studies assessing this relationship, specifically for populations of young people and in the Canadian context. The objective of this study was to examine the relationship between exposure to public natural space and positive emotional well-being among young adolescent Canadians.

This cross-sectional study was based upon the Canadian 2009/10 Health Behaviour in School-aged Children Survey with linked geographic information system (GIS) data. Following exclusions, the sample included 17,249 (grades 6 to 10, mostly ages 11 to 16) students from 317 schools. Features of the natural environment were extracted using GIS within a 5 km radius circular buffer surrounding each school. Multilevel logistic regression was used to examine the relationship between the presence of public natural space (features include green and blue spaces such as parks, wooded areas, and water bodies) and students' reports of positive emotional well-being, while controlling for salient covariates and the clustered nature of the data.

Results: Over half of Canadian youth reported positive emotional well-being (58.5% among boys and 51.6% among girls). Relationships between measures of natural space and positive emotional well-being were weak and lacked consistency overall, but modest protective effects were observed in small cities. Positive emotional well-being was more strongly associated with other factors including demographic characteristics, family affluence, and perceptions of neighbourhood surroundings.

Conclusion: Exposure to natural space in youth's immediate living environment may not be a leading determinant of their emotional well-being. The relationship between natural space and positive emotional well-being may be context specific, and thus different for Canadian youth compared to adult populations and those studied in other nations. Factors of the individual context were stronger potential determinants.

Drawing upon the published annual reports of the National Health Society (established in 1871) and its intimate relationship with the Metropolitan Public Gardens and Playgrounds Association, this paper will explore the discourses expressed by the sanitarians and health professionals represented by the Society in relation to the parks movement in London in the 1870s and 1880s. By analysing this particular aspect of the Society, the connections between medical professionals, sanitarians and philanthropic members of the upper classes in relation to the urban parks movement will be explored. Notions of health as a state achieved through the dual combination of the physical environment and the behaviour of the individual will also be discussed, building on the work of recent commentators such as Nancy Tomes, H.L. Malchow, Felix Driver, Martin Gaskell and Peter Thorsheim. Finally, the inter-relationships between the temperance movement, the National Health Society, and the idea of urban green spaces as places of health will be drawn out. This approach will demonstrate the important influence of named medical practitioners, and their approaches regarding health and disease, on the design of the urban fabric in which the majority of Britons now live.


Introduction: Young-onset dementia affects about 1 in 1500 people aged under 65 years in the United Kingdom (UK). It is associated with loss of employment, independence and an increase in psychological distress. This project set out to identify the benefits of a 2 hours per week structured activity programme of gardening for people with young-onset dementia.

Method: A mixed methods (qualitative and quantitative) study of therapeutic gardening for people with young-onset dementia, measuring outcomes for both participants with young-onset dementia and their caregivers, was used. Twelve participants were recruited from a county-wide mental health service for older adults, based on onset of dementia being before the age of 65 years (range 43-65 years). Of these, two participants dropped out and one died during the project. Measures included the Mini Mental State Examination (MMSE), Bradford Well-Being Profile, Large Allen Cognitive Level Screen (LACLS) and Pool Activity Level (PAL). Findings: Over a 1-year period the careers of the people with young-onset dementia found that the project had given participants a renewed sense of purpose and increased well-being, despite cognitive functioning continuing to decline during this period. Conclusion: This study suggests that a meaningful guided activity programme can maintain or improve well-being in the presence of cognitive deterioration.


Exposure to surface ozone (O3), which is influenced by emissions of precursor chemical species, meteorology and population distribution, is associated with excess mortality and respiratory morbidity. In this study, the EMEP-WRF atmospheric chemistry transport model was used to simulate surface O3 concentrations at 5 km horizontal resolution over the British Isles for a baseline year of 2003, for three anthropogenic emissions scenarios for 2030, and
for a +5 °C increase in air temperature on the 2003 baseline. Deaths brought forward and hospitalization burdens for 12 UK regions were calculated from population-weighted daily maximum 8-hour O3. The magnitude of changes in annual mean surface O3 over the UK for +5 °C temperature (+1.0 to +1.5 ppbv, depending on region) were comparable to those due to inter-annual meteorological variability (−1.5 to +1.5 ppbv) but considerably less than changes due to precursor emissions changes by 2030 (−3.0 to +3.5 ppbv, depending on scenario and region). Including population changes in 2030, both the ‘current legislation’ and ‘maximum feasible reduction’ scenarios yield greater O3-attributable health burdens than the ‘high’ emission scenario: +28%, +22%, +16%, respectively, above 2003 baseline deaths brought forward (11,500) and respiratory hospital admissions (30,700), using O3 exposure over the full year and no threshold for health effects. The health burdens are greatest under the ‘current legislation’ scenario because O3 concentrations increase as a result of both increases in background O3 concentration and decreases in UK NOx emissions. For the +5 °C scenario, and no threshold (and not including population increases), total UK health burden increases by 500 premature deaths (4%) relative to the 2003 baseline. If a 35 ppbv threshold for O3 effects is assumed, health burdens are more sensitive to the current legislation and +5 °C scenarios, although total health burdens are roughly an order of magnitude lower. In all scenarios, the assumption of a threshold increases the proportion of health burden in the south and east of the UK compared with the no threshold assumption. The study highlights that the total, and geographically-apportioned, O3-attributable health burdens in the UK are highly sensitive to the future trends of hemispheric, regional and local emissions of O3 precursors, and to the assumption of a threshold for O3 effect.


The objective of this study is to trace short-term changes in mood and heart function in elderly individuals in response to exposure to different landscaped spaces. Background: Nineteen elderly but cognitively intact residents of an assisted living facility participated in the study. They were exposed to three landscaped spaces: a Japanese style garden, an herb garden, and a simple landscaped area planted with a single tree. To assess the effect of different landscaped spaces on older adults, individuals were monitored for mood and cardiac function in response to short exposures to spaces. Mood state was assessed using Profile of Mood States (POMS) before and after viewing the spaces. Cardiac output was assessed using a portable electrocardiograph monitor before and during the viewing. We found that the structured gardens evoked greater responses in all outcome measures. Scores on the POMS improved after observation of the two organized gardens compared to responses to the simple landscaped space with a single tree. During the observation period, heart rate was significantly lower in the Japanese garden than in the other environments, and sympathetic function was significantly lower as well. We conclude that exposure to organized gardens can affect both the mood and cardiac physiology of elderly individuals. Our data further suggest that these effects can differ depending on the types of landscape to which an individual is exposed.

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To provide a review on the benefits associated with the use of sensory gardens and horticultural activities in dementia care. Maintaining quality of life is important in dementia care. Sensory gardens and horticultural activities are increasingly used in dementia care, yet their benefits are uncertain. A modified scoping review with descriptive analysis of selected empirical studies. Systematic searches in Amed, CINAHL, MEDLINE, ISI Web of Science, Embase and Scopus were used. Search terms were the free-text concepts 'healing garden', 'horticultural therapy', 'restorative garden' and 'wander garden' which were combined with dementia and Alzheimer. Sixteen studies were included with included participants ranging from eight to 129 participants. Research designs were case studies (n=2), survey (n=1), intervention studies with pretest/post-test design (n=11) and randomised controlled studies (n=2). Of these 16 studies, eight examined the benefits of sensory gardens, seven examined horticultural therapy or therapeutic horticulture and one examined the use of plants indoors. This study offers a review of the research addressing benefits of sensory gardens, therapeutic horticulture, horticultural therapy and other purposeful use of plants in dementia care. The reported findings are mainly on issues related to behaviour, affect and well-being. The findings are in general mutually supportive, however, with some contradictory findings. In addition, sleep pattern, well-being and functional level seem to improve. These types of nonpharmacological interventions may improve well-being and affect and reduce the occurrence of disruptive behaviour. Additionally, the use of psychotropic drugs, incidents of serious falls, sleep and sleep pattern also seem to improve. To further improve the use of the existing or planned gardens, an educational programme for staff that also includes skill training is recommended.


This study examines the influence of social processes on the spatial distribution of residential lawns, one of the most prominent anthropogenic environmental challenges in US
urban/suburban areas today. Specifically, we examine how three theoretically informed social drivers of urban vegetation patterns—population density, social stratification, and lifestyle behavior—explain two measures of residential lawns at the US Census block group (CBG) scale in suburban Boston, MA, USA. Using fine-spatial resolution (0.5 m) remotely sensed data, we map land cover from which we generate two lawn measures: (1) “percent lawn cover,” which is the overall percentage of land in a CBG containing lawn, and (2) “percent lawn realized stewardship,” which is the percentage of non-developed land in a CBG containing lawn. We use spatial regression to find that population density and lifestyle behavior, proxied by percentage of single-family detached homes, average household size, and percentage of protected land in the CBG—are the key social processes driving the spatial distribution of both lawn measures in our study area. Results also show that spatial regression provides theoretical insight into additional, unspecified processes influencing the spatial distribution of lawns, net of the effects of the independent variables. These findings contribute to the existing understanding of the social processes influencing the residential lawn landscape, and are therefore useful for scientists, decision-makers, and stakeholders who are interested in moderating the potential social and ecological impacts of this landscape.


At present, there are many studies that collect information on aspects of neurologic and behavioral function (cognition, sensation, movement, emotion), but with little uniformity among the measures used to capture these constructs. Further, available measures are generally expensive, normed on homogenous nondiverse populations, not easily administered, do not cover the lifespan (or have easily linked pediatric and adult counterparts for the purposes of longitudinal comparison), and not based on the current thinking in the neuroscience community. There is also a paucity of measurement tools to gauge normal children in the motor and sensation domain areas, and many of these measures rely heavily on proxy reporting. Investigators have expressed the need for brief assessment tools that could address these issues and be used as a form of "common currency" across diverse study designs and populations. This ability to assess functionality along a common metric and "crosswalk" across measures is essential to the process of being able to pool data, which is often necessary when a large and diverse sample is needed. When individual studies employ unique assessment batteries, comparisons between studies and combining data from multiple studies can be problematic. The contract for the NIH Toolbox for the Assessment of Neurological and Behavioral Function (www.nihtoolbox.org) was initiated by the NIH Blueprint for Neuroscience Research (www.neuroscienceblueprint.nih.gov) to develop a set of state-of-the-art measurement tools to enhance collection of data in large cohort studies and to advance the biomedical research enterprise.


Chronic combat-related posttraumatic stress disorder (CR-PTSD) is a condition with many treatment barriers. Nature Adventure Rehabilitation (NAR) as a second line or as a supplemental intervention has the potential to overcome some of these barriers and incorporate aspects of successful treatment modalities for PTSD within an experiential learning paradigm. In a pre-post controlled trial, CR-PTSD veterans (n1/422) underwent a 1-year NAR intervention
compared to a waiting list (WL) control group (n=20). Posttraumatic symptoms (PTS), depression, functional problems, quality of life, perceived control over illness (PCI) and hope were measured by self-report measures. PTS, emotional and social quality of life, PCI, hope and functioning improved significantly. Change in PTS was contingent upon change in PCI. The current study is the first to present NAR as a promising supplemental intervention for chronic CR-PTSD. NAR seems to work through a process of behavioral activation, desensitization, gradual exposure to anxiety evoking situations and gaining control over symptomatology.


Background Vacant lots are often overgrown with unwanted vegetation and filled with trash, making them attractive places to hide illegal guns, conduct illegal activities such as drug sales and prostitution, and engage in violent crime. There is some evidence that greening vacant lots is associated with reductions in violent crime. Methods We performed a randomised controlled trial of vacant lot greening to test the impact of this intervention on police reported crime and residents' perceptions of safety and disorder. Greening consisted of cleaning the lots, planting grass and trees, and building a wooden fence around the perimeter. We randomly allocated two vacant lot clusters to the greening intervention or to the control status (no intervention). Administrative data were used to determine crime rates, and local resident interviews at baseline (n=29) and at follow-up (n=21) were used to assess perceptions of safety and disorder. Results Unadjusted difference-in-differences estimates showed a non-significant decrease in the number of total crimes and gun assaults around greened vacant lots compared with control. People around the intervention vacant lots reported feeling significantly safer after greening compared with those living around control vacant lots (p<0.01). Conclusions In this study, greening was associated with reductions in certain gun crimes and improvements in residents' perceptions of safety. A larger randomised controlled trial is needed to further investigate the link between vacant lot greening and violence reduction.


Neurophenomenological studies seek to utilize first-person self-report to elucidate cognitive processes related to physiological data. Grounded theory offers an approach to the qualitative analysis of self-report, whereby theoretical constructs are derived from empirical data. Here we used grounded theory methodology (GTM) to assess how the first-person experience of meditation relates to neural activity in a core region of the default mode network—the posterior cingulate cortex (PCC). We analyzed first-person data consisting of meditators' accounts of their subjective experience during runs of a real time fMRI neurofeedback study of meditation, and third-person data consisting of corresponding feedback graphs of PCC activity during the same runs. We found that for meditators, the subjective experiences of undistracted awareness such as concentration and observing sensory experience, and effortless doing such as observing sensory experience, not efforting, and contentment, correspond with PCC deactivation. Further, the subjective experiences of distracted awareness such as distraction and interpreting, and controlling such as efforting and discontentment, correspond with PCC activation. Moreover, we derived several novel hypotheses about how specific qualities of cognitive processes during meditation relate to PCC activity, such as the difference between meditation
and trying to meditate. These findings offer novel insights into the relationship between meditation and mind wandering or self-related thinking and neural activity in the default mode network, driven by first-person reports.


A research agenda is currently developing around the linkages between ecosystem services and poverty alleviation. It is therefore timely to consider which conceptual frameworks can best support research at this nexus. Our review of frameworks synthesises existing research on poverty/environment linkages that should not be overlooked with the adoption of the topical language of ecosystem services. A total of nine conceptual frameworks were selected on the basis of relevance. These were reviewed and compared to assess their ability to illuminate the provision of ecosystem services, the condition, determinants and dynamics of poverty, and political economy factors that mediate the relationship between poverty and ecosystem services. The paper synthesises the key contributions of each of these frameworks, and the gaps they expose in one another, drawing out lessons that can inform emerging research. Research on poverty alleviation must recognize social differentiation, and be able to distinguish between constraints of access and constraints of aggregate availability of ecosystem services. Different frameworks also highlight important differences between categories of services, their pathways of production, and their contribution to poverty alleviation. Furthermore, we highlight that it is important to acknowledge the limits of ecosystem services for poverty alleviation, given evidence that ecosystem services tend to be more associated with poverty prevention than reduction. We conclude by reflecting on the relative merits of dynamic Social–Ecological Systems frameworks versus more static checklists, and suggest that research on ecosystem services and poverty alleviation would be well served by a new framework distilling insights from the frameworks we review.


Background Sedentary time is increasing in all societies and results in limited non-exercise physical activity (NEPA) of daily life. The importance of low NEPA for cardiovascular health and longevity is limited, especially in elderly. Aim To examine the association between NEPA and cardiovascular health at baseline as well as the risk of a first cardiovascular disease (CVD) event and total mortality after 12.5 years. Study design Cohort study. Every third 60-year-old man and woman in Stockholm County was invited to a health screening study; 4232 individuals participated (78% response rate). At baseline, NEPA and exercise habits were assessed from a self-administered questionnaire and cardiovascular health was established through physical examinations and laboratory tests. The participants were followed for an average of 12.5 years for the assessment of CVD events and mortality. At baseline, high NEPA was, regardless of regular exercise and compared with low NEPA, associated with more preferable waist circumference, high-density lipoprotein cholesterol and triglycerides in both sexes and with lower insulin, glucose and fibrinogen levels in men. Moreover, the occurrence of the metabolic syndrome was significantly lower in those with higher NEPA levels in non-exercising and regularly exercising individuals. Furthermore, reporting a high NEPA level, compared with low, was associated with a lower risk of a first CVD event (HR=0.73; 95% CI
and lower all-cause mortality (0.70; 0.53 to 0.98). A generally active daily life was, regardless of exercising regularly or not, associated with cardiovascular health and longevity in older adults.


To evaluate whether a therapeutic garden can improve the quality of life of aged care residents with dementia and their carers, objective instruments as well as interviews with residents, staff, and family members were employed. Residents' mean quality of life scores increased by just over 10%, mean depression scores decreased similarly and mean agitation scores decreased by almost half. Resident, staff and family member interviews elicited positive feedback including observations that it had improved the quality of life for residents and decreased staff and family stress levels. In sum, qualitative and quantitative pre and post findings indicate that an environmental change such as a therapeutic garden can improve the lives of aged care residents with dementia, and their formal and informal carers.


Managing physical and mental health issues associated with military service is a considerable challenge for many veterans. Helping veterans cope with these issues has become particularly important in recent years given the extraordinary demands placed on military personnel and their families. In response, a number of outdoor recreation groups such as the Sierra Club Military Families and Veterans Initiative have begun to develop and sponsor group-based nature recreation programs targeting veterans. While both anecdotal and experimental data suggest that exposure to natural environments is beneficial, few studies have examined the impacts of these programs on veterans specifically. Therefore the purpose of this research was to explore the potential benefits of veterans’ participation in multi-day group-based outdoor recreation experiences.

Four organizations, offering 12 different programs each lasting 4-7 days, were included in the study. The majority did not include formal, structured psychological counseling or therapy. The emphasis was on the outdoor programs which included activities such as backpacking and canoeing. The 98 veterans comprising the study sample were recruited and surveyed one week before, one week after, and approximately one month after participating in one of these group wilderness recreation experiences. In addition to assessing demographic and background information, survey instruments were used to measure changes in psychological well-being, social functioning, life outlook, and activity engagement over time.

Results of this study indicate that participation in extended group outdoor recreation experiences may be associated with a number of significant benefits. Study participants reported significant improvements in psychological well-being, social functioning, and life outlook one week after the outdoor experience; there was also some indication that these improvements persisted over the next month. As well participants reported that they were much more likely to take part in activities that involved exploration (i.e., learning new things, testing abilities) and listening to and helping others after the outdoor recreation experience. The changes in
psychological well-being, social functioning, life outlook, and activity engagement were particularly strong for veterans who had initially reported more severe on-going health issues.

The findings suggest that extended group-based nature recreation experiences can have significant positive impacts on veterans struggling with serious health problems. This approach is especially intriguing since many veterans may find nature recreation programs more appealing than conventional clinical treatments. Engaging in activities outdoors that involve physical challenge, camaraderie, and achievement of an objective may resonate with types of experiences that make military service highly meaningful and rewarding. Although more research is needed and many questions remain, the use of extended group-based outdoor recreation programs to ease veterans’ transition back into civilian life seems to be a promising approach.


Background: Several recent studies have identified a relationship between the natural environment and improved health outcomes. However, for practical reasons, most have been observational, cross-sectional studies.

Purpose: A natural experiment, which provides stronger evidence of causality, was used to test whether a major change to the natural environment—the loss of 100 million trees to the emerald ash borer, an invasive forest pest—has influenced mortality related to cardiovascular and lower-respiratory diseases.

Methods: Two fixed-effects regression models were used to estimate the relationship between emerald ash borer presence and county-level mortality from 1990 to 2007 in 15 U.S. states, while controlling for a wide range of demographic covariates. Data were collected from 1990 to 2007, and the analyses were conducted in 2011 and 2012.

Results: There was an increase in mortality related to cardiovascular and lower-respiratory-tract illness in counties infested with the emerald ash borer. The magnitude of this effect was greater as infestation progressed and in counties with above-average median household income. Across the 15 states in the study area, the borer was associated with an additional 6113 deaths related to illness of the lower respiratory system, and 15,080 cardiovascular-related deaths.

Conclusions: Results suggest that loss of trees to the emerald ash borer increased mortality related to cardiovascular and lower-respiratory-tract illness. This finding adds to the growing evidence that the natural environment provides major public health benefits.


Together with the call for a “green” society and the quest for well-being, the development of public action to prevent dependency make for a good context in which to revive an old idea: the therapeutic value of gardening, or gardening as therapy. What, then, do activists who advocate turning horticulture into a legitimate, professionally therapeutic practice, and to cultivate it within healthcare institutions, recommend? Proving the therapeutic virtues of gardening are the reality they must deal with, either choosing to highlight them or to avoid them. But they must also convince the medical profession, and their ambivalence is precisely what is at stake in that test.

The positive benefits of urban greenspaces for human health and well-being are widely recognised. While much intellectual effort has gone into identifying and cataloguing the environmental characteristics of places, spaces and landscapes associated with particular health outcomes, less well understood are the social dimensions through which everyday engagements with such greenspaces are framed and put into practice, and interactions between these dimensions. This article reports on preliminary findings from ethnographic research in two areas of Dundee, UK. We used mobile and participatory visual methods with greenspace users in order to investigate their everyday experiences and engagements with local greenspaces, and to understand how meanings associated with use translate (or not) into well-being benefits. The research found that experiences of greenspace – and thus any well-being benefits produced through engagement – are inescapably social and mediated through people's positioning in relation to particular social groups. Moreover there is not one social context or social order, but many, and hence meanings are contested. This prompts for more attention to be paid to how well-being from greenspace can be delivered in ways meaningful to different people and groups. We conclude that social relations and social health (as well as individual mental and physical health) need to be more thoroughly explored in relation to greenspace and its management practices.


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Several studies have shown a positive relationship between local greenspace availability and residents' health, which may offer opportunities for health improvement. This study focuses on three mechanisms through which greenery might exert its positive effect on health: stress reduction, stimulating physical activity and facilitating social cohesion. Knowledge on mechanisms helps to identify which type of greenspace is most effective in generating health benefits. In eighty neighbourhoods in four Dutch cities data on quantity and quality of streetscape greenery were collected by observations. Data on self-reported health and proposed mediators were obtained for adults by mail questionnaires (N = 1641). Multilevel regression analyses, controlling for socio-demographic characteristics, revealed that both quantity and quality of streetscape greenery were related to perceived general health, acute health-related complaints, and mental health. Relationships were generally stronger for quality than for quantity. Stress and social cohesion were the strongest mediators. Total physical activity was not a mediator. Physical activity that could be undertaken in the public space (green activity) was, but less so than stress and social cohesion. With all three mediators included in the analysis, complete mediation could statistically be proven in five out of six cases. In these analyses the contribution of green activity was often not significant. The possibility that the effect of green activity is mediated by stress and social cohesion, rather than that it has a direct health effect, is discussed.


Purpose – The number of gardening-based mental health interventions is increasing, yet when the literature was last reviewed in 2003, limited evidence of their effectiveness was identified. The purpose of this paper is to evaluate the current evidence-base for gardening-based mental health interventions and projects through examining their reported benefits and the quality of research in this field. Design/methodology/approach – Studies evaluating the benefits of gardening-based interventions for adults experiencing mental health difficulties were identified through an electronic database search. Information on the content and theoretical foundations of the interventions, the identified benefits of the interventions and the study methodology was extracted and synthesised.

Findings – Ten papers published since 2003 met the inclusion criteria. All reported positive effects of gardening as a mental health intervention for service users, including reduced symptoms of depression and anxiety. Participants described a range of benefits across emotional, social, vocational, physical and spiritual domains. Overall the research was of a considerably higher quality than that reviewed in 2003, providing more convincing evidence in support of gardening-based interventions. However, none of the studies employed a randomised-controlled trial design.

Research limitations/implications – There is a need for further high-quality research in this field. It is important that adequate outcome measures are in place to evaluate existing gardening-based mental health interventions/projects effectively.


The article examines consumers’ price sensitivity of demands for ornamental plants by estimating a system of demand equations for 16 plants at the individual consumer level. The extent to which demand would respond to price changes is an important economic question for retailers who formulate pricing strategy. The decision to increase or decrease the price of one
plant is important in optimizing retailer profit and should depend on both the own price elasticity and the substitutability of other plants for the plant in consideration. In order to answer to those questions, we collected stated preference data through a nationwide internet survey. Two-stage demand system approach proposed by Hausman and Leonard (2002) is employed in order to estimate a large system of demand equations for 16 annual, perennial and foliage plants. In estimation, a correction is made for censored data problem resulting from the use of household data with zero purchases.

There are many studies in the literature with information on consumer preferences for nursery and floriculture products. Earlier studies focused on identifying floriculture consumers by clustering consumers according to their characteristics and propensities of consumption. Behe, Prince, and Tayama (1992a) segmented supermarket floral consumers on the basis of demographic characteristics and floral-purchase factors that include their attitudes toward floral products, types of products purchased, and the uses of floral-product purchases. Behe, Prince, and Tayama (1992b) identified principal factors that affect the consumer’s floral purchase decision in supermarkets, which include product, store, occasion, use of location, and psychographic characteristics. Palma, Hall and Collart (2010) investigated plant-specific and socio-demographic factors affecting the frequency of purchase for ornamental plants. They found that the major factors impacting the frequency of buying were the purpose of the purchase (i.e., self use vs. gifts) and seasonality. As the outlets of floriculture and nursery products are diversified and the competition arises among the retailers, consumers’ preference toward different types of retail outlets became an interest of researchers’. Yue and Behe (2008) evaluated consumers’ choice of different floral retail outlets among box stores, traditional freestanding floral outlets, general retailer, other stores, and direct-to-consumer channels. They found that consumers patronizing traditional freestanding floral outlets or direct-to-consumer channels were more likely to buy arranged flowers than unarranged flowers. The authors also found that the consumers who purchased foliage plants and outdoor bedding or garden plants were more likely to buy them from box stores.

It is notable from the literature that, while these studies provide valuable information on consumer preferences for floricultural products, they do not take into account the influence of product prices on demand behavior. To the best of our knowledge, there are only three studies that evaluate the relationship between price and quantity demanded by estimating demand functions derived from consumers’ utility maximization problems under budget constraints. Abdelmagid, Wohlgenant, and Safley (1996) estimated demand for selected nursery plants sold in North Carolina employing a modified Almost Ideal Demand System (AIDS) model. Girapunthong and Ward (2003) examined the demand for fresh-cut flowers, dry/artificial flowers and potted flowers employing an AIDS model. Steen (2006) estimated the demand for cut flowers using an inverse AIDS model and data from Dutch flower auctions. However, these studies provide a limited treatment of demand analysis as they incorporate only a fraction of the floriculture and nursery market by using regional data or including only specific type of products in the analysis.


Biophilia is humans’ inherited psychological tendency to be attracted to other forms of life and the natural environment. The main purpose of this study was to identify the attributes of
horticultural activity as a form of biophilia leisure, which is based on humans’ biophilic tendency to affiliate with life and nature. Confirmatory factor analysis was used to examine the multidimensional structure of horticultural attitudes in understanding biophilia leisure. The results identified a second-order factor structure with four dimensions of horticultural attitudes: leisure belief, increasing positive mood, improving social relationships, and improving the environment. This result suggests a persuasive framework for biophilia leisure, which is beneficial not only for human well-being, but also for preserving the natural environment.


A randomized crossover study explored whether viewing different scenes prior to a stressor altered autonomic function during the recovery from the stressor. The two scenes were (a) nature (composed of trees, grass, fields) or (b) built (composed of man-made, urban scenes lacking natural characteristics) environments. Autonomic function was assessed using noninvasive techniques of heart rate variability; in particular, time domain analyses evaluated parasympathetic activity, using root-mean-square of successive differences (RMSSD) During stress, secondary cardiovascular markers (heart rate, systolic and diastolic blood pressure), showed significant increases from baseline which did not differ between the two viewing conditions. Parasympathetic activity, however was significantly higher in recovery, following, the stressor in the viewing scenes of nature condition compared to viewing scenes depicting built environments, (RMSSD 50.0 +/- 31.3 vs 34.8 +/-14.8 ms). Thus; viewing nature, scenes prior to a stressor alters autonomic activity in the recovery period,. The secondary aim was to examine autonomic function during viewing of the two scenes. Standard deviation of R–R intervals (SDRR), as change from baseline during the first 5 min of viewing nature scenes was greater than during built scenes. Overall, this suggests that nature can elicit improvements in the recovery process following a stressor.


Cancer survivors are at increased risk for second malignancies, cardiovascular disease, diabetes, and functional decline. Evidence suggests that a healthful diet and physical activity may reduce the risk of chronic disease and improve health in this population. We conducted a feasibility study to evaluate a vegetable gardening intervention that paired 12 adult and child cancer survivors with Master Gardeners to explore effects on fruit and vegetable intake, physical activity, quality-of-life, and physical function. Throughout the year-long study period, the survivor-Master Gardener dyads worked together to plan/plant three gardens, harvest/rotate plantings, and troubleshoot/correct problems. Data on diet, physical activity, and quality-of-life were collected via surveys; anthropometrics and physical function were objectively measured. Acceptability of the intervention was assessed with a structured debriefing survey. The gardening intervention was feasible (robust enrollment; minimal attrition) and well-received by cancer survivors and Master Gardeners. Improvement in three of four objective measures of strength, agility, and endurance was observed in 90% of survivors, with the following change scores [median (interquartile range)] noted between baseline and one-year follow-up: hand grip test [+ 4.8 (3.0, 6.7) kg], 2.44 meter Get-Up-and-Go [-1.0 (-1.8, -0.2) seconds], 30-second chair stand [+ 3.0 (-1.0, 5.0) stands], and six-minute walk [+ 11.6 (6.1, 48.8) meters]. Increases of >=
1 fruit and vegetable serving/day and >= 30 minutes/week of physical activity were observed in 40% and 60%, respectively. These preliminary results support the feasibility and acceptability of a mentored gardening intervention and suggest that it may offer a novel and promising strategy to improve fruit and vegetable consumption, physical activity, and physical function in cancer survivors. A larger randomized controlled trial is needed to confirm our results.


We analyse environmental learning in public-access community gardens (‘PAC-gardens’) in Berlin, representing public green spaces that are collectively managed by civil society groups. Through extensive fieldwork, and drawing upon social theories of learning, we describe learning communities in four PAC-gardens and analyse factors that influence participation and boundary interaction, that is when experiences brought in from the outside encounter socially defined competences. Results show that these PAC-gardens have self-generated social and physical structures, which to different degrees inhibit or facilitate boundary interactions, whereas skills of individuals to put those to work, in combination with the quality of the surrounding neighbourhoods, can be ascribed for creating broader participation and greater diversity in the content of learning about local sustainability. Identified learning streams included learning about gardening and local ecological conditions; about urban politics, and about social entrepreneurship. We discuss results in relation to environmental learning that combats the generational amnesia in cities about our dependence on nature, where PAC-gardens clearly distinguish themselves from more closed forms of urban gardening such as allotment gardens and gated community gardens. We conclude that PAC-gardens that intertwine gardening with social, political and economic practices can create broader and more heterogeneous learning about social–ecological conditions, and help develop sense-of-place in degraded neighbourhoods.


Environments shape health and well-being, yet little research has investigated how different real-world environmental settings influence the well-known determinant of health known as stress. Using a cross-over experimental design; this pilot study investigated the effect of four urban environments on physiological and psychological stress measures. Participants (N = 15) were exposed on separate days to one of the four settings for 20 min. These settings were designated as Very Natural; Mostly Natural; Mostly Built and Very Built. Visitation order to the four settings was individually randomized. Salivary cortisol and alpha-amylase; as well as self-report measures of stress; were collected before and after exposure to each setting. Gender was included as a variable in analysis; and additional data about environmental self-identity, pre-existing stress, and perceived restorativeness of settings were collected as measures of covariance. Differences between environmental settings showed greater benefit from exposure to natural settings relative to built settings; as measured by pre-to-post changes in salivary amylase and self-reported stress; differences were more significant for females than for males. Inclusion of covariates in a regression analysis demonstrated significant predictive value of perceived restorativeness on these stress measures, suggesting some potential level of mediation. These
data suggest that exposure to natural environments may warrant further investigation as a health promotion method for reducing stress.


Objective: While many studies report that green spaces promote mental health, some suggest the psychological benefits of physical activity are amplified if participation occurs within greener environs. We investigated whether this relationship could be observed among adults in middle-to-older age.

Method: Multilevel logit regression was used to investigate association between green space and psychological distress (Kessler scores of 22 +) among 260,061 Australians over 45 years old living in New South Wales (2006–2009). Physical activity was measured using the Active Australia survey. Percentage green space was estimated within a 1-kilometre of residence.

Results: In comparison to residents of the least green areas, those in the greenest neighbourhoods were at a lower risk of psychological distress (Odds Ratio 0.83, 95% CI: 0.76, 0.92) and were less sedentary (0.81: 0.77, 0.87). An interaction was observed between physical activity and green space (p = 0.0028). More green space did not appear to benefit mental health among the least active (0.99: 0.85, 1.15), but there was a protective association for the more physically active (0.82: 0.67, 0.99).

Conclusion: For adults in middle-to-older age, green spaces are not only important for promoting physical activity, but the mental health benefits of greener environs appear contingent upon those active lifestyles.


Objectives Experiments demonstrate that exposure to parks and other ‘green spaces’ promote favourable psychological and physiological outcomes. As a consequence, people who reside in greener neighbourhoods may also have a lower risk of short sleep duration (<6 h). This is potentially important as short sleep duration is a correlate of obesity, chronic disease and mortality, but so far this hypothesis has not been previously investigated.

Design Cross-sectional data analysis.

Setting New South Wales, Australia.

This study investigated whether neighbourhood green space was associated with a healthier duration of sleep (to the nearest hour) among 259 319 Australians who completed the 45 and Up Study baseline questionnaire between 2006 and 2009 inclusive. Multinomial logit regression was used to investigate the influence of an objective measure of green space on categories of sleep duration: 8 h (normal); between 9 and 10 h (mid-long sleep); over 10 h (long sleep); between 6 and 7 h (mid-short sleep); and less than 6 h (short sleep). Models were adjusted for psychological distress, physical activity and a range of demographic and socioeconomic characteristics.

People living in greener neighbourhoods reported a lower risk of short sleep. For example, compared with participants living in areas with 20% green space land-use, the relative risk ratios for participants with 80%+ green space was 0.86 (95% CI 0.81 to 0.92) for durations between 6 and 7 h, and 0.68 (95% CI 0.57 to 0.80) for less than 6 h sleep. Unexpectedly, the
benefit of more green space for achieving 8 h of sleep was not explained by controls for psychological distress, physical activity or other socioeconomic factors.

Green space planning policies may have wider public health benefits than previously recognised. Further research in the role of green spaces in promoting healthier sleep durations and patterns is warranted.


Experimental research on stress recovery in natural environments is limited, as is study of the effect of sounds of nature. After inducing stress by means of a virtual stress test, we explored physiological recovery in two different virtual natural environments (with and without exposure to sounds of nature) and in one control condition. Cardiovascular data and saliva cortisol were collected. Repeated ANOVA measurements indicated parasympathetic activation in the group subjected to sounds of nature in a virtual natural environment, suggesting enhanced stress recovery may occur in such surroundings. The group that recovered in virtual nature without sound and the control group displayed no particular autonomic activation or deactivation. The results demonstrate a potential mechanistic link between nature, the sounds of nature, and stress recovery, and suggest the potential importance of virtual reality as a tool in this research field.


Despite growing evidence of public health benefits from urban green space there has been little longitudinal analysis. This study used panel data to explore three different hypotheses about how moving to greener or less green areas may affect mental health over time. The samples were participants in the British Household Panel Survey with mental health data (General Health Questionnaire scores) for five consecutive years, and who relocated to a different residential area between the second and third years (n = 1064; observations = 5320). Fixed-effects analyses controlled for time-invariant individual level heterogeneity and other area and individual level effects. Compared to premove mental health scores, individuals who moved to greener areas (n = 594) had significantly better mental health in all three postmove years (P = .015; P = .016; P = .008), supporting a "shifting baseline" hypothesis. Individuals who moved to less green areas (n = 470) showed significantly worse mental health in the year preceding the move (P = .031) but returned to baseline in the postmove years. Moving to greener urban areas was associated with sustained mental health improvements, suggesting that environmental policies to increase urban green space may have sustainable public health benefits.


Early visual areas contain specific information about visual items maintained in working memory, suggesting a role for early visual cortex in more complex cognitive functions [14]. It is an open question, however, whether these areas also underlie the ability to internally generate images de novo (i.e., mental imagery). Research on mental imagery has to this point focused mostly on whether mental images activate early sensory areas, with mixed results [5-7]. Recent studies suggest that multivariate pattern analysis of neural activity patterns in visual regions can reveal content-specific representations during cognitive processes, even though overall activation
levels are low [1-4]. Here, we used this approach [8, 9] to study item-specific activity patterns in early visual areas (V1-V3) when these items are internally generated. We could reliably decode stimulus identity from neural activity patterns in early visual cortex during both working memory and mental imagery. Crucially, these activity patterns resembled those evoked by bottom-up visual stimulation, suggesting that mental images are indeed "perception-like" in nature. These findings suggest that the visual cortex serves as a dynamic "blackboard" [10, 11] that is used during both bottom-up stimulus processing and top-down internal generation of mental content.


Some consumers are becoming more interested in and purchasing products that are locally grown and/or ecologically friendly. Market segmentation and product targeting are efficient methods to allocate a firm’s scarce marketing resources to supply heterogeneous markets. This study’s objective was to identify consumer segments, focusing on their gardening purchases, to determine whether there were differences in consumer preferences for provenance and environmental attributes for transplant purchases. Using a consumer survey of U.S. and Canadian consumers, we found that participants who purchased different plant types had distinct preferences for varying environmental attributes and provenances. We profiled nine consumer segments, identifying their plant purchases and preferences for local and sustainably grown products and plant containers. Results provide plant producers and retailers with market segments that can be identified and targeted and provide a basis for customizable marketing communications to enhance profits.


In a rehabilitation programme for people with stress disorder, a garden room can be an important ingredient. Stress disorder has been the most common cause of sick leave in Sweden since the 1990s. The study is about the therapeutic role of nature in the form of a garden, as participants experienced it during the recovery process. The research subjects were on sick leave due to stress related symptoms and took part in rehabilitation at the Alnarp Rehabilitation Garden in southern Sweden. The article is based on interviews with five participants who describe their experiences of garden therapy and what they perceive as essential for their recovery. The garden was associated with many positive experiences of interacting with people and greenery and perceived as a safe and useful arena in their recovery. The participants described how nature affords positive sensory experiences, physical and psychological well-being, but also how nature and the garden facilitate beneficial social interactions with other participants and care-givers. Importance was also allocated to the symbolism of nature as associated to one's own growth and the passing of time. They conceptualised the recovery process as initiated by more traditional forms of therapies but reinforced and consolidated by the access to nature and the garden rooms. In a dynamic psychological perspective on place, the study illustrates the potential role of using nature as a venue to facilitate self-regulation of physiological, psychological and social needs.

There is longstanding belief that vegetation encourages crime as it can conceal criminal activity. Other studies, however, have shown that urban residential areas with well-maintained vegetation experience lower rates of certain crime types due to increased surveillance in vegetated spaces as well as the therapeutic effects ascribed to vegetated landscapes. The present research analyzes the association of vegetation with crime in a case study of Philadelphia, Pennsylvania. We examine rates of assaults, robberies, burglaries, and thefts in relation to remotely sensed vegetation abundance at the Census tract level. We employ choropleth mapping, correlation, ordinary least squares regression, and spatial econometric modeling to examine the influence of vegetation on various crime types while controlling for tract-level socioeconomic indicators. Results indicate that vegetation abundance is significantly associated with lower rates of assault, robbery, and burglary, but not theft. This research has implications for urban planning policy, especially as cities are moving towards ‘green’ growth plans and must look to incorporate sustainable methods of crime prevention into city planning.


The original Health Effects of Climate Change in the UK report, published by the Department of Health in 2002 was one of the earliest attempts at quantifying the health effects of climate change for the UK. In 2008, a further update was published by the Department of Health and the Health Protection Agency, based on new climate change projections for the UK. The present report has been prepared on the recommendation of the Department of Health, and provides further evidence and analysis, based on the most recent climate change projections for the UK. Individual chapters have been written and peer-reviewed by a wide range of experts from academia, industry and government as well as within the Health Protection Agency. The latest UK climate change projections have provided clear indications of the future climate in the UK over the coming decades based on probabilistic outcomes and a range of future emissions scenarios. Where possible, and taking into account the wide range of uncertainties in both climate projections and health effects, quantitative analyses have been performed. For each chapter, the analysis focuses on regional differences in possible future health impacts and discusses vulnerable populations and adaptation effects in the UK. This report follows on from the first UK Climate Change Risk Assessment (published in 2012) and can be used to inform the National Adaptation Programme.

The global scientific consensus is that climate change is unequivocal, with high confidence that the net effect of anthropogenic activity since 1750 has been that of warming the planet. In the UK, temperatures have been increasing by around 0.25°C per decade since the 1960s, summer rainfall has decreased and winter rainfall has increased. Climate projections indicate that annual mean temperatures will be around 2 to 5°C higher than present in the UK by 2080. Heatwaves are likely to become more frequent in the future in the UK. At present, the health burden due to low temperature exceeds that of high temperature. However, heat-related mortality, which is currently around 2,000 premature deaths per year, is projected to increase steeply in the UK throughout the 21st century, from around a 70% increase in the 2020s to around 540% in the 2080s. Southern, central and eastern England appear to be most vulnerable to current and future effects of hot weather compared with other UK regions. Cold is still likely to contribute to the majority of temperature related health effects over the coming decades, although the health burden due to the cold is projected to decline by the 2080s compared with the
present day levels. The elderly are more vulnerable to extreme heat and cold than younger people, so future health burdens are likely to be amplified by an ageing population.

The future health impacts of air pollution due to climate change are difficult to project, since air pollution levels are largely controlled by man-made atmospheric emissions of chemicals, as well as weather and climate. We have focused our quantitative assessment on the future impacts of ground level ozone pollution on health for a range of emission scenarios for the 2030s. Ozone is a respiratory irritant strongly affected by the climate, and background levels of ozone are increasing across much of Europe. As well as future emissions scenarios, we have included a temperature sensitivity analysis to test changes in ozone related to increased temperatures in the UK. The extent of health impacts of future ozone levels depends on whether or not a threshold effect for ozone is assumed, and the type of future emissions scenario for ozone precursors and greenhouse gases.

Present day ozone-related mortality is estimated to be up to around 11,900 premature deaths per year, and the assessment shows increases of up to between 14,000 and 15,000 for the 2030s depending on future ozone precursor emissions. Increasing temperatures by 5°C is projected to lead to an increased ozone related health burden of 4% (around 500 premature deaths per year) compared with the baseline and assuming no threshold effect, with the south east of England seeing the largest increases.

A new chapter in this report concerns aeroallergens associated with pollen grains and fungal spores in the context of climate change. It is thought that changes in seasonality, temperature and weather patterns in the UK, related to climate change may have an effect on human exposure to pollen grains, as well as affecting the potency of aeroallergens. Existing allergy sufferers may suffer from longer pollen seasons and more rapid symptom development. There is also likely to be a longer term indirect effect on the UK population through changes in plant and fungal distributions. This chapter reviews links between aeroallergens and the climate, and motivates the need for further research on the likely effects of climate change on the health impacts of pollen exposure in future.

Effects of climate change in the indoor environment should not be overlooked, as the population of the UK typically spends 90% of their time indoors. Another new chapter discusses the way in which climate change may exacerbate health risks associated with building overheating, indoor air pollution, flood damage and water and biological contamination of buildings. Hospitals, health centres and care homes may be adversely affected by high temperatures during heatwaves and flooding. The potential health effects of climate change adaptation and mitigation options are discussed in this context.

Climate change may have an effect on ambient levels of Ultraviolet (UV) radiation in the UK, but human exposure to UV radiation is also strongly influenced by lifestyle and behaviour. For example, warmer summers in the UK may increase population exposure to UV radiation due to increased time spent outdoors. This could increase health risks associated with UV including some skin cancers. However, moderate exposure to the sun is beneficial for the production of vitamin D. Climate change is also thought to be delaying the recovery of the stratospheric ozone layer, which affects the amount of UV radiation reaching the surface of the Earth.

The effects of climate change on floods and droughts have been investigated in terms of health impact, although this is difficult to quantify. Understanding of the health implications of flooding, particularly impacts on mental health and impacts from disruption to critical supplies of utilities such as electricity and water has increased in recent years, but knowledge gaps still remain. It is likely that climate change will increase river and coastal flood risk in the coming
decades, particularly in South Wales, Northwest Scotland, East Anglia, the Thames Estuary and Yorkshire and Humberside regions.

Vector-borne diseases are influenced in complex ways by the climate, land use changes and human activities, and as such it is difficult to make quantitative predictions of future changes due to climate change. However, it is likely that the range, activity and vector potential of many ticks and mosquitoes will increase across the UK by the 2080s. There is also the potential for introduction of exotic species and pathogens. Potential drivers of these changes include milder winters and warmer summers. Climate change adaptation strategies such as those to mitigate flooding and sea level rise may have more effect on vector-borne disease exposure than the direct effects of climate change.

Climate change can influence the incidence of certain water and food-borne diseases, which show seasonal variation. Climate change is also likely to affect the risk from water and food-borne disease through changes in human behaviour associated, for example, with food hygiene. Increased temperature will allow pathogens such as Salmonella to grow more readily in food. However, interventions to prevent this are likely to have more of an effect in reducing numbers of cases than climate change will have on increasing them. Climate change may also lead to reductions in the availability of certain food groups, which may lead to reductions in the nutritional quality of dietary intake in some population groups.

The final chapter of this report discusses the health co-benefits of measures to reduce greenhouse gas emissions. Examples include a decline in air pollution from measures to reduce anthropogenic greenhouse gas emissions (e.g. from coal combustion), increased physical activity as a result of reduced car use in urban centres, and health benefits from reduced dietary saturated fat consumption from animal products. When taking into account these types of health co-benefits, climate change mitigation policies become more attractive. However, certain climate change mitigation policies, such as sealing buildings to increase energy efficiency, may lead to increased exposure to indoor air pollution (unless adequate ventilation is maintained). This highlights the need for climate change mitigation policies to be subject to health impact assessment.

Public health recommendations and research needs have been identified for each of the specific health effects of climate change in the UK covered in this report.


Background: Previous research shows a positive link between the amount of green area in one’s residential neighbourhood and self-reported health. However, little research has been done on the quality of the green area, as well as on quantity and quality of smaller natural elements in the streetscape. This study investigates the link between the objectively assessed quantity and quality of (1) green areas and (2) streetscape greenery on the one hand and three self-reported health indicators on the other.

Methods: 80 Dutch urban neighbourhoods were selected, varying in the amount of nearby green area per dwelling, as determined by Geographic Information System analysis. The quality of green areas, as well as the quantity and quality of streetscape greenery, was assessed by observers using an audit tool. Residents of each neighbourhood were asked to complete a questionnaire on their own health (N=41641). In multilevel regression analyses, we examined the relationship between greenspace indicators and three health indicators, controlling for socio-demographic and socioeconomic characteristics.
Results: Both indicators for the quantity of greenspace were positively related to all three health indicators. Quantity and quality indicators were substantially correlated in the case of streetscape greenery. Nevertheless, the quality indicators tended to have added predictive value for the health indicators, given that the quantity information was already included in the model.

Conclusions: The quantity and also the quality of greenspace in one’s neighbourhood seem relevant with regard to health. Furthermore, streetscape greenery is at least as strongly related to self-reported health as green areas.


The extent to which urban tree cover influences crime is in debate in the literature. This research took advantage of geocoded crime point data and high resolution tree canopy data to address this question in Baltimore City and County, MD, an area that includes a significant urban–rural gradient. Using ordinary least squares and spatially adjusted regression and controlling for numerous potential confounders, we found that there is a strong inverse relationship between tree canopy and our index of robbery, burglary, theft and shooting. The more conservative spatially adjusted model indicated that a 10% increase in tree canopy was associated with a roughly 12% decrease in crime. When we broke down tree cover by public and private ownership for the spatial model, we found that the inverse relationship continued in both contexts, but the magnitude was 40% greater for public than for private lands. We also used geographically weighted regression to identify spatial non-stationarity in this relationship, which we found for trees in general and trees on private land, but not for trees on public land.

Geographic plots of pseudo-t statistics indicated that while there was a negative relationship between crime and trees in the vast majority of block groups of the study area, there were a few patches where the opposite relationship was true, particularly in a part of Baltimore City where there is an extensive interface between industrial and residential properties. It is possible that in this area a significant proportion of trees is growing in abandoned lands between these two land uses.


This contribution builds upon contemporary work on principles of biological attraction as well as earlier work on biophilia while synthesizing literatures on restorative environments, community-based ecological restoration, and both community and social-ecological disaster resilience. It suggests that when humans, faced with a disaster, as individuals and as communities and populations, seek engagement with nature to further their efforts to summon and demonstrate resilience in the face of a crisis, they exemplify an urgent biophilia. This urgent biophilia represents an important set of human-nature interactions in SES characterized by hazard, disaster, or vulnerability, often appearing in the ‘backloop’ of the adaptive cycle. The relationships that human-nature interactions have to other components within interdependent systems at many different scales may be one critical source of resilience in disaster and related contexts. In other words, the affinity we humans have for the rest of nature, the process of remembering that attraction, and the urge to express it through creation of restorative environments, which may also restore or increase ecological function, may confer resilience across multiple scales. In making this argument, the paper also represents a novel contribution to
further theorizing alternatives to anthropocentric understandings of human-nature relations, and strongly makes the case for humans as part of, not separate from, ecosystems.


Green space has been associated with a wide range of health benefits, including stress reduction, but much pertinent evidence has relied on self-reported health indicators or experiments in artificially con- trolled environmental conditions. Little research has been reported using ecologically valid objective measures with participants in their everyday, residential settings. This paper describes the results of an exploratory study (n = 25) to establish whether salivary cortisol can act as a biomarker for variation in stress levels which may be associated with varying levels of exposure to green spaces, and whether recruitment and adherence to the required, unsupervised, salivary cortisol sampling protocol within the domestic setting could be achieved in a highly deprived urban population. Self-reported measures of stress and general wellbeing were also captured, allowing exploration of relationships between cortisol, wellbeing and exposure to green space close to home. Results indicate significant relationships between self-reported stress (P < 0.01), diurnal patterns of cortisol secretion (P < 0.05), and quantity of green space in the living environment. Regression analysis indicates percentage of green space in the living envi- ronment is a significant (P < 0.05) and independent predictor of the circadian cortisol cycle, in addition to self-reported physical activity (P < 0.02). Results also show that compliance with the study protocol was good. We conclude that salivary cortisol measurement offers considerable potential for exploring relationships between wellbeing and green space and discuss how this ecologically valid methodology can be developed to confirm and extend findings in deprived city areas to illuminate why provision of green space close to home might enhance health.


Background: In recent years, the physiological relaxing effect brought by nature is becoming clear; however, many workers find it difficult to be exposed to nature in their working environment. Exposure to fresh flowers represents an opportunity to incorporate nature into their working lives. In this study, we examined the effects of exposure to roses on physiological and psychological variables (heart rate variability, pulse rate, and subjective responses) in office workers.

Results: The experimental site was Mizuho Information & Research Institute, Inc., in the Tokyo metropolitan area. Thirty-one male office workers were included in the present study. The subjects were exposed to thirty unscented pink roses (Rosa, Dekora) arranged in a cylindrical glass vase for 4 min. In the control condition, the subjects were not exposed to flowers. After the experiments, the subjects completed a questionnaire. The order of exposure was counterbalanced among subjects. Among subjects exposed to roses, the high-frequency component of heart rate variability was significantly higher than in controls. Similarly, ‘comfortable,’ ‘relaxed’ and ‘natural’ feelings were more common in subjects exposed to roses.

Conclusions: Data from this study support the presence of physiological and psychological relaxing effects of being exposed to flowers on office workers.
Florida’s floriculture industry had experienced a decrease in sales beginning in 2007. This decrease coincided with the recession of 2007. In 2009 and 2010 there was some recovery but sales were not up to their 2006 level. To improve these sales the industry is search for a new way to market indoor plants. One possible avenue is to market indoor plants as “green” or natural indoor air cleaners. Scientific research has shown that specific indoor plants can remove indoor air pollution, sometimes called Volatile Organic Compounds/Chemicals (VOCs). In order to determine if consumers are interested in buying these indoor plants choice-based conjoint (CBC) analysis was used. CBC analysis is a commonly used marketing tool and is most often in a survey form as was done here. This method allows participants to choose the attribute levels that they would prefer to have in a houseplant. Usually the attributes are chosen by the researcher and/or a marketing manager. In this study, however, the majority of participants were allowed to select the attributes they preferred. The survey permitted participants to choose three of six attributes. In addition, information about VOCs and the ability of specific indoor plants to remove them was randomly provided to some participants. This information was provided to determine if it had an effect on participants’ choices. The results of the CBC analysis when VOC information was provided were compared to the results of the CBC analysis when VOC information was not given. To determine if there was a difference between surveys allowing participants to choose attributes and a survey with a set number of attributes, a survey with a fixed number of attributes was also distributed. Again, VOC information was randomly provided to participants. The results show that VOC information did make a difference in participants’ selections. There were also small differences between the surveys permitting attribute selection and the surveys with fixed attributes.


Background Cities are expanding and accommodating an increasing proportion of the world’s population. It is important to identify features of urban form that promote the health of city dwellers. Access to green space has been associated with health benefits at both individual and neighbourhood level. We investigated whether a relationship between green space coverage and selected mortality rates exists at the city level in the USA.

Methods An ecological cross-sectional study. A detailed land use data set was used to quantify green space for the largest US cities (n=49, combined population of 43 million). Linear regression models were used to examine the association between city-level ‘greenness’ and city-level standardised rates of mortality from heart disease, diabetes, lung cancer, motor vehicle fatalities and all causes, after adjustment for confounders.

Results There was no association between greenness and mortality from heart disease, diabetes, lung cancer or automobile accidents. Mortality from all causes was significantly higher in greener cities.

Conclusions While considerable evidence suggests that access to green space yields health benefits, we found no such evidence at the scale of the American city. In the USA, greener cities tend also to be more sprawling and have higher levels of car dependency. Any benefits that
the green space might offer seem easily eclipsed by these other conditions and the lifestyles that accompany them. The result merits further investigation as it has important implications for how we increase green space access in our cities.


To examine the health benefits of a bedroom window view to natural surroundings for patients undergoing a residential rehabilitation programme. Longitudinal quasi-experiment. 

SETTING: A residential rehabilitation centre. Two-hundred and seventy-eight coronary and pulmonary patients provided data at all measurement points during the programme. Blind, quasi-random allocation to a private bedroom with a panoramic view to natural surroundings or with a view either partially or entirely blocked by buildings. Self-reported physical and mental health (SF-12), subjective well-being, emotional states, use of the private bedroom and leisure activities. For women, a blocked view appeared to negatively influence change in physical health (time x view x gender interaction, F(4,504) = 2.51, P = 0.04), whereas for men, a blocked view appeared to negatively influence change in mental health (time x view x gender interaction, F(4,504) = 5.67, P < 0.01). Pulmonary patients with a panoramic view showed greater improvement in mental health than coronary patients with such a view (time x view x diagnostic group interaction, F(4,504) = 2.76, P = 0.03). Those with a panoramic view to nature more often chose to stay in their bedroom when they wanted to be alone than those with a blocked view (odds ratio (OR) = 2.32, 95% confidence interval (CI) 1.08-5.01). An unobstructed bedroom view to natural surroundings appears to have better supported improvement in self-reported physical and mental health during a residential rehabilitation programme, although the degree of change varied with gender and diagnostic group.


Previous studies performed by the National Aeronautics Space Administration (NASA) indicated that plants and associated soil microorganisms may be used to reduce indoor pollutant levels. This study investigated the ability of plants to improve indoor air quality in schools. A 9-wk intensive monitoring campaign of indoor and outdoor air pollution was carried out in 2011 in a primary school of Aveiro, Portugal. Measurements included temperature, carbon dioxide (CO(2)), carbon monoxide (CO), concentrations of volatile organic compounds (VOC), carbonyls, and particulate matter (PM(1)(0)) without and with plants in a classroom. PM(1)(0) samples were analyzed for the water-soluble inorganic ions, as well for carbonaceous fractions. After 6 potted plants were hung from the ceiling, the mean CO(2) concentration decreased from 2004 to 1121 ppm. The total VOC average concentrations in the indoor air during periods of occupancy without and with the presence of potted plants were, respectively, 933 and 249 mug/m(3). The daily PM(1)(0) levels in the classroom during the occupancy periods were always higher than those outdoors. The presence of potted plants likely favored a decrease of approximately 30% in PM(1)(0) concentrations. Our findings corroborate the results of NASA studies suggesting that plants might improve indoor air and make interior breathing spaces healthier.
Past studies have suggested that a link between health outcomes and green space is due to increased levels of physical activity of individuals living in areas with more green space. We found a positive association between green space and physical activity levels. The odds of achieving the recommended amount of physical activity was 1.27 (95% CI: 1.13–1.44) for people living in the greenest quintile in England compared to those living in the least green quintile, after controlling for individual and environmental factors. However, no association was found between green space and types of physical activity normally associated with green space. An association was found with other types of physical activity (gardening and do-it-yourself, and occupational physical activity). These findings suggest that although there is a positive association between physical activity and green space it may not be explained by individuals using green space for recreation.

Experimental evidence suggests that there may be synergy between the psychological benefits of physical activity, and the restorative effects of contact with a natural environment; physical activity in a natural environment might produce greater mental health benefits than physical activity elsewhere. However, such experiments are typically short-term and, by definition, artificially control the participant types, physical activity and contact with nature. This observational study asked whether such effects can be detected in everyday settings at a population level. It used data from the Scottish Health Survey 2008, describing all environments in which respondents were physically active. Associations were sought between use of each environment, and then use of environments grouped as natural or non-natural, and the risk of poor mental health (measured by the General Health Questionnaire (GHQ)) and level of wellbeing (measured by the Warwick Edinburgh Mental health and Wellbeing Score (WEMWBS). Results showed an independent association between regular use of natural environments and a lower risk of poor mental health, but not for activity in other types of environment. For example, the odds of poor mental health (GHQ ≥ 4) among those regularly using woods or forests for physical activity were 0.557 (95% CI 0.323–0.962), compared to non-users. However, regular use of natural environments was not clearly associated with greater wellbeing, whilst regular use of non-natural environments was. The study concludes that physical activity in natural environments is associated with a reduction in the risk of poor mental health to a greater extent than physical activity in other environments, but also that activity in different types of environment may promote different kinds of positive psychological response. Access to natural environments for physical activity should be protected and promoted as a contribution to protecting and improving population mental health.

Highlights:  ► Experimental studies show physical activity in natural environments may be better for mental health than activity elsewhere.  ► Such studies tend to be small, brief and not to test effects of activity in natural environments as part of everyday life.  ► This study looked for evidence of such effects in a large, real-world population.  ► It found evidence that physical activity in natural environments is better for mental health than activity elsewhere.  ► Each additional use of a natural environment per week is associated with about a 6% lower risk of poor mental health.

The past decade has seen resurgence in interest in gathering wild plants and fungi in cities. In addition to gathering by individuals, dozens of groups have emerged in U.S., Canadian, and European cities to facilitate access to nontimber forest products (NTFPs), particularly fruits and nuts, in public and private spaces. Recent efforts within cities to encourage public orchards and food forests, and to incorporate more fruit and nut trees into street tree planting programs indicate a growing recognition among planners that gathering is an important urban activity. Yet the academic literature has little to say about urban gathering practices or the people who engage in them. This annotated bibliography and literature review is a step toward filling the gap in knowledge about the socioecological roles of NTFPs in urban ecosystems in the United States. Our objectives are to demonstrate that gathering—the collecting of food and raw materials—is a type of human-plant interaction that warrants greater attention in urban green space management, and to provide an overview of the literature on human-plant interactions—including gathering—in urban environments. Our review found that very few studies of urban gathering have been done. Consequently, we included gathering field guides, Web sites, and articles from the popular media in our search. These sources, together with the small number of scientific studies of urban gathering, indicated that people derive numerous benefits from gathering plants and fungi in U.S. cities. Gathering provides useful products, encourages physical activity, offers opportunities to connect with and learn about nature, helps strengthen social ties and cultural identities, and, in some contexts, can serve as a strategic tool for ecological restoration. These benefits parallel those identified in environmental psychology and cultural ecology studies of the effects of gardening and being in nature. The literature on human-plant interactions also emphasizes that humans need to be treated as endogenous factors in dynamic, socially and spatially heterogeneous urban ecosystems. Spatially explicit analyses of human-plant interactions show that the distribution of wealth and power within societies affects the composition, species distribution, and structure of urban ecologies. Our review also indicates that tensions exist between NTFP gatherers and land managers, as well as between gatherers and other citizens over gathering, particularly in public spaces. This tension likely is related to perceptions about the impact these practices have on cherished species and spaces. We conclude that gathering is an important urban activity and deserves a greater role in urban management given its social and potential ecological benefits. Research on urban gathering will require sensitivity to existing power imbalances and the use of theoretical frameworks and methodologies that assume humans are integral and not always negative components of ecosystems.


Adults associate their childhood with playing outdoors, often in natural settings. This type of free play is valuable to child development. Children tend to use outdoor play areas in physically active ways, and time spent outdoors relates positively to increased physical activity in children. However, children today are spending an increasing amount of time indoors rather than outdoors. Recent research has shown that the amount of time children spend in outdoor play is directly related to parental concerns about their children's exposure to outdoor hazards. The purpose of this project was to investigate the relationship between parental attitude toward nature
and the development of fine and gross motor skills in young children. The sample for this study was drawn from parents of children ages 3 to 5 years old enrolled at one of two University Child Development Centers. The assessment tool used was composed of sections that ask parents about their attitudes toward nature, about their young children spending time outdoors, how much time their children actually spend in outdoor and indoor activities, and standard demographic questions. The childcare centers independently assessed correlations and ANOVA. Results from this study indicated that parents had positive views toward nature and towards their child's recreation. Children who participated in certain indoor activities tended to score higher in the area of fine motor skills. However, children who spent more time indoors in free play had lower gross motor skill scores. Parents who scored better on the Parental Attitude toward Their Child's Outdoor Recreation scale reported that their child spent more time in outdoor free play and outdoor organized sports and activities. Parents preferred outdoor play spaces when compared to indoor play spaces and specifically those outdoor spaces that were constructed with more nearby natural components.


This paper focuses on the role of home gardens in the lives of immigrants. An ethnographic research was conducted which included observations of 16 home gardens and unstructured open-ended interviews with 28 immigrants from India, Vietnam, Indonesia, Philippines, Iran, China and Taiwan, to Southern California, USA. The lessons from this study are that for immigrants home gardens can be: (a) religious space enabling everyday practice of religion as well as meditation and socialization; (b) culture space through plants, fruits and flowers that enable cultural cuisine, ethnomedicine, and identity continuity; (c) ecological space that assists with environmental/ecological nostalgia, reconnecting people with landscapes left behind as well as forging new connections to place; (d) family memorial space where gardens honor and memorialize family members and provide opportunities for intergenerational linkages. These enable immigrants to engage with, personalize, and experience their new environment in deeply meaningful ways.


Outdoor shading affects the thermal environment and human thermal comfort, thereby influencing the usage of space. The objective of this study is to establish a relationship between the thermal environment and number of people visiting an outdoor space, and to explore the utilization of outdoor space during different seasons with various shading levels. This study includes onsite investigations of the microclimate parameters of the thermal environment and attendance at a park in central Taiwan. The results in cool seasons showed a positive correlation among the air temperature, mean radiant temperature (Tmrt), and physiologically equivalent temperature (PET) of shaded areas and the number of visitors. In hot seasons, the Tmrt and PET, which also reflect solar radiation conditions, are negatively correlated with the number of visitors. In other words, the higher Tmrt/PET values indicate that fewer people visit the park during the summer. Meanwhile, a significant correlation exists between park utilization and solar radiation conditions. This study proposes the use of area-averaged sky view factor (SVFa), instead of the traditional single-point sky view factor from fisheye photographs (SVFsp), as the indicator for measuring the shading level at various areas in parks. Analytical results indicate
that the lower the SVFa, the higher the park utilization. This study highlights the importance of shade design in parks located in tropical or subtropical climates. The results can serve as a reference for park design in the future.

**Highlights:**
- Assessment of thermal environment and park attendance in Taiwan.
- Warmer thermal conditions contribute more attendances in cool season.
- Warmer thermal conditions contribute fewer attendances in hot season.
- Areas with more shading have higher utilization intensity in the park.
- Lower area-averaged sky view factors attract more people attending the park.


Five million years passed before humans evolved into what we are today. Therefore, more than 99.99% of our evolutionary history was spent in natural environments, assuming that urbanization can be defined as a postindustrial revolution development. We have become the species we are today, living in a modern civilization, through a process of evolution within a natural environment. Human bodies are made so as to adapt to nature. However, terms that we hear today, such as “technostress (Brod, 1984),” indicate that artificialization, which is the process of society and our lives being intruded by technologies of different types, is occurring so rapidly that we now experience stressful situations and are forced to deal with the resultant pressures.

If, under such circumstances, we receive a nature-based stimulus through nature therapy, we may become aware of what we really are. We may have the chance to relax and be very comfortable. This is accomplished without logical thought. Instead, we intuitively perceive the world through the five senses. Because this process cannot be described in words, physiological indicators play an important role.

Although we are now living in a society characterized by urbanization and artificialization, our physiological functions are still adapted to nature (Miyazaki et al., 2011). Because of this discrepancy between our body requirements and our manner of living, our stress levels are always very high and our sympathetic nervous system is excessively stimulated. In many cases, lowering elevated stress levels to a point where the body can function properly is an immediate necessity. This is exactly where nature therapy comes in. As the body approaches the “expected” natural state of well-being, immune functions are enhanced and disease resistance improves. In modern medicine, for example, we treat ourselves with antibiotics when we contract pneumonia, expecting them to relieve symptoms. In contrast, nature therapy causes a “nonspecific effect” whereby our bodies become resistant to pneumonia as a result of increased immune function induced by relief of body stress.


Heat waves have a drastic impact on urban populations, which could increase with climate change. We evaluated new indicators of elderly people’s exposure to heat in Paris, from a public health prevention perspective, using satellite thermal images. We used a time series of 61 images from the satellites of the National Oceanic and Atmospheric Administration’s (NOAA) Advanced Very High Resolution Radiometer (AVHRR) taken from 1 to 13 August 2003 to produce thermal indicators of minimum, maximum, and mean surface temperatures and diurnal temperature amplitude, with different lags between the meteorological data and the
health impact. Health data came from a case-control study involving 241 people ≥ 65 years of age who died in the city of Paris or the nearby suburban area of Val-de-Marne during the August 2003 heat wave, and 241 controls who were matched to cases on age, sex, and residence. For each person, we integrated the thermal indicators in a conditional logistic regression model, adjusted for age and other potential confounders. We computed odds ratios (ORs) comparing the 90th and 50th percentiles of the temperature differences between cases and controls for various indicators. Mortality risk was significantly associated with exposure for two indicators: minimum temperatures averaged for 1–13 August [for a 0.41°C increase, OR = 2.17; 95% confidence interval (CI): 1.14, 4.16] and minimum temperature averaged on the day of death and the 6 preceding days (for a 0.51°C increase: OR = 2.24; 95% CI: 1.03, 4.87). Our results support the influence of night temperatures on the health impact of heat waves in urban areas. Urban heat exposure indicators based on satellite imagery have the potential to identify areas with higher risk of death, which could inform intervention decisions by key stakeholders.


Seasonal affective disorder (SAD) is a form of recurrent depressive or bipolar disorder, with episodes that vary in severity. Seasonal patterns of depressive episodes are common, but SAD seems to be less common than such patterns suggest. SAD was at first believed to be related to abnormal melatonin metabolism, but later findings did not support this hypothesis. Studies of brain serotonin function support the hypothesis of disturbed activity. The short-allele polymorphism for serotonin transporter is more common in patients with SAD than in healthy people. Atypical depressive symptoms commonly precede impaired functioning, and somatic symptoms are frequently the presenting complaint at visits to family physicians. The best treatment regimens include 2500 lx of artificial light exposure in the morning. When patients seem to have no response or to prefer another treatment, antidepressants should be considered.


Production of attractive marketable poinsettia (Euphorbia pulcherrima) pot plants throughout the year can be achieved by forced blooming in the off season, but it is necessary to study their post production conditions and public acceptability prior to marketing. The poinsettia pot plants produced in the off season, when evaluated on its acceptability by the general public through a questionnaire, indicated that 76.6% of the participants accepted it as a suitable pot plant for indoor decorations in local festivals. In the experiments conducted to evaluate retention of attractiveness of poinsettia under different indoor conditions, mainly at different light levels, it was revealed that leaves, bracts and bract color of these artificially-induced plants remained more than 8 weeks under 1600-4000 lux light level. Almost all leaves and more than 50% of colorful bracts dropped under the 1-50 lux, and 50-200 lux light levels within the first four weeks while their color reduced to 50%.


Urban nature, including residential gardens, can promote biodiversity and increase human wellbeing. Understanding factors that encourage the spread of gardening within cities may help
planners facilitate healthier and more biodiverse urban communities. This study characterizes the spatial distribution and attributes of gardens found in easement areas of Ann Arbor, Michigan. Spatial analyses of these privately managed public spaces provide evidence of clustering for both presence of gardens and their esthetic quality. Data collected on the location and attributes of easements from 22,562 properties during summer of 2009, show that 11% of these properties held an easement garden. Results of multiple spatial analyses, each targeting a different aspect of garden distribution, show that (a) the most intense easement garden clustering occurs among neighbors with direct visual access to nearest neighbors’ easement areas; (b) it is 2.4 times as likely that a property holds an easement garden if a property within 300m holds one; (c) although clustering is measureable for all neighborhood sizes up to 610m from home, peak clustering happens within 910m of home; and (d) clustering of easement gardens are clustered in terms of quality (appeal), and greatest clustering occurs between pairs of adjacent neighbors. While larger scale factors may play a role in where a garden cluster is initiated, the dominant occurrence of relatively small cluster sizes indicates that social contagion is in play. The potential value of social contagion is discussed as a mechanism for spread sustainable behaviors that support ecological resilience in urban areas.


Traditional turfgrasses found in residential lawns provide a functional and aesthetically pleasing landscape if provided adequate resource inputs, yet, as available natural resources become more limited and public concerns grow stronger about the ecological effects of urban turfgrass management, it becomes increasingly important to pursue alternative landscape options. There are non-traditional turfgrasses that require fewer resource inputs that could be made available to homeowners. The objective of this study was to estimate consumer preferences and the relative importance of aesthetic and maintenance attributes of turfgrasses as well as identify potential market segments of the residential turfgrass market. Conjoint analysis was conducted on survey responses of 116 Minnesota homeowners. The results indicated that maintenance attributes of turfgrasses, specifically irrigation requirement, significantly affected consumer purchasing behavior. The analysis also identified four potential market segments, the Price Conscious segment, the Shade Adaptation segment, the Mowing Conscious segment, and the Water Conscious segment.


We studied the restorative potential of fragmented urban forests in Helsinki, Finland. Our aim was to explore how perceived restorativeness (PR) in urban forests changes when exposed to different levels of urbanity observed through the forest vegetation from the viewpoint of the forest interior. The level of PR was measured in forests that bordered either housing or a road. Three sampling points were selected within each forest, which included (1) an open view (at the edge), (2) a semi-closed view (at the edge zone), and (3) a closed view (in the forest interior) to the urban matrix. We hypothesized that the less urban matrix is observed through the forest vegetation from within the forest, the higher PR would be, and that PR is higher in forests bordering housing than in forests bordering roads. Results supported our hypotheses, as PR was higher inside forests with a closed view to the urban matrix compared to semi-closed and open
views. PR was also higher in forests bordering housing than forests bordering a road, albeit not statistically significantly so. We conclude that in order to enhance the restorative potential of an urban forest, planners and managers should preserve sufficiently large forest patches with forest interior habitats, or promote the growth of dense and multilayered vegetation to restrict visibility to the urban matrix.


Globally, rapid urbanisation has substantially reduced the amount of viable agricultural land – a food security issue. Food security is bringing a renewed scholarly interest in community gardens. This paper reviews the extent of English academic literature on community gardens, including: who has undertaken the research, where it has been published, the geographical location of the gardens studied, and the various methods used to undertake the research. The characteristics of the community gardens are summarised, including what types of plants are grown, who is involved in the gardens, and who owns the land. The motivations, benefits and limitations of community gardening are also examined. Finally, potential directions for research into community gardens are highlighted. Academic literature on community gardens is dominated by studies investigating gardens in low-income areas with diverse cultural backgrounds. Research based in cities in the USA also dominates the literature. Scholars from a wide diversity of disciplines have examined community gardens but research is mostly concentrated in the social sciences. The natural sciences are notably under-represented, yet they have much to offer including assessing gardening practices to better understand the agro-biodiversity conservation potential of community gardens.


Over the past years our group has been working on a coherent research program on the relationships between greenspace and health. The main aims of this "Vitamin G" program (where G stands for green) were to empirically verify relationships between greenspace in residential areas and health and to gain insight into mechanisms explaining these relationships. In this article, we bring together key results of our program regarding the relevance of three possible mechanisms: stress reduction, physical activity, and social cohesion. The program consisted of three projects in which relationships between greenspace and health were studied at national, urban, and local scales. We used a mixed-method approach, including secondary analysis, survey data, observations, and an experiment. The results confirmed that quantity as well as quality of greenspace in residential areas were positively related to health. These relationships could be (partly) explained by the fact that residents of greener areas experienced less stress and more social cohesion. In general, residents of greener areas did not engage in more physical activity. The article concludes with a discussion of the practical implications of these findings and identification of areas that need more in-depth research. Key Words: greenspace, health, physical activity, social cohesion, stress


Domestic gardens offer immense potential as sites for native biodiversity conservation. In urban areas they often comprise the largest land use, thus presenting an accessible and immediate
way for urban dwellers to connect with nature and to support and enhance native biodiversity. This paper presents findings from a study of 55 domestic gardens undertaken in Dunedin, New Zealand, which explores householders' relationships with their gardens. The study data was derived from two interviews with householders, two photo exercises (approximately a year apart), together with a number of biological studies of the gardens. Gardens proved to be very important for our householders; for physical and mental health, as an expression of ownership and identity, as sites for social relationships, for connecting with nature and as site of domestic produce production. Householders' connections with nature were idiosyncratic, multifaceted and exhibited in ways that are more complex and varied than those usually considered by those working in the natural sciences and indeed biophilia supporters. We emphasize the importance of the people side of nature in seeking to build and support positive ecological change in the urban environment and the value of combining natural and social science approaches.


To get an inkling of what a well-designed hospital garden can mean to a seriously ill child, watch the home video posted on YouTube last August of Aidan Schwalbe, a three-year-old heart-transplant recipient. The toddler is shown exploring the meandering paths, sun-dappled lawn and gnarled roots of a branching shade tree in the Prouty Garden at Children's Hospital Boston. "He loves to be out in the garden feeding the birds and squirrels," wrote Aidan's grandmother in an August blog entry. "They will all weigh 30 lbs. each by the time we leave here!"

The garden that Aidan loves -- with its vibrant greenery, shaded places to sit and walk, and small, half-hidden animal sculptures that fascinate visitors of all ages -- is "one of the most successful hospital gardens in the country," says Clare Cooper Marcus, an emeritus professor in landscape architecture at the University of California, Berkeley.

Dismissed as peripheral to medical treatment for much of the 20th century, gardens are back in style, now featured in the design of most new hospitals, according to the American Society of Landscape Architects. In a recent survey of 100 directors and architects of assisted-living residences, 82 percent agreed that "the design of outdoor space should be one of the most important considerations in the design." But can gardens, in fact, promote healing? It turns out that they often can. Scientists around the world are now digging into the data to find out which features of gardens account for the effect.


Mental health is a public health priority globally. Public Open Space (POS) may enhance mental health by facilitating contact with nature and the development of supportive relationships. Despite growing interest in the influence of the built environment on mental health, associations between POS attributes and mental health remain relatively unexplored. In particular, few studies have examined the relative effects of the quantity and quality of POS within a neighbourhood on mental health. Guided by a social–ecological framework, this study investigated the relationship between POS attributes (i.e., quantity and quality) and better mental health (i.e., low risk of psychological distress) in residents of new housing developments in the Perth metropolitan area, Western Australia. The extent to which relationships between POS attributes and mental health were confounded by psychosocial factors (e.g., social support, sense of community) and frequent
use of POS was also explored. Data were obtained from a cross-sectional survey (n = 911), a POS audit, and Geographical Information Systems, and was analysed using logistic regression. Approximately 80% of survey participants were at low risk of psychological distress. Residents of neighbourhoods with high quality POS had higher odds of low psychosocial distress than residents of neighbourhoods with low quality POS. This appeared to be irrespective of whether or not they used POS. However, the quantity of neighbourhood POS was not associated with low psychological distress. From a mental health perspective, POS quality within a neighbourhood appears to be more important than POS quantity. This finding has policy implications and warrants further investigation.

Highlights: ▶ Public Open Space (POS) quality appears significantly and negatively associated with psychological distress. ▶ Residents near medium or high quality POS have twice the odds of better mental health as those near low quality POS. ▶ POS quality appears to be more important for mental health than POS quantity. ▶ Residents may not need to use POS to benefit from it.


A strong sense of community has been associated with improved wellbeing, increased feelings of safety and security, participation in community affairs and civic responsibility. Although interest in how the broader built environment influences sense of community is gaining momentum, there is a dearth of empirical research examining the association between sense of community and the quality of public space. This study investigates the relationship between four public spaces – Public Open Space (POS), community centres, schools and shops – and sense of community in residents of new housing developments in the Perth metropolitan area, Western Australia. Data was obtained from a cross-sectional survey (n = 911), a POS audit, and Geographical Information Systems, and analysed using linear regression. The perceived quality of neighbourhood POS and shops was significantly and positively associated with sense of community. This relationship appears to be unaffected by how frequently people use these spaces. High quality public spaces may be important settings for enhancing sense of community within residents of new housing developments.


“Green infrastructure” is a term that is appearing more and more frequently in land conservation and development discussions across the country and around the world. Green infrastructure means different things to different people depending on the context in which it is used. For example, some people refer to trees in urban areas as green infrastructure because of the “green” benefits they provide, while others use green infrastructure to refer to engineered structures (such water treatment facilities or green roofs) that are designed to be environmentally friendly.

For the purposes of this Sprawl Watch Clearinghouse Monograph, green infrastructure is defined as an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations. In our view, green infrastructure is the ecological framework needed for environmental, social and economic sustainability—in short it is our nation’s natural life sustaining system. Green infrastructure differs from conventional approaches to open space planning because it looks at conservation
values and actions in concert with land development, growth management and built infrastructure planning. Other conservation approaches typically are undertaken in isolation from — or even in opposition to — development.

This monograph introduces green infrastructure as a strategic approach to land conservation that is critical to the success of smart growth initiatives. Green infrastructure is “smart” conservation that addresses the ecological and social impacts of sprawl and the accelerated consumption and fragmentation of open land. This monograph describes the concept and values of green infrastructure and presents seven principles and associated strategies for successful green infrastructure initiatives.


The authors estimate the relationship between trees and three crime aggregates (all crime, violent crime, and property crime) and two individual crimes (burglary and vandalism) in Portland, Oregon. During the study period (2005-2007), 431 crimes were reported at the 2,813 single-family homes in our sample. In general, the authors find that trees in the public right of way are associated with lower crime rates. The relationship between crime and trees on a house's lot is mixed. Smaller, view-obstructing trees are associated with increased crime, whereas larger trees are associated with reduced crime. The authors speculate that trees may reduce crime by signaling to potential criminals that a house is better cared for and, therefore, subject to more effective authority than a comparable house with fewer trees.

de Jong, K., et al. (2012). "Perceived green qualities were associated with neighborhood satisfaction, physical activity, and general health: results from a cross-sectional study in suburban and rural Scania, southern Sweden." Health Place 18.

In this study using cross-sectional survey data from suburban and rural Scania, Sweden (N=424,847), we assessed how the recently validated index score of area-aggregated perceived green neighborhood qualities (Scania Green Score; SGS), and the five distinct qualities within this index were associated with three self-reported indicators of well-being: neighborhood satisfaction, physical activity and general health. Effect sizes were compared with objective (GIS-based) assessments of the same five qualities. Area-aggregated SGS was positively associated with neighborhood satisfaction, physical activity and general health. The association with general health was mediated by physical activity and neighborhood satisfaction. Three perceived qualities had salutogenic potential: historical remains (culture), silence such that sounds of nature can be heard (serene) and species richness (lush). Spacious and wild were not appreciated. Some independent positive effects of the GIS-based index were noted, but could not be consistently attributed to specific qualities. Perceived qualities within green areas, not merely quantity, are related to aspects of well-being in suburban and rural areas.


Green spaces have been suggested to improve physical and mental health and well-being by increasing physical activity, reducing air pollution, noise, and ambient temperature, increasing social contacts and relieving psychophysiological stress. Although these mechanisms also suggest potential beneficial effects of green spaces on pregnancy outcomes, to our knowledge there is no available epidemiological evidence on this impact. We investigated the
effects of surrounding greenness and proximity to major green spaces on birth weight and gestational age at delivery and described the effect of socioeconomic position (SEP) on these relationships. This study was based on a cohort of births (N=8246) that occurred in a major university hospital in Barcelona, Spain, during 2001–2005. We determined surrounding greenness from satellite retrievals as the average of Normalized Difference Vegetation Index (NDVI) in a buffer of 100 m around each maternal place of residence. To address proximity to major green spaces, a binary variable was used to indicate whether maternal residential address is situated within a buffer of 500 m from boundaries of a major green space. For each indicator of green exposure, linear regression models were constructed to estimate change in outcomes adjusted for relevant covariates including individual and area level SEP. None of the indicators of green exposure was associated with birth weight and gestational age. After assessing effect modification based on the level of maternal education, we detected an increase in birth weight (grams) among the lowest education level group (N = 164) who had higher surrounding NDVI (Regression coefficient (95% confidence interval (CI)) of 436.3 (43.1, 829.5)) or lived close to a major green space (Regression coefficient (95% CI)) of 189.8 (23.9, 355.7)). Our findings suggest a beneficial effect of exposure to green spaces on birth weight only in the lowest SEP group.


This study examines the daily and seasonal climatic behavior of various urban parks with different vegetation cover and its impact on human thermal sensation in the summer and winter in Tel Aviv, Israel. The study draws a comparison between the climatic conditions developed in various types of urban green open spaces, exposed open urban squares and street canyons near such sites.

The results showed that an urban park with a dense canopy of trees has maximum cooling effect during summer and winter in daytime. In summer it reduces temperatures by up to 3.8 °C and thermal comfort values by up to 18 °C PET (Physiological Equivalent Temperature), while in winter it reduces temperatures by up to 2 °C and thermal comfort by up to 10 °C PET. The climatic variable that mostly affects human thermal comfort conditions is the Mean Radiant Temperature (Tmrt) which is more dominant at exposed urban sites as compared to shady urban parks. These results emphasize the importance of treed open spaces as an effective tool for heat mitigation. The benefit of the cooling effect achieved by treed urban spaces is much stronger than the comparative disadvantage they create in winter.

Highlights: ▶ Most studies on the climatic effect of urban green areas focused on cooling effect. ▶ The cooling effect caused by urban vegetation is higher in summer than in winter. ▶ Treed open spaces are effective tool for the mitigation of heat stress. ▶ The benefit of park cooling effect in summer outweighs its disadvantages in winter.


This study examines whether participation in gardening predicts reduced fall risk and performance on balance and gait-speed measures in older adults. Data on adults age 65 and older (N = 3,237) from the Health and Retirement Study and Consumption and Activities Mail Survey were analyzed. Participants who spent 1 hr or more gardening in the past week were defined as gardeners, resulting in a total of 1,585 gardeners and 1,652 non-gardeners. Independent t tests,
chi square, and regression analyses were conducted to examine the relationship between gardening and health outcomes. Findings indicate that gardeners reported significantly better balance and gait speed and had fewer chronic conditions and functional limitations than non-gardeners. Significantly fewer gardeners than non-gardeners reported a fall in the past 2 yr. The findings suggest that gardening may be a potential activity to incorporate into future fall-prevention programs.


This document provides an evidence base for the importance of children’s and youth’s connections with nature, now and for the future. Evidence provided in this annotated bibliography of research relates to: 1) children’s experiences of the outdoors and nature, particularly the often limited nature of these experiences and 2) the benefits derived from children’s experiences of the outdoors and nature—both for their healthy development and the protection of the Earth.

The studies selected for this bibliography represent a small sample of the studies that have been conducted on these topics over the past several decades and were included to highlight: 1) the variety and quality of research in these areas and 2) the diversity of places where this research is taking place. Researchers have used a range of methods and techniques to creatively and effectively study these issues. In addition, research is increasingly taking place worldwide, which provides a critical opportunity to begin to understand children’s outdoor and nature experiences and the benefits derived from these experiences across cultures. While additional research is needed, these studies highlight some of the important progress that has been made in recent years as well as the profound risks to the health of the planet, its diversity, and its wild areas in a world in which children are increasingly disconnected from direct experiences in nature.


Domestic gardens provide a significant component of urban green infrastructure but their relative contribution to eco-system service provision remains largely un-quantified. 'Green infrastructure' itself is often ill-defined, posing problems for planners to ascertain what types of green infrastructure provide greatest benefit and under what circumstances. Within this context the relative merits of gardens are unclear; however, at a time of greater urbanization where private gardens are increasingly seen as a 'luxury', it is important to define their role precisely. Hence, the nature of this review is to interpret existing information pertaining to gardens/gardening, per se, identify where they may have a unique role to play and to highlight where further research is warranted. The review suggests that there are significant differences in both form and management of domestic gardens which radically influence the benefits.

Nevertheless, gardens can play a strong role in improving the environmental impact of the domestic curtilage, e.g. by insulating houses against temperature extremes they can reduce domestic energy use. Gardens also improve localized air cooling, help mitigate flooding and provide a haven for wildlife. Less favourable aspects include contributions of gardens and gardening to greenhouse gas emissions, misuse of fertilizers and pesticides, and introduction of alien plant species. Due to the close proximity to the home and hence accessibility for many, possibly the greatest benefit of the domestic garden is on human health and well-being, but
further work is required to define this clearly within the wider context of green infrastructure. © 2012 Elsevier GmbH.


Scholars spanning a variety of disciplines have studied the ways in which contact with natural environments may impact human well-being. We review the effects of such nature experience on human cognitive function and mental health, synthesizing work from environmental psychology, urban planning, the medical literature, and landscape aesthetics. We provide an overview of the prevailing explanatory theories of these effects, the ways in which exposure to nature has been considered, and the role that individuals’ preferences for nature may play in the impact of the environment on psychological functioning. Drawing from the highly productive but disparate programs of research in this area, we conclude by proposing a system of categorization for different types of nature experience. We also outline key questions for future work, including further inquiry into which elements of the natural environment may have impacts on cognitive function and mental health; what the most effective type, duration, and frequency of contact may be; and what the possible neural mechanisms are that could be responsible for the documented effects.


This field study investigated the potential stress-reducing effects of exposure to real or artificial nature on patients in a hospital waiting room. Additionally, it was investigated whether perceived attractiveness of the room could explain these effects. In this between-patients experimental design, patients were exposed to one of the following: real plants, posters of plants, or no nature (control). These conditions were alternately applied to two waiting rooms. Location: The location of this study was two waiting rooms at the Radiology Department of a Dutch hospital. The subjects comprised 457 patients (60% female and 40% male) who were mostly scheduled for echocardiogram, dual-energy x-ray absorptiometry, magnetic resonance imaging, computed tomography scans, or nuclear research. Patients exposed to real plants, as well as patients exposed to posters of plants, report lower levels of experienced stress compared to the control condition. Further analyses show that these small but significant effects of exposure to nature are partially mediated by the perceived attractiveness of the waiting room. Natural elements in hospital environments have the potential to reduce patients’ feelings of stress. By increasing the attractiveness of the waiting room by adding either real plants or posters of plants, hospitals can create a pleasant atmosphere that positively influences patients’ well-being.


Background: This study aimed to explore whether walking in nature may be beneficial for individuals with major depressive disorder (MDD). Healthy adults demonstrate significant cognitive gains after nature walks, but it was unclear whether those same benefits would be achieved in a depressed sample as walking alone in nature might induce rumination, thereby worsening memory and mood.
Methods: Twenty individuals diagnosed with MDD participated in this study. At baseline, mood and short term memory span were assessed using the PANAS and the backwards digit span (BDS) task, respectively. Participants were then asked to think about an unresolved negative autobiographical event to prime rumination, prior to taking a 50 minute walk in either a natural or urban setting. After the walk, mood and short-term memory span were reassessed. The following week, participants returned to the lab and repeated the entire procedure, but walked in the location not visited in the first session (i.e., a counterbalanced within-subjects design).

Results: Participants exhibited significant increases in memory span after the nature walk relative to the urban walk, p < .001, ηp² = .53 (a large effect-size). Participants also showed increases in mood, but the mood effects did not correlate with the memory effects, suggesting separable mechanisms and replicating previous work.

Limitations: Sample size and participants’ motivation.

This study explores students’ preferences toward natural and wild versus clean and neat residential landscapes using preference survey data. Based on the rating scores of four housing landscape designs, multinomial logit models were used to explore the potential influential factors on people's preferences, especially the wildness or neatness of the home landscape. The results suggest that students in agricultural economics, horticulture, and social sciences are more inclined to choose a neat, well-kept environment around their homes. In contrast, wildlife science students prefer more natural landscapes. This study also found that senior students and students from large cities also prefer well-maintained and artificial landscapes. Also, students who are members of an environmental group, and those whose parents have a better education, are more likely to choose a more natural landscape. The results would provide additional information for planners, developers, engineers, architects and foresters in building more livable communities which are aesthetically appealing but also ecologically sound.

the extent to which this is the case and the particular value of community gardening for obesity, is less well established. [...] while a focus on environment may reduce the stigmatizing effects of individually focused obesity policy, critiques of the 'obesogenic' literature caution against the ways in which such approaches create a dystopian view of the future, make people fearful and limit their positive life (and ergo gardening) experience in the present.2 There is a paucity of research specifically focusing on the impact of community gardening on obesity.

The study presented in this article represents an initial attempt to generate in-depth information about how ornamental plants in real-life office workplaces interact with workplace characteristics, thus influencing working environment and well-being of the employees. Using a qualitative, explorative, and inductive case-study design, the study provides an example of how a cross-disciplinary unit engaged in administrative office work at a Danish institution applied ornamental plants. The results document that ornamental plants are an integrated part of the workplace. The employees used ornamental plants in numerous ways to either actively
manipulate different aspects of the surroundings or more passively cope with demands from the surroundings. Furthermore, the use of the ornamental plants was structured by a number of factors: culture and traditions, provisional orders, organizational structures, practices, values and history, company policies, and characteristics of the indoor architectural environment. Ornamental plants were perceived as affecting many aspects of the working environment (e.g., the physical surroundings, the social climate, image of the workplace, etc.), the individual's well-being (e.g., mood, general well-being, emotions, self-confidence, etc.), and to some degree the workplace's competitiveness. However, the actual effects were the results of a complex interaction among the way the ornamental plants were applied, characteristics of the present ornamental plants (e.g., size, species and condition), and characteristics of the individual employee (e.g., personal experiences, preferences, and values).


This paper traces evidence of the influence of the landscape on people’s health, from ancient times to the present day, noting how access to nature and attractive green spaces has been a recurring theme in descriptions of therapeutic environments and associated healthy lifestyles. It describes how the theme of health in the picturesque debates of eighteenth century England (including such concepts as ‘active curiosity’) was taken up and developed in arguments for the nineteenth century urban park movement in England and North America. Recent theories on the mechanisms behind health benefits of nature and access to landscape are compared with claims made in the nineteenth century and earlier. The importance of access to the landscape appears to be as relevant as ever in the context of modern urban lifestyles but the need for better evidence and understanding remains.


Our objective was to compare the effects on mental and physical wellbeing, health related quality of life and long-term adherence to physical activity, of participation in physical activity in natural environments compared with physical activity indoors. We conducted a systematic review using the following data sources: Medline, Embase, Psychinfo, GreenFILE, SportDISCUS, The Cochrane Library, Science Citation Index Expanded, Social Sciences Citation Index, Arts and Humanities Citation Index, Conference Proceedings Citation Index – Science and BIOSIS from inception to June 2010. Internet searches of relevant Web sites, hand searches of relevant journals, and the reference lists of included papers and other review papers identified in the search were also searched for relevant information. Controlled trials (randomized and nonrandomized) were included. To be eligible trials had to compare the effects of outdoor exercise initiatives with those conducted indoors and report on at least one physical or mental wellbeing outcome in adults or children. Screening of articles for inclusion, data extraction, and quality appraisal were performed by one reviewer and checked by a second with discrepancies resolved by discussion with a third if necessary. Due to the heterogeneity of identified studies a narrative synthesis was performed. Eleven trials (833 adults) were included. Most participants (6 trials; 523 adults) were young students. Study entry criteria and methods were sparsely reported. All interventions consisted of a single episode of walking or running outdoors with the same activity at a similar level conducted outdoors on a separate occasion. A
A total of 13 different outcome measures were used to evaluate the effects of exercise on mental wellbeing, and 4 outcome measures were used to assess attitude to exercise. Most trials (n = 9) showed some improvement in mental wellbeing on one or other of the outcome measures. Compared with exercising indoors, exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, and depression, and increased energy. However, the results suggested that feelings of calmness may be decreased following outdoor exercise. Participants reported greater enjoyment and satisfaction with outdoor activity and declared a greater intent to repeat the activity at a later date. None of the identified studies measured the effects of physical activity on physical wellbeing or the effect of natural environments on exercise adherence. The hypothesis that there are added beneficial effects to be gained from performing physical activity outdoors in natural environments is very appealing and has generated considerable interest. This review has shown some promising effects on self-reported mental wellbeing immediately following exercise in nature which are not seen following the same exercise indoors. However, the interpretation and extrapolation of these findings is hampered by the poor methodological quality of the available evidence and the heterogeneity of outcome measures employed. The review demonstrates the paucity of high quality evidence on which to base recommendations and reveals an undoubted need for further research in this area. Large, well designed, longer term trials in populations who might benefit most from the potential advantages of outdoor exercise are needed to fully elucidate the effects on mental and physical wellbeing. The influence of these effects on the sustainability of physical activity initiatives also awaits investigation.


The purpose of this paper is to investigate the indoor environmental quality benefits of plants in offices by undertaking trials using live plants. Using two offices in the same building, one with plants and one as a control, daily tests were undertaken for relative humidity, carbon dioxide, carbon monoxide and volatile organic compounds (VOCs). Results were analysed to identify any differences between the office with plants and the one without. Relative humidity increased following the introduction of plants and more significantly following additional hydroculture plants being installed, taking it to within the recommended range. Carbon dioxide was slightly higher in the planted office for the majority of the trial although there was an overall reduction in both offices. Carbon monoxide levels reduced with the introduction of plants and again with the additional plants. VOC levels were consistently lower in the non-planted office.


New crops research and development, particularly on potted plants in the United States, has been influenced by floriculture in Europe and received attention by many research scientists since the early 1980s. The success of new crops programs in Denmark and the Netherlands can be attributed to continuous efforts to identify candidate new species and develop market-orientated year-round production systems. Growers often produce a single crop or several crops in highly mechanized green-houses or outdoors where environments are suitable. Many genera from around the world with potential for potted plant production were evaluated in collaboration with a “New Crops Advisory Committee” representing major industry members in the US and abroad at the ARS’ Floral and Nursery Plants Research Unit in Beltsville, MD. Cultural
information on the production of new crops such as Eustoma, Clematis, Gerbera, and Anigozanthos was released to the industry through trade magazines and many scientific papers on dwarf Eustoma, Lachenalia, Correa, and Ornithogalum describing on the growth and flowering we also published. The purpose of this review is to summarize observations and conclusions on the process of new crop development based on the research results and to describe the factors, such as aesthetic value, crop production technology, growth and flowering physiology, and marketing required for success. This information is essential for the development of new floral crops for domestic and international markets.


This research studied possible benefits of indoor plants on attention capacity in a controlled laboratory experiment. Participants were 34 students randomly assigned to one of two conditions: an office setting with four indoor plants, both flowering and foliage, or the same setting without plants. Attention capacity was assessed three times, i.e. immediately after entering the laboratory, after performing a demanding cognitive task, and after a five-minute break. Attention capacity was measured using a reading span test, a dual processing task known to tap the central executive function of attention. Participants in the plant condition improved their performance from time one to two, whereas this was not the case in the no-plant condition. Neither group improved performance from time two to three. The results are discussed in the context of Attention Restoration Theory and alternative explanations.


The use of horticulture in mental health settings is widespread. Moreover, its effectiveness is supported by a body of qualitative evidence. The investigators in this research study sought to determine those aspects of their horticultural projects that conferred the greatest therapeutic benefit to their clients. They used outcome measures to rate the responses of participants, paying particular attention to the participants’ expressed motivation. Qualitative and quantitative methods were used to evaluate six horticultural projects. Ten participants were interviewed, using an adapted version of the Work Environment Impact Scale (WEIS) to rate factors that supported their motivation. Fifty participants were assessed, using the Volitional Questionnaire (VQ) to observe and rate the extent of their motivation. The therapeutic value of horticulture arose from a complex interplay of personal factors, including gender-based preferences, individual interests and social needs. The benefits of engaging in horticultural activity are not automatic. The external environment provides challenges, which can be graded by the facilitators to maximise the therapeutic benefit.


The goal of this paper is to introduce community gardening as a promising method of furthering well-being and resilience on multiple levels: individual, social group, and natural environment. We examine empirical evidence for the benefits of gardening, and we advocate the development and testing of social ecological models of community resilience through examination of the impact of community gardens, especially in urban areas. The definition of
community is extended beyond human social ties to include connections with other species and the earth itself, what Berry (1988) has called an Earth community. We discuss the potential contribution of an extensive network of community gardens to easing the global climate change crisis and address the role of community psychologists in community gardening research and policy-oriented action.


Traditional medical and public health approaches to illness and health are among the successes of modern science. However, society today is faced with the increasing incidence of various forms of poor health related to modern lifestyles. Contributing factors include an increasingly sedentary population, increasing levels of psychological stress related to urban living and contemporary work practices. In addition people with disabilities and chronic illness demand a transition from institutional care to care in society. These problems encourage thinking about alternative ways to prevent disease and promote health. Lack of physical activity and stress have led to increased occurrence of certain diseases where medication is perhaps only reducing the symptoms rather than combating the true cases of illness and reduced quality of life. Efforts to promote public health and well-being in Europe have thus become increasingly complex.


Human beings feel comfortable when they are close to nature, but this feeling is difficult to describe in words, and science has yet not provided an adequate explanation for it. However, based on the recent development of assessment methods that can measure the physiological effects of relaxation, a considerable amount of scientific data has now been accumulated on the subject.


The Million Trees LA initiative intends to improve Los Angeles's environment through planting and stewardship of 1 million trees. The purpose of this study was to measure Los Angeles's existing tree canopy cover (TCC), determine if space exists for 1 million additional trees, and estimate future benefits from the planting. High-resolution QuickBird remote sensing data, aerial photographs, and geographic information systems were used to classify land cover types, measure TCC, and identify potential tree planting sites. Benefits were forecast for planting of 1 million trees between 2006 and 2010, and their growth and mortality were projected until 2040. Two scenarios reflected low (17%) and high (56%) mortality rates. Numerical models were used with geographic data and tree size information for coastal and inland climate zones to calculate annual benefits and their monetary value. Los Angeles's existing TCC was 21%, and ranged from 7 to 37% by council district. There was potential to add 2.5 million additional trees to the existing population of approximately 10.8 million, but only 1.3 million of the potential tree sites are deemed realistic to plant. Benefits for the 1-million-tree planting for the 35-year period were $1.33 billion and $1.95 billion for the high- and low-mortality scenarios, respectively. Average annual benefits were $38 and $56 per tree planted. Eighty-one percent of total benefits
were aesthetic/other, 8% were stormwater runoff reduction, 6% energy savings, 4% air quality improvement, and less than 1% atmospheric carbon reduction.


Nature is believed to restore the human body and mind because humans have evolved in close association with it. Miyazaki proposed that “The human body is thus made to adapt to nature.”1 Indoor or field studies on forest bathing (taking in the forest atmosphere) have helped in investigating whether the “natural environment” restores the human body and mind2 and repairs a suppressed immune system.3


We considered the relationship between an urban adult population’s fruit and vegetable consumption and several selected social and psychological processes, beneficial aesthetic experiences, and garden participation. We conducted a population-based survey representing 436 residents across 58 block groups in Denver, Colorado, from 2006 to 2007. We used multilevel statistical models to evaluate the survey data.

Neighborhood aesthetics, social involvement, and community garden participation were significantly associated with fruit and vegetable intake. Community gardeners consumed fruits and vegetables 5.7 times per day, compared with home gardeners (4.6 times per day) and nongardeners (3.9 times per day). Moreover, 56% of community gardeners met national recommendations to consume fruits and vegetables at least 5 times per day, compared with 37% of home gardeners and 25% of nongardeners. Our study results shed light on neighborhood processes that affect food-related behaviors and provides insights about the potential of community gardens to affect these behaviors. The qualities intrinsic to community gardens make them a unique intervention that can narrow the divide between people and the places where food is grown and increase local opportunities to eat better.


In the natural world, the transfer of resources between landscape features such as the corridors and patches that make up the mosaic of ecological niches is increased where those boundaries are more complex. This article explores this as an analogue for the relationship between natural landscapes and human communities and the possible link between those landscapes greater human diversity and innovation. Using Canadian case study research this article explores the potential link between landscape and human creativity. The case studies are all examples of human communities with higher than average populations of the creative class and with noted landscapes that have influenced the nature and direction of development. We explore the possibility that there is a link between landscape and creativity and consider how this may reflect the potential for cultural diversity and thus the sustainable community development.

Objective: To provide scientific evidence supporting the efficacy of forest bathing as a natural therapy by investigating its physiological benefits using biological indicators in outdoor settings. Within-group comparisons were used to examine psychological and physiological responses to exposure to real forest and urban environments.

Methods: Young Japanese male adults participated in a 3-day, 2-night field experiment. Physiological responses as well as self-reported psychological responses to forest and urban environmental stimuli were measured in real settings. The results of each indicator were compared against each environmental stimulus.

Results: Heart rate variability analysis indicated that the forest environment significantly increased parasympathetic nervous activity and significantly suppressed sympathetic activity of participants compared with the urban environment. Salivary cortisol level and pulse rate decreased markedly in the forest setting compared with the urban setting. In psychological tests, forest bathing significantly increased scores of positive feelings and significantly decreased scores of negative feelings after stimuli compared with the urban stimuli.

Conclusion: Physiological data from this field experiment provide important scientific evidence on the health benefits of forest bathing. The results support the concept that forest bathing has positive effects on physical and mental health, indicating that it can be effective for health promotion. Despite the small sample size in this study, a very clear tendency towards positive physiological and psychological outcomes in forests was observed.


Background: Urban development projects can be costly and have health impacts. An evidence-based approach to urban planning is therefore essential. However, the evidence for physical and non-physical health benefits of urban green space is unclear.

Methods: A literature search of academic and grey literature was conducted for studies and reviews of the health effects of green space. Articles found were appraised for their relevance, critically reviewed and graded accordingly. Their findings were then thematically categorized.

Results: There is weak evidence for the links between physical, mental health and well-being, and urban green space. Environmental factors such as the quality and accessibility of green space affects its use for physical activity. User determinants, such as age, gender, ethnicity and the perception of safety, are also important. However, many studies were limited by poor study design, failure to exclude confounding, bias or reverse causality and weak statistical associations.

Conclusion: Most studies reported findings that generally supported the view that green space have a beneficial health effect. Establishing a causal relationship is difficult, as the relationship is complex. Simplistic urban interventions may therefore fail to address the underlying determinants of urban health that are not remediable by landscape redesign.


More than half of the world’s population now lives in cities, making the creation of a healthy urban environment a major policy priority. Cities have both health risks and benefits, but mental health is negatively affected: mood and anxiety disorders are more prevalent in city dwellers and the incidence of schizophrenia is strongly increased in people born and raised in
cities3,4,5,6. Although these findings have been widely attributed to the urban social environment2,3,7,8, the neural processes that could mediate such associations are unknown. Here we show, using functional magnetic resonance imaging in three independent experiments, that urban upbringing and city living have dissociable impacts on social evaluative stress processing in humans. Current city living was associated with increased amygdala activity, whereas urban upbringing affected the perigenual anterior cingulate cortex, a key region for regulation of amygdala activity, negative affect9 and stress10. These findings were regionally and behaviourally specific, as no other brain structures were affected and no urbanicity effect was seen during control experiments invoking cognitive processing without stress. Our results identify distinct neural mechanisms for an established environmental risk factor, link the urban environment for the first time to social stress processing, suggest that brain regions differ in vulnerability to this risk factor across the lifespan, and indicate that experimental interrogation of epidemiological associations is a promising strategy in social neuroscience.


Objectives: Cultivating healthy workplaces is a critical aspect of comprehensive worksite health promotion. The influence of healthy workplace exposures on employee health outcomes warrants research attention. To date, it is unknown if nature contact in the workplace is related to employee stress and health. This study was designed to examine the effects of nature contact experienced at work on employee stress and health.

Methods: Office staff at a southeastern university (n=503, 30% response rate) participated in the cross-sectional study. We used a 16-item workplace environment questionnaire, the Nature Contact Questionnaire, to comprehensively measure, for the first time, nature contact at work. The Perceived Stress Questionnaire and 13 established health and behavioral items assessed the dependent variables, general perceived stress, stress-related health behaviors, and stress-related health outcomes.

Results: There was a significant, negative association between nature contact and stress and nature contact and general health complaints. The results indicate that as workday nature contact increased, perceived stress and generalized health complaints decreased.

Conclusions: The findings suggest that nature contact is a healthy workplace exposure. Increasing nature contact at work may offer a simple population-based approach to enhance workplace health promotion efforts. Future researchers should test the efficacy of nature-contact workplace stress interventions.


Greenspace is theoretically a valuable resource for physical activity and hence has potential to contribute to reducing obesity and improving health. This paper reports on a systematic review of quantitative research examining the association between objectively measured access to greenspace and (i) Physical activity, (ii) Weight status and (iii) Health conditions related to elevated weight. Literature searches were conducted in SCOPUS, Medline, Embase and PSYCHINFO. Sixty studies met the inclusion criteria and were assessed for methodological quality and strength of the evidence. The majority (68%) of papers found a positive or weak association between greenspace and obesity-related health indicators, but findings were inconsistent and mixed across studies. Several studies found the relationship
varied by factors such as age, socioeconomic status and greenspace measure. Developing a theoretical framework which considers the correlates and interactions between different types of greenspace and health would help study design and interpretation of reported findings, as would improvement in quality and consistency of greenspace access measures. Key areas for future research include investigating if and how people actually use greenspace and improving understanding of the mechanisms through which greenspace can improve health and, in particular, if physical activity is one such mechanism.


We estimate the cumulative stress mitigating impact of neighborhood greenness by investigating whether neighborhood green mitigates stress directly, and indirectly by encouraging physical activity and/or fostering social support. Using data from a recent community health survey in Chicago and two-stage instrumental variables regression modeling, we find that different components of neighborhood green play distinct roles in influencing stress. Park spaces are found to indirectly mitigate stress by fostering social support. Overall neighborhood vegetation is found to have direct stress mitigation impact, yet the impact is counteracted by its negative effect on social support. When comparing the effect size, park spaces show a more positive impact on health and well-being than the overall neighborhood vegetation level. Policy makers are recommended to focus on creating structured green spaces with public recreation and socialization opportunities rather than simply conserving green spaces in the neighborhood. Previous studies, as they often investigate the direct impact only and rarely use multiple measures of greenness, may have mis-estimated health benefits of neighborhood green.

Elzeyadi, I. M. (2011). Daylighting bias and biophilia: Quantifying the impact of daylighting on occupants’ health, USGBC.

This paper reports on a state-of-the-art study quantifying the health and human impacts of daylighting strategies and views quality from windows on employees health in offices. The study attempts to quantify an important yet not scientifically proven assumption concerning the biophilic relationship between views of nature and daylighting in the workplace and their impacts on sick leave of office workers. The specific hypothesis tested is; that employees with a view of nature will take fewer sick days, have fewer Sick Building Syndrome (SBS) symptoms than those with a view of urban structures, or with no views out at all. A corollary hypothesis is whether daylight availability and dynamic lighting quality in offices could also play a role in reducing the number of sick leave hours and SBS symptoms related to poor circadian rhythms and hypersensitivity. This is an objective to answer and quantify a long debated hypothesis regarding the importance non-residential building occupants place on the need to be in contact with nature/the outdoors while working within a building. This paper reports on a three-phase long-term study. In phase I, employees’ preferences and ratings towards natural and urban human-made views were investigated. For this phase of the study a qualitative sorting task technique was employed, followed by in-depth interviews on a cross-sectional sample of office employees (n=98). In phase II of the study, physical office conditions, lighting qualities, and quantities inside120 office spaces and cubicles in an office building were systematically evaluated covering 175 employees participating in this study. This included daylighting availability (window shape, properties, glazing properties, area, and its distance from employees’
desks); Daylighting quality (luminance, glare analysis, room materials, reflections, orientation, brightness patterns, etc.), and quality of outside views (type of view, pleasantness rating, and preference rank) according to the view metric developed earlier in phase I of the study. In phase III of the study, employees’ health conditions were surveyed using an on-line questionnaire and physical health screening forms. In addition, we compiled employees’ actual sick leave days from their payroll records as well as in aggregate format based on their office locations, views, floor level, and area of the building they occupy. A multi regression and Pearson correlation statistical analyses tests were performed on the data set. Standard bivariate regression and correlation were used to examine the relationship between sick leave hours and ratings of lighting quality and views. In both cases, the relationships are in the predicted direction and statistically significant supporting positively our hypothesis. Workers in offices with poor ratings of light quality and in offices with poorer views used significantly more sick leave hours. Taken together, the two variables explained 6.5% of the variation in sick leave use, which was statistically significant. The implications of these findings are huge when one considers productivity and health insurance costs these sick leave hours can affect to an organization.


Exposure of individuals to natural environments, such as forests and coastlines, can promote stress reduction and assist in mental recovery following intensive cognitive activities. Settings as simple as hospital window views onto garden-like scenes can also be influential in reducing patients’ postoperative recovery periods and analgesic requirements. This paper reviews the evidence supporting the exploitation of these restorative natural environments in future healthcare strategies. The paper also describes early research addressing the development of multisensory, computer-generated restorative environments for the benefit of patients with a variety of psychologically related conditions (including depression, attention deficit disorder, pain, and sleep deficit), who may be unable to access and experience real natural environments, such as those in hospices, military rehabilitation centers, and long-term care facilities. The Table of Contents art is a virtual reconstruction of Wembury Bay, in the southwest of the UK, based on imported Digital Terrain Elevation Data (DTED) to provide the topography and a high-resolution aerial image to provide a template for the location of 3D building and vegetation models, rock features, and pathways. The 3D environment is rendered using the Unity 3 Game Development Tool and includes spatial sound effects (waves, wind, birdsong, etc.), physics-based features (such as early morning sea mist), time-of-day cycles, and real-time weather changes. The Village Church of St. Werburgh can also be seen in this image.


To investigate associations between neighbourhood greenspace and weight status, and to explore the contribution of physical activity to these associations.

Cross-sectional observational study over two time-periods. Participants were adults (aged 18 years+) in from a nationally representative sample of the English population for the time periods 2000–2003 (n=42 177) and 2004–2007 (n=36 959). Weight status was defined as body mass index (BMI) category according to WHO classification. Neighbourhood greenspace was measured using the Generalised Land use Database for England that defines greenspace as parks,
open spaces and agricultural land, excluding domestic gardens. Multinomial logistic regression models were used to estimate associations between neighbourhood greenspace and BMI and, in eligible sub-samples, to investigate the contribution of total physical activity to these. All models were adjusted for age, sex, social class, economic activity, neighbourhood income deprivation and urban/rural status.

In 2000–2003 there was a counterintuitive association between greenspace and BMI. Residence in the greenest areas was significantly associated with increases in overweight (12%) and obesity (23%). In 2004–2007, there was a small protective effect of greenspace for those living in the greenest areas, but this was not statistically significant. Markers of total physical activity did not attenuate associations. Tests for interactions with urban/rural status confirmed that significant associations between neighbourhood greenspace and obesity were only present in urban areas in 2000–2003.

Conclusion: Better evidence for the utility of greenspace in the prevention of weight gain is required before greenspace interventions are developed.


Recent studies show that introducing sound from water features in urban open spaces may reduce the loudness of road traffic noise, but it is not clear in which situations this measure also improves overall soundscape quality. This work describes a listening experiment on loudness, pleasantness, and eventfulness of stimuli that combine road traffic noise with fountain or bird sound at different sound levels. Adding fountain sound reduced the loudness of road traffic noise only if the latter had low temporal variability. Conversely, adding bird sound significantly enhanced soundscape pleasantness and eventfulness, more than what was achieved by adding fountain sound.


The microbiota of the human metaorganism is not a mere bystander. These microbes have coevolved with us and are pivotal to normal development and homoeostasis. Dysbiosis of the GI microbiota is associated with many disease susceptibilities, including obesity, malignancy, liver disease and GI pathology such as IBD. It is clear that there is direct and indirect crosstalk between this microbial community and host immune response. However, the precise mechanism of this microbial influence in disease pathogenesis remains elusive and is now a major research focus. There is emerging literature on the role of the microbiota in the pathogenesis of autoimmune disease, with clear and increasing evidence that changes in the microbiota are associated with some of these diseases. Examples include type 1 diabetes, coeliac disease and rheumatoid arthritis, and these contribute significantly to global morbidity and mortality. Understanding the role of the microbiota in autoimmune diseases may offer novel insight into factors that initiate and drive disease progression, stratify patient risk for complications and ultimately deliver new therapeutic strategies. This review summarises the current status on the role of the microbiota in autoimmune diseases.

Urban green spaces are a key element in the planning of today’s cities, since they favor the interaction between citizens and the environment, as well as promoting human health. However, lack of planning in the design of urban spaces and in the choice of ornamental species has been among the factors triggering one of the most widespread diseases in urban populations: pollen allergy. In this paper are reviewed the major causes of this extensive allergenicity, including: low species biodiversity at planting; the overabundance of given species acting as key specific pollen sources; the planting of exotic species prompting new allergies in the population; the choice of male, pollen-producing individuals in dioecious species; the presence of invasive species; inappropriate garden management and maintenance activities; the appearance of cross-reactivity between phylogenetically related species; and the interaction between pollen and air pollutants. The findings of this analysis highlight the clear need for guidelines regarding the design and planning of urban green spaces with a low allergy impact. Proposals include increased biodiversity, careful control when planting exotic species, the use of low pollen producing species, the adoption of appropriate management and maintenance strategies, and active consultation with botanists when selecting the most suitable species for a given green space.

Highlights: ► Low biodiversity of urban ornamental species is some of the causes of growing allergenicity in cities. ► Botanical sexism stimulates the choice of male pollen-producing individuals. ► The planting of exotics prompt new allergies. ► Guidelines for designing urban green zones with low allergy impact, avoiding massive use of some species, are proposed.


With increasing prevalence of urban air pollution (UAP), associated problems are becoming of major international concern environmentally, economically and with respect to human health. About SCJ >/o of the world’s population (including 8CJ >/o of Australians) live in urban areas and spend approximately 9CJ >/o of their life indoors, where indoor air quality (IAQ) is almost always more polluted than outdoors, even in urban centres with the high reliance on fossil fuels for transport and industry. An increasing proportion of urban dwellers work in sealed buildings, dependent for air supply and thermal comfort on heating, ventilating, and air conditioning (HVAC) systems. This project investigated the potential benefits for more sustainable cities, that could be achieved by using potted-plants as a supplement to HVAC systems, with the added benefits of decreasing the incidence of sick building syndrome (SBS), and of lowering the carbon footprint of a city. The research considered three major aspects of IAQ. Indoor plants have been shown to be able to significantly reduce levels of C02 and volatile organic compounds (VOCs), two classes of contaminants almost always found in higher concentrations indoors than outside. However, they have also been named as a likely source of pathogenic mould spores, and this was also investigated. An office field study was conducted in which the effects were tested of four plant treatments using Dracaena marginate 'Janet Craig' and Spathiphyllum walisi 'petite' (plus reference offices) on a range of IAQ parameters: C02, VOCs, temperature, relative humidity; plus airborne mould spore abundance and diversity. Laboratory studies were also carried out, on the capabilities of plants to: reduce C02 at different light intensities and from two different light acclimation intensities; remove benzene (as model VOC) applied at various dosages; and contribute to air-borne mould spore concentrations and species diversity. Through the laboratory test-chamber studies it was shown that the three species tested; Aglaonema modestum– Chamaedorea elegans and Philodendron 'Congo' had the ability
to remove the 8-hour averaged exposure limit after an induction period. Also plants were readily capable of reducing chamber CO2 by up to 9% within one hour, under favourable lighting intensities and after two light acclimation levels. The mould studies revealed that, compared with outdoor air, there were 8-15 times lower mould spore loads indoors, and there was little correlation between the mould genera found in potting mix soil with those found in office air. The results indicate that it is unlikely that potted-plants are significantly contributing to the levels of moulds found in the air in Sydney. The office study, in two relatively new buildings, demonstrated that, with modern HVAC systems, indoor plants had little to no impact on IAQ, with no significant differences between offices with plants and those without. This is at variance with a previous study from this laboratory using two buildings with much older HVAC systems, and one with no air conditioning. Thus it appears that modern HVACs can mask any benefits of plants on IAQ. This result opens up the possibility of reducing the energy load on the HVAC system by allowing plants to play a greater role in cleaning indoor air. The results obtained in this study are very promising for future indoor environmental management. The possibility of reducing urban air pollution by lowering energy requirements of city buildings is also encouraging and, in a time of emission trading schemes and carbon taxes, nature's ability to cost-effectively mitigate urban pollution is impressive, and its development is urgently needed.


Greening of vacant urban land may affect health and safety. The authors conducted a decade-long difference-in-differences analysis of the impact of a vacant lot greening program in Philadelphia, Pennsylvania, on health and safety outcomes. “Before” and “after” outcome differences among treated vacant lots were compared with matched groups of control vacant lots that were eligible but did not receive treatment. Control lots from 2 eligibility pools were randomly selected and matched to treated lots at a 3:1 ratio by city section. Random-effects regression models were fitted, along with alternative models and robustness checks. Across 4 sections of Philadelphia, 4,436 vacant lots totaling over 7.8 million square feet (about 725,000 m2) were greened from 1999 to 2008. Regression-adjusted estimates showed that vacant lot greening was associated with consistent reductions in gun assaults across all 4 sections of the city (P < 0.001) and consistent reductions in vandalism in 1 section of the city (P < 0.001). Regression-adjusted estimates also showed that vacant lot greening was associated with residents’ reporting less stress and more exercise in select sections of the city (P < 0.01). Once greened, vacant lots may reduce certain crimes and promote some aspects of health. Limitations of the current study are discussed. Community-based trials are warranted to further test these findings.


Recent work in France has suggested that poor geographic access to primary healthcare may have a negative influence upon detection rates of the hepatitis C virus. Topography and poor infrastructure can exacerbate geographic remoteness, while the stigma surrounding hepatitis C and intravenous drug use may also discourage healthcare-seeking behaviour in rural communities with limited choice of general practitioner. No similar study has been conducted in the UK, where detection rates of hepatitis C are also low. Moreover, the previous French findings did not adjust for the uneven spatial distribution of HCV prevalence and associated risk
factors, which raises the possibility that the reported travel-time associations were a reflection of greater hepatitis C prevalence in urban areas (where the travel-times to primary healthcare are short) and not an effect of geographic access to primary healthcare.

Using geographic information systems, Poisson regression and a dataset from Tayside (Scotland), we explored whether lower rates of hepatitis C detection were associated with higher travel-times to primary healthcare. We tested whether any travel-time effects remained once the models were adjusted for deprivation, by controlling for the spatial variation of some of the known risk factors of hepatitis C infection. Separate models were calculated according to patient history of opiate substitution therapy to take account of people likely to have been infected through intravenous drug use.

Rates of detected hepatitis C were highest among males aged between 25 and 39 years. A statistically significant travel-time-decay effect was observed, though with notable attenuation for all patients after adjusting for deprivation. Further modelling identified a travel-time effect only for those who had received opiate substitution therapy. The absence of a similar effect in the non-opiate substitution therapy group indicates that selection effects, not causation, are the most likely explanation for the initial travel-time-decay effects. Thus, future studies of hepatitis C detection and geographic access to primary healthcare will need to consider ways of controlling for the uneven spatial distribution of HCV prevalence and associated risk factors beyond ecological measures of socioeconomic deprivation.


Little research has been conducted that comprehensively studies consumers' choices of cut flowers at different occasions and for different gift recipients and how they associate different meanings with various types of cut flowers. Therefore, this article attempts to fill this gap in the literature. Using data collected by the Ipsos-National Panel Diary Group for the American Floral Endowment, we determine how the purchases of both traditional and specialty cut flowers have been changing over time and how characteristics of gift purchasers and gift recipients affect consumers' choice of different types of cut flowers. The data include consumers in 48 states and Washington, DC, whose floral purchases were tracked monthly for 14 years. Findings of this analysis confirm that floral purchases have been changing over time. In addition, the underlying drivers of floral purchases are dependent on the floral-buying occasion and the motivations underlying gift giving. These factors also influence the choice of which flowers to purchase along with the sentiment and/or symbolic meaning associated with each flower type.


Flower color is a dominant attribute of fresh flowers, likely playing a key role in purchase preference. Several prior studies showed flower color preference differed by gender, but other information on color preferences is sparse. Data for this study were collected by the Ipsos-National Panel Diary Group for the American Floral Endowment, which maintained an extensive panel of consumer transactions from 1992 to 2005, including floral purchases. Multinomial logit analysis of single-stem cut flower purchases showed that men and women differed in their cut flower color preferences but that flower color preference also varied with demographic
characteristics and by occasion. We grouped colors into six categories: BluePurple, RedBronze, PeachPink, White, Yellow, and Other. The highest percentage of flowers purchased were RedBronze (34%), whereas the lowest percentage of flowers were Yellow (10.01%) with Other flower colors accounting for less than 5% of purchases. Although women used a more diverse color palette, both men and women were more likely to buy RedBronze flowers for an anniversary and buy PeachPink flowers for Mother's Day. Between 1992 and 2005, women were less likely to purchase PeachPink flowers and men were less likely to purchase RedBronze over time. Overall demand for BluePurple and Yellow flower colors increased over time, whereas the demand for other color categories decreased over time.


Research on the restorative benefits of nature primarily has focused on the spiritual benefits of wilderness areas, but other areas, such as cities, have not been studied. Horticultural activities have the potential to promote spiritual health, but most participants are not aware of this benefit. To improve this situation and to increase evidence of the benefits of therapeutic horticulture, this study suggests treating plant parables as trigger cues, which would allow an approach to interaction with plants through metaphysical imagination, resulting in an improvement in spiritual health from horticultural activities. The purpose of this study was to understand participants' beliefs of the spiritual benefits of horticultural activities, and to see if these beliefs were enhanced after reading plant parables. This study surveyed subjects with different horticultural backgrounds, and measured their opinions regarding belief in the spiritual benefits of horticultural activities, before and after reading the parables. The results indicated that before reading the plant parables, neither group of subjects with different horticultural backgrounds agreed with the spiritual benefits of horticultural activities; however, after reading the plant parables, the belief of participants with formal horticultural education backgrounds increased significantly (P ≤ 0.001). The increase was not significant in subjects without formal horticultural education backgrounds.


New research initiatives focusing on urban ecology and natural resources are underway. Such programs coincide with increased local government action in urban forest planning and management, activities that are enhanced by scientific knowledge. This project used a participatory stakeholder process to explore and understand urban forestry research and technology transfer needs in the Pacific Northwest region of the United States. The approach can be readily used for any geographic region or metropolitan area. A two-phase, abbreviated Delphi process was conducted, inviting input from urban forestry professionals, academics, and agency-based managers. Research issues were identified and prioritized within three themes: urban forest resource, resource management, and community framework. The results serve as a stakeholder relevant research framework to guide science proposals for funding initiatives of regional and national levels. Notable is major support by respondents for a better understanding of the transactional dynamics of human systems and urban natural resources.

The expansion of urban-rural interfaces continues apace and with that expansion come new challenges and opportunities. How effectively we meet these challenges and opportunities depends, in no small measure, on information provided by the scientific community. Our Emerging Issues conference series focuses on interdisciplinary aspects of the information needed to really understand what is happening along urban-rural interfaces. Specific objectives included the (1) facilitation of discussion and sharing of perspectives by stakeholders from around the world and (2) fostering interdisciplinary linkages that better enable complex ramifications of urban sprawl to be addressed.

Despite the economic downturn, which has adversely affected conferences across-the-board, approximately 140 people attended our third URI conference. Participants came from a variety of venues across the United States and from several countries. We specifically encouraged attendance and contributions from students, as our conference provided a unique opportunity to help develop interdisciplinary perspectives in the rising generation of scientists that will tackle issues related to urban-rural interfaces. In addition, our conference provided opportunities for participants to establish valuable contacts with other researchers, practitioners, educators, and/or policy makers. We hope and trust that these contacts serve as conduits for continued exchange of ideas and future collaborations.

The papers and abstracts in this Proceedings volume reflect the breadth of perspectives presented at our 2010 URI conference. Additional presentations from the conference will be published in a special issue of Urban Ecosystems. The conference organizers and sponsors thank those who attended and presented their ideas. Our continuing hope is that the Proceedings will serve as a long term source of information that facilitates the search for compatibility among urban sprawl, natural resources, and the quality of human lives.


Reducing the negative impacts of storm water is gaining priority in United States communities' efforts to develop more sustainably and to comply with Clean Water Act requirements. Nationwide, communities may need to invest hundreds of billions of dollars in coming decades to meet clean water goals, assuming expansion and repair of conventional infrastructure. These projections include $54.8 billion for combined sewer overflow (CSO) control, and another nine billion dollars for storm water management programs. The Clean Water Act's regulatory requirements, along with perennial budget struggles facing many municipalities, are driving cities and utilities to identify and choose the most cost-effective approaches to storm water management. The parallel needs to improve water quality and prioritize cost-effective infrastructure investments have brought Green Infrastructure (GI) and Low Impact Development (LID) practices to the fore of cities' water infrastructure investment strategies. Several major metropolitan areas, including Portland, Seattle, Philadelphia, Kansas City, New York, Washington, Louisville, and others, have sought to integrate green infrastructure into their control plans for combined sewer overflows, and many more are or will be facing similar strategic investment choices soon. Green infrastructure and LID practices (we use these terms interchangeably) produce a range of economic and social benefits in conjunction with managing storm water. Incorporating the value of those benefits into investment decisions is essential in
comparing GI and conventional infrastructure's costs and ecological, economic and social effectiveness. Natural drainage practices improve storm water management and water quality. Recent studies also indicate that GI storm water benefits are accompanied by capital and avoided cost savings compared to conventional infrastructure (EPA 2007b). Research has identified other economic impacts of LID, including impacts on energy consumption, property value, urban heat island effect, community health, and global climate change.


The present research examined individual differences in preferences for three basic garden styles: manicured, romantic, and wild. Building on theoretical insights from landscape preference research, it was hypothesized that preferences for garden styles are guided by psychological needs. This hypothesis was empirically tested in two studies that used Personal Need for Structure (PNS; Neuberg and Newsom, 1993) as a predictor of preferences for allotment gardens in the Netherlands. In Study 1, 150 respondents rated the beauty of 30 photos of manicured, romantic, and wild allotment gardens. Results showed that respondents with a high PNS, as compared to respondents with a low PNS, rated wild gardens as less beautiful, and manicured gardens as more beautiful. Study 2 investigated the relationship between the PNS of allotment gardeners and the actual appearance of their gardens. One hundred and twenty-three owners of allotment gardens filled out the PNS scale and classified their garden as manicured, romantic, or wild. Gardeners with a high PNS, as compared to gardeners with a low PNS, more often owned a manicured or romantic garden, and less often owned a wild garden. In both studies, preference for garden types was also related to demographic characteristics, including gender, education level, and age. The theoretical and practical implications of these findings are discussed.


"Shinrin-yoku”, which can be defined as “taking in the forest atmosphere or forest bathing”, has been receiving increasing attention in Japan in recent years for its capacity to provide relaxation and reduce stress. Since 2004, the authors of this paper have been involved in an investigation designed to ascertain the physiological effects of “Shinrin-yoku” within the framework of the “Therapeutic Effects of Forests” project. We have conducted physiological experiments, both in actual forests and in the laboratory, to elucidate the physiological effects on individuals of exposure to the total environment of forests or to only certain elements of this environment, such as the odor of wood, the sound of running stream water, and the scenery of the forest. We have obtained physiological measurements of central nervous activity, autonomic nervous activity, and bio-markers reflecting stress response that can be applied in this line of approach. Using these measurements, we have summarized the separate elements of forests in terms of the five senses. We have also reviewed a selection of field studies and introduced a number of results from ongoing projects as well as those from early studies. Future perspectives are also discussed.

Aims: To investigate the associations between green space and health, health-related quality of life and stress, respectively. Methods: Data were derived from the 2005 Danish Health Interview Survey and are based on a region-stratified random sample of 21,832 adults. Data were collected via face-to-face interviews followed by a self-administered questionnaire, including the SF-36, which measures eight dimensions of health and the Perceived Stress Scale, which measures self-reported stress. A total of 11,238 respondents completed the interview and returned the questionnaire. Multiple logistic regression analyses were performed to investigate the association between distance to green space and self-perceived stress. Results: Danes living more than 1 km away from the nearest green space report poorer health and health-related quality of life, i.e. lower mean scores on all eight SF-36 dimensions of health than respondents living closer. Respondents living more than 1 km away from a green space have 1.42 higher odds of experiencing stress than do respondents living less than 300 m from a green space. Respondents not reporting stress are more likely to visit a green space than are respondents reporting stress. Reasons for visiting green spaces differ significantly depending on whether or not respondents experience stress. Respondents reporting stress are likely to use green spaces to reduce stress. Conclusions: An association between distance to a green space and health and health-related quality of life was found. Further, the results indicate awareness among Danes that green spaces may be of importance in managing stress and that green spaces may play an important role as health-promoting environments.


A zero-dimensional energy balance model was previously developed to serve as a user-friendly mitigation tool for practitioners seeking to study the urban heat island (UHI) effect. Accordingly, this established model is applied here to show the relative effects of four common mitigation strategies: increasing the overall (1) emissivity, (2) percentage of vegetated area, (3) thermal conductivity, and (4) albedo of the urban environment in a series of percentage increases by 5, 10, 15, and 20% from baseline values. In addition to modeling mitigation strategies, we present how the model can be utilized to evaluate human health vulnerability from excessive heat-related events, based on heat-related emergency service data from 2002 to 2006. The 24-h average heat index is shown to have the greatest correlation to heat-related emergency calls in the Phoenix (Arizona, USA) metropolitan region. The four modeled UHI mitigation strategies, taken in combination, would lead to a 48% reduction in annual heat-related emergency service calls, where increasing the albedo is the single most effective UHI mitigation strategy.


Five studies utilizing survey, experimental, and diary methods assessed the effects of being outdoors on subjective vitality. In Study 1, we used a vignette method to examine whether being outdoors was associated with vitality, above and beyond the influences of physical activity and social interactions. Study 2 explored the effects of being outdoors on vitality through an experimental design contrasting indoor and outdoor walks. In Study 3, participants were exposed to photographic scenes of either nature or buildings. Results showed that only the nature scenes
enhanced subjective vitality. Studies 4 and 5 used a diary methodology to examine within-person variations in subjective energy as a function of being outdoors, again controlling for physical and social activity. Being outdoors was associated with greater vitality, a relation that was mediated by the presence of natural elements. Limitations of these studies are discussed, as well as their implications for research on energy and vitalization. (C) 2009 Elsevier Ltd. All rights reserved.


There is mounting international evidence that exposure to green environments is associated with health benefits, including lower mortality rates. Consequently, it has been suggested that the uneven distribution of such environments may contribute to health inequalities. Possible causative mechanisms behind the green space and health relationship include the provision of physical activity opportunities, facilitation of social contact and the restorative effects of nature. In the New Zealand context we investigated whether there was a socioeconomic gradient in green space exposure and whether green space exposure was associated with cause-specific mortality (cardiovascular disease and lung cancer). We subsequently asked what is the mechanism(s) by which green space availability may influence mortality outcomes, by contrasting health associations for different types of green space.


Effects of an indoor plant intervention in a Norwegian rehabilitation center were assessed in a quasi-experiment. During a 2-year period, coronary and pulmonary patients (N = 282) completed self-report measures of health, subjective well-being, and emotion on arrival, after 2 weeks, and at the end of a 4-week program. The intervention involved the addition of indoor plants for the second year. On average, patient physical and mental health improved during the program, but the addition of plants did not increase the degree of improvement. Subjective well-being did, however, increase more in patients who went through their program after the addition of plants, although the effect was only apparent in the pulmonary patients. The patients reported more satisfaction with indoor plants and the interior generally after the intervention. Room for the intervention to affect outcomes may have been limited by the well-designed interior and the center's location in a scenic mountain area, but these favorable features of the context apparently did not negate the potential for indoor plants to contribute to patient well-being.


People from all ethnic backgrounds spend some of their leisure time in green areas. This study found that urban parks are more inclusive green places than non-urban green areas, and that urban parks can promote social cohesion. The objective of the research was to establish the extent to which urban parks facilitate social cohesion and how social interaction and place attachment can contribute to such cohesion. Quantitative research (a survey) and qualitative research (observations and interviews) carried out in five urban parks in the Netherlands revealed that there are many similarities in the ways that ethnic groups use urban parks and in the meanings of such parks to these groups. Urban parks are sites where different ethnic groups mingle and where informal and cursory interactions can stimulate social cohesion. Furthermore,
being involved and concerned with parks can facilitate attachment to these places. Urban parks can provide a vital locality where everyday experiences are shared and negotiated with a variety of people. The design of a park, its location and people's image of the park in combination with the cultural characteristics of various ethnic groups inform the opportunities for intercultural interactions.


Climate change can be viewed as human-induced change to climate and depletion of natural systems. It potentially the biggest global health threat of the 21st century. It is predicted to have wide-ranging impacts upon human mental health and well-being, through changes and challenges to people’s environment, socioeconomic structures and physical security. Even the most conservative estimates of the health impacts are extremely alarming. Increasingly, the causes of poor human health and environmental damage are related. This implies that there are common solutions. For example, there are co-benefits to human health and biodiversity from mitigating and adapting to climate change (e.g. promoting active transport and reducing car use reduces CO2 emissions, benefits our environment and reduces morbidity and mortality associated with a sedentary lifestyle). This article outlines how climate change impacts upon mental health and well-being. It introduces ecological concepts, applies these to public health and outlines their implications in transforming the way that we prioritize and deliver public health in order to promote both environmental and human health. Evidence, from psychology and neuroscience, suggests that the perception of being disconnected from our inner selves, from each other and from our environment has contributed to poor mental and physical health. We argue that we must transform the way we understand mental health and well-being and integrate it into action against climate change. We describe a Public Health Framework for Developing Well-Being, based on the principles of ecological public health.


Students' perception of their overall academic experience and the campus environment is related to academic accomplishment, and research has found that the designed environment of the university can influence the degree of stress students may feel. Past research found that undergraduate student use of campus green spaces and perceptions of quality of life were related to each other. The main objective of this study was to investigate the relationship between graduate student use of campus green spaces and their perceptions of quality of life at a university in Texas. A total of 347 of 3279 (approx 10%) of the graduate student body received e-mails with information regarding the incentive for participation and instructions on accessing an on-line survey. The survey included questions that related to student use of campus green spaces, overall quality of life statements, an instrument to measure the quality of life of university students, and demographic questions. A total of 79 (22.8% response rate) graduate student questionnaires were collected and analyzed to compare perceptions of quality of life of university students and the level of individual usage of campus green spaces. Descriptive statistics determined that, unlike undergraduates who were primarily "high users" of campus green spaces, graduate students were about equally split between being "low," "medium," and "high users" of campus green spaces. However, graduate students still ranked their quality of life
Finally, this study found that, unlike undergraduates, graduate students did not have a statistically significant relationship between green-user scores and perception of quality of life scores. It may be that graduate students have less time to spend in outdoor spaces, yet still meet their quality of life needs through other means such as academic achievements.


High school students today are experiencing unprecedented levels of school-related stress. At the same time, a growing body of research has linked views of nature with restoration from mental fatigue and stress reduction. How important are such views for students while they are at school? This study investigated 101 public high schools in southeastern Michigan to examine the role played by the availability of nearby nature in student academic achievement and behavior. The analyses revealed consistent and systematically positive relationships between nature exposure and student performance. Specifically, views with greater quantities of trees and shrubs from cafeteria as well as classroom windows are positively associated with standardized test scores, graduation rates, percentages of students planning to attend a four-year college, and fewer occurrences of criminal behavior. In addition, large expanses of landscape lacking natural features are negatively related to these same test scores and college plans. These featureless landscapes included large areas of campus lawns, athletic fields, and parking lots. All analyses accounted for student socio-economic status and racial/ethnic makeup, building age, and size of school enrollment.


The U.S. nursery and landscape industry generates 1.9 million jobs and had an annual payroll of greater than $3 billion in 2002, yet little is known about nursery and landscape workers. This lack of information is even more pressing considering that labor generally accounts for greater than 40% of production costs and 31% of gross sales. Labor shortages, immigration reform, and legal status of employees are widely reported as the industry's most critical issues. We hypothesized that relevant data regarding the nursery industry workforce may raise an appreciation of the industry's diversity, increase political power and public awareness, and help stakeholders evaluate policy decisions and plan corrective strategies in a more informed manner. A total of 4466 self-administered questionnaires were sent in 2006, attempting to reach 30 nurseries in each of nine states with 1561 returned (35% response rate). Hispanics constituted 70% of the average nursery workforce, including general laborers (76%), crew leaders (61%), and sales/managers (others) (21%). Across firms, labor retention was less than 51% after 5 years and only 22% of employees understood English, raising questions regarding availability and access to training. Sixty percent of nursery employees had not received work-related training, although 81% of men and 72% of women were interested, and an association between training and employee retention existed. The highest rated training topic of interest was English/Spanish (respective of Spanish/English primary language respondents). There was a positive correlation between developing fluency and worker turnover, making the laborer attrition rate even more unfavorable for employers who not only lost employees with acquired experience, but also with acquired English skills.

Over the last three decades solid empirical evidence for the positive influence of greenery on human psychological and cognitive functioning has been steadily accruing. Based on this evidence, researchers and practitioners increasingly realize the importance of urban greening as a strategic activity to promote human wellbeing. Although commercial and retail activities constitute a significant and influential component of urban contexts, a concern is that the stakeholders involved (e.g. merchants) can sometimes be reluctant to integrate vegetation in commercial districts. This can be an important stumbling block for the process of urban greening. In this paper we introduce the concept of Biophilic Store Design (BSD) as the retail design strategy to consciously tap the beneficial effects of vegetation. The central aim of this paper is to demonstrate that the reluctance of certain retail stakeholders to integrate greening practices like BSD is unjustified. Two lines of evidence in support of this claim will be discussed. On the one hand, we sketch a conceptual framework which supports the view that BSD can have restorative effects for those implied in store environments. On the other hand, we review Wolf's multi-study research program on the effects of urban greening on consumer behavior, attitudes, and perceptions. These two lines of evidence show that commercial activities and urban greening are not to be considered as antagonistic but as mutually reinforcing practices.


This study examined neighborhood satisfaction in relation to naturalness and openness. It used Geographic Information System (GIS) and Landsat satellite imagery to physically measure the environmental attributes. Through path analysis it examined the relationship among the attributes, resident ratings of those environmental attributes, their satisfaction with them, and their overall neighborhood satisfaction (n = 725). We expected overall neighborhood satisfaction to relate to the resident's ratings of the environmental attributes and to the physical measures of them. The path model showed that overall neighborhood satisfaction was associated directly with the physical measure of building density and indirectly with the physical measure of vegetation rate through perception and evaluation of them. The perceptions and evaluations of the attributes related to one another. With refinements, GIS and Landsat data geo-related to survey data can offer a powerful tool for understanding the complex nature of neighborhood satisfaction and behavior.


Dramatically increasing urbanization is observable worldwide and brings pressure on space within urban areas as the built environment intensifies. Considerable evidence suggests that contact with nature is important for city dwellers, although it is not known whether residents’ appreciation of the forms of urban green spaces is constant across different contexts. More specifically, it has not yet been shown whether our appreciation of nature is innate and inherently human, is cultural and something that we learn, or is a mixture of both. This article describes an exploratory study consisting of 17 interviews carried out in Zurich, Switzerland. Kelly’s repertory grid technique is used to identify preferred urban landscapes, which were contrasted with identified rejected landscapes. Principle components analysis and
multidimensional scaling reveal a clear separation of cultural and biological modes of landscape assessment in some respondents. The research contributes to an understanding of the meanings of urban green spaces, which would in turn provide planners with a tool to match urban natural resource management with the needs of residents.


The areas of community service work, civic or cultural engagement and volunteer work with society are rapidly becoming popular topics of research, as many individuals are discovering the value and psychosocial need to contribute to a community or social event (Ferber 2007). The value of community service work in relation to how individuals communicate and identify with others as well as within their own cultural and ethnic group has been well established (Chun & Akutsu 2003; Martin & Nakayama 2004). When specific types of environments are created and established, allowing individuals to contribute to the community and work with each other, prosocial behaviours develop more readily, which improves the overall context of other relationships in society and culture (Bond & Smith 1996). Current research suggests that increased contact with ethnically diverse groups can in fact reduce prejudice and racial conflict (Paolini et al. 2004; Pettigrew 1997).

Given the fact that increased contact (via superordinate goals) with different ethnic groups has been shown to help reduce racial conflict and improve race relations, we decided to create a conceptual replication of past research where a gardening environment would allow for members of ethnically diverse groups to interact and work on a variety of gardening-related projects. While there have been numerous studies exploring the relationship between group work and general interethnic relations (see, for example, Gaertner et al. 1989; Hoffman & Wallach 2007a; Pettigrew 1997), little empirical research to date has explored the relationship between actual community service gardening activities and reductions in ethnocentrism.

Because different theorists have different perceptions of what community service work actually is, we define community service work as any community volunteer service that is primarily devoted to improving the environment and relationships of those who comprise any community. Community service activities (such as those in the current study) are organized under the direction of supervisors (or mentors) who help train and educate the community members who work in some way to improve the environment (such as cleaning parks and recreational systems) or society.


The goal of this article is to understand strategies by which both the environmental and poverty alleviation objectives of PES programs can be achieved cost effectively. To meet this goal, we first create a conceptual framework to understand the implications of alternative targeting when policy makers have both environmental and poverty alleviation goals. We then use the Grain for Green program in China, the largest PES program in the developing world, as a case study. We also use a data set from a survey that we designed and implemented to evaluate
the program. Using the data set we first evaluate what factors determined selection of program areas for the Grain for Green program. We then demonstrate the heterogeneity of parcels and households and examine the correlations across households and their parcels in terms of their potential environmental benefits, opportunity costs of participating, and the asset levels of households as an indicator of poverty. Finally, we compare five alternative targeting criteria and simulate their performance in terms of cost effectiveness in meeting both the environmental and poverty alleviation goals when given a fixed budget. Based on our simulations, we find that there is a substantial gain in the cost effectiveness of the program by targeting parcels based on the “gold standard,” i.e., targeting parcels with low opportunity cost and high environmental benefit managed by poorer households.


This study explored the relationship between neighbourhood design and residents’ fear of crime in new suburban housing developments. Self-report and objective data were collected as part of the RESIDential Environments (RESIDE) Project. A neighbourhood form index based on the planning and land-use characteristics that draw people into public space, facilitate pedestrian movement and ensure the presence of ‘territorial guardians’ was developed for each participant (n=1059) from objective environmental data. With each additional index attribute, the odds of being fearful reduced (trend test p value=0.001), and this persisted even after progressive adjustment for demographics, victimisation, collective efficacy and perceived problems. The findings support the notion that a more walkable neighbourhood is also a place, where residents feel safer, and provides further evidence endorsing a shift away from low density, curvilinear suburban developments towards more walkable communities with access to shops, parks and transit.


Advances in horticultural production technology are often hindered by slow grower adoption. Low adoption rates are largely the product of skepticism, which can lead to weaknesses in the commercialization process and affect future research and product development. To better understand industry concerns and design effective outreach methods, an information technology survey was designed as part of the U.S. Department of Agriculture Specialty Crop Research Initiative project titled Comprehensive Automation for Specialty Crops (CASC). This study outlines the survey results from 111 participants at tree fruit meetings in the Pacific northwestern and eastern United States in 2009. Many of the misgivings about new automated technologies, such as equipment cost and reliability of harvest assist, sensor systems, and fully automated harvest machinery, were consistent across the country. Subtle differences appeared between the eastern U.S. and Pacific northwestern U.S. responses, including justifiable equipment price points and irrigation and pest concerns; these are likely attributable to regional differences in climate, operation size and scale, and marketing strategies. These survey data will help the project team better address grower concerns and uncertainty on a regional and national level, thereby improving adoption speed and rates after CASC-developed technologies are rolled out.

Community gardens have been a part of modern American culture since the late 19th century. Participation in community gardening has ebbed and flowed in response to changing socioeconomic conditions, and thus the current economic recession has reheightened public interest. In a review of the scholarly literature from 1999 to 2010, rigorous quantitative research studies on the effects of community gardens are found to be sparse; however, a larger body of qualitative data is available. Eleven themes related to the purposes, benefits of, and motivations for participating in community gardens are identified. Community gardens can serve as an effective tool for community-based practitioners in carrying out their roles within the arenas of organizing, development, and change.


The authors estimate the relationship between trees and three crime aggregates (all crime, violent crime, and property crime) and two individual crimes (burglary and vandalism) in Portland, Oregon. During the study period (2005-2007), 431 crimes were reported at the 2,813 single-family homes in our sample. In general, the authors find that trees in the public right of way are associated with lower crime rates. The relationship between crime and trees on a house’s lot is mixed. Smaller, view-obstructing trees are associated with increased crime, whereas larger trees are associated with reduced crime. The authors speculate that trees may reduce crime by signaling to potential criminals that a house is better cared for and, therefore, subject to more effective authority than a comparable house with fewer trees.


A sense of belonging is a key element in enabling social inclusion through meaningful occupations. This is evident in occupational science and social and therapeutic horticulture (STH) literature. How these theories interact in practice was explored at Thrive's STH project in Battersea in London. A workshop conducted with Thrive Battersea's therapists examined how gardening may facilitate health and wellbeing through belonging. The authors reflect on themes of belonging from the workshop. The implications for occupational therapy from this apparently rich synergy of occupational science, STH and social inclusion are considered.


Background: Type 2 diabetes is a major public health problem in Australia with prevalence increasing in parallel with increasing obesity. Prevention is an essential component of strategies to reduce the diabetes burden. There is strong and consistent evidence from randomised controlled trials that type 2 diabetes can be prevented or delayed through lifestyle modification which improves diet, increases physical activity and achieves weight loss in at risk people. The current challenge is to translate this evidence into routine community settings, determine feasible and effective ways of delivering the intervention and providing on-going support to sustain successful behavioural changes.
Methods/Design: The Sydney Diabetes Prevention Program (SDPP) is a translational study which will be conducted in 1,550 participants aged 50-65 years (including 100 indigenous people aged 18 years and older) at high risk of future development of diabetes. Participants will be identified through a screening and recruitment program delivered through primary care and will be offered a community-based lifestyle modification intervention. The intervention comprises an initial individual session and three group sessions based on behaviour change principles and focuses on five goals: 5% weight loss, 210 min/week physical activity (aerobic and strength training exercise), limit dietary fat and saturated fat to less than 30% and 10% of energy intake respectively, and at least 15 g/1000 kcal dietary fibre. This is followed by 3-monthly contact with participants to review progress and offer ongoing lifestyle advice for 12 months. The effectiveness and costs of the program on diabetes-related risk factors will be evaluated. Main outcomes include changes in weight, physical activity, and dietary changes (fat, saturated fat and fibre intake). Secondary outcomes include changes in waist circumference, fasting plasma glucose, blood pressure, lipids, quality of life, psychological well being, medication use and health service utilization.

Discussion: This translational study will ascertain the reach, feasibility, effectiveness and cost-effectiveness of a lifestyle modification program delivered in a community setting through primary health care. If demonstrated to be effective, it will result in recommendations for policy change and practical methods for a wider community program for preventing or delaying the onset of type 2 diabetes in high risk people.


To assess and compare health care costs for normal-weight, overweight and obese Australians. Analysis of 5-year follow-up data from the Australian Diabetes, Obesity and Lifestyle study, collected in 2004–2005. Data were available for 6140 participants aged ≥ 25 years at baseline. Direct health care cost, direct non-health care cost and government subsidies associated with overweight and obesity, defined by both body mass index (BMI) and waist circumference (WC).

The annual total direct cost (health care and non-health care) per person increased from $1472 (95% CI, $1204–$1740) for those of normal weight to $2788 (95% CI, $2542–$3035) for the obese, however defined (by BMI, WC or both). In 2005, the total direct cost for Australians aged ≥ 30 years was $6.5 billion (95% CI, $5.8–$7.3 billion) for overweight and $14.5 billion (95% CI, $13.2–$15.7 billion) for obesity. The total excess annual direct cost due to overweight and obesity (above the cost for normal-weight individuals) was $10.7 billion. Overweight and obese individuals also received $35.6 billion (95% CI, $33.4–$38.0 billion) in government subsidies. Comparing costs by weight change since 1999–2000, those who remained obese in 2004–2005 had the highest annual total direct cost. Cost was lower in overweight or obese people who lost weight or reduced WC compared with those who progressed to becoming, or remained, obese.

The total annual direct cost of overweight and obesity in Australia in 2005 was $21 billion, substantially higher than previous estimates. There is financial incentive at both individual and societal levels for overweight and obese people to lose weight and/or reduce WC.

Data from the 2004 National Nursery Survey conducted by the USDA-CSREES S-1021 Multistate Research Committee (referred to as the Green Industry Research Consortium) were used to evaluate the effect of pricing influences and selling characteristics on total gross firm sales and gross sales of several plant categories (trees, roses, shrubs/azaleas, herbaceous perennials, bedding plants, foliage, and potted flowering plants) for commercial nurseries and greenhouses. As expected, the firm's selling characteristics play a large role in whether a firm sells a specific plant category. Demand factors also play a role in affecting plant category sales with income, population, and race tending to be the only significant variables, except for the potted flowering plants category. In regard to sales, our results show that certain factors affecting pricing decisions play a critical role in both plant category sales and total sales. Furthermore, demand and business characteristics play a limited role as well, but not as big a role as selling characteristics. Of note is that firms with an increased percentage of sales through wholesale channels (of most plant categories and overall) result in increased sales. By understanding the nursery and greenhouse industry environment and how decisions affect overall and categorical sales, firms can implement strategies that capitalize on factors that have the potential to generate increased sales.


Background: There is increasing interest in the potential role of the natural environment in human health and well-being. However, the evidence-base for specific and direct health or well-being benefits of activity within natural compared to more synthetic environments has not been systematically assessed.

Methods: We conducted a systematic review to collate and synthesise the findings of studies that compare measurements of health or well-being in natural and synthetic environments. Effect sizes of the differences between environments were calculated and meta-analysis used to synthesise data from studies measuring similar outcomes.

Results: Twenty-five studies met the review inclusion criteria. Most of these studies were crossover or controlled trials that investigated the effects of short-term exposure to each environment during a walk or run. This included ‘natural’ environments, such as public parks and green university campuses, and synthetic environments, such as indoor and outdoor built environments. The most common outcome measures were scores of different self-reported emotions. Based on these data, a meta-analysis provided some evidence of a positive benefit of a walk or run in a natural environment in comparison to a synthetic environment. There was also some support for greater attention after exposure to a natural environment but not after adjusting effect sizes for pretest differences. Meta-analysis of data on blood pressure and cortisol concentrations found less evidence of a consistent difference between environments across studies.

Conclusions: Overall, the studies are suggestive that natural environments may have direct and positive impacts on well-being, but support the need for investment in further research on this question to understand the general significance for public health.


This paper aims to review available research into the impact of plants on people and labour productivity in order to test a number of hypotheses and the reliability and validity of
“evidence based” statements. An extended literature review was conducted of research concerning the potential impacts of plants on people and labour productivity. In order to be able to compare the findings of different researchers, an analysis was made of similarities and dissimilarities with regard to the research context, starting-points and test methods. The paper identifies a lack of precise descriptions of the research design and poor comparability between different research with regard to the characteristics of the plant, test persons, test procedures, surrounding conditions and contents of the reports. Although it can be concluded that plants can have a positive impact on the productivity of human beings, it is remarkable that in research reports and research papers the properties of the plant itself are only mentioned by exception. The condition of the plant – whether it is healthy or not – is not described at all. Only 17 studies and underlying papers were investigated and no new research was conducted with the proposed improvements. The findings can be used by managers to legitimate investments in plants and by researchers to improve (the comparability of) research into plants. In addition to the review of the impact of plants on different types of productivity a vision is presented about the impact of the vitality of plants. Furthermore recommendations are given on how to cope with the methodological problem of poor comparability of research.


- **Background:** Public open spaces (POS) are recognized as important to promote physical activity engagement. However, it is unclear how POS attributes, such as activities available, environmental quality, amenities present, and safety, are associated with neighborhood-level walkability and deprivation.
- **Methods:** Twelve neighborhoods were selected within 1 constituent city of Auckland, New Zealand based on higher (n = 6) or lower (n = 6) walkability characteristics. Neighborhoods were dichotomized as more (n = 7) or less (n = 5) socioeconomically deprived. POS (n = 69) were identified within these neighborhoods and audited using the New Zealand-Public Open Space Tool. Unpaired 1-way analysis of variance tests were applied to compare differences in attributes and overall score of POS by neighborhood walkability and deprivation.
- **Results:** POS located in more walkable neighborhoods have significantly higher overall scores when compared with less walkable neighborhoods. Deprivation comparisons identified POS located in less deprived communities have better quality environments, but fewer activities and safety features present when compared with more deprived neighborhoods.
- **Conclusions:** A positive relationship existed between presence of POS attributes and neighborhood walkability, but the relationship between POS and neighborhood-level deprivation was less clear. Variation in neighborhood POS quality alone is unlikely to explain poorer health outcomes for residents in more deprived areas.


- Although natural environments can help promote health, they also contain a number of dangers. This study attempted to examine how variations in the physical structure of a simulated natural environment influenced perceptions of both overall and specific types of danger, fear and preference before exploring the relationships between these variables. Three simulated walks through a natural environment differing in levels of prospect-refuge were created for the study.
Respondents were randomly assigned to one of the conditions and asked to imagine taking the walk for real. In support of the typology, the results found that the walks with higher levels of prospect-refuge (higher visibility, fewer hiding places and more accessibility) were perceived as less dangerous and fearful and more preferred than walks with lower levels of prospect-refuge. However despite levels of prospect-refuge appearing to impact on the perceived likelihood of encountering a physical danger or becoming lost, they were not found to impact on the perception of encountering a social danger.


Asthma prevalence has increased very considerably in recent decades such that it is now one of the commonest chronic disorders in the world. Recent evidence from epidemiological studies, however, suggests that the prevalence of asthma may now be declining in many parts of the world, which, if true is important for health service planning and also because this offers the possibility of generating and testing new aetiological hypotheses. Our objective was to determine whether the prevalence of asthma is declining worldwide. We undertook a systematic search of EMBASE, Medline, Web of Science and Google Scholar, for high quality reports of cohort studies, repeat cross-sectional studies and analyses of routine healthcare datasets to examine international trends in asthma prevalence in children and adults for the period 1990-2008. There were 48 full reports of studies that satisfied our inclusion criteria. The large volume of data identified clearly indicate that there are, at present, no overall signs of a declining trend in asthma prevalence; on the contrary, asthma prevalence is in many parts of the world still increasing. The reductions in emergency healthcare utilization being reported in some economically developed countries most probably reflect improvements in quality of care. There remain major gaps in the literature on asthma trends in relation to Africa and parts of Asia. There is no overall global downward trend in the prevalence of asthma. Healthcare planners will for the foreseeable future, therefore, need to continue with high levels of anticipated expenditure in relation to provision of asthma care.


Cities worldwide have sought to improve their environmental quality through the enhancement of their green space. It seems apparent that if these green spaces are to flourish then there is a critical need to understand and describe the beneficial relationships that exist between plants, people, and places and so develop an appropriate paradigm that leads to sustainable green space. The paradigm needs to be a dynamic entity, ever shifting due to changes in the environmental, social, economical, lifestyle and demographic drivers. In recent years these drivers have become more crucial with unprecedented urban growth and the need to adapt to the agents of climate change. Such a paradigm reinforces the fact that horticulturists, economists, ecologists, planners, social and health scientists need to retain closer linkages among their disciplines and how the effects of such a paradigm can influence food production, biodiversity, behaviour, health and wellbeing as well as human survival. We explore three key dimensions of the concept that make it both complex and broadly useful—its basic definition, the benefits and outcomes that accrue from such a relationship and the factors that would influence a paradigm shift towards sustainable green space.

This study examined associations between participation in community gardening/beautification projects and neighborhood meetings with perceptions of social capital at both the individual and neighborhood levels. Data were analyzed from a cross-sectional stratified random telephone survey conducted in Flint, Michigan (N=1916). Hierarchical linear and logistic regression analyses were used to study associations, controlling for individual and Census block group-level confounders. At the individual level, household involvement in community gardening/beautification activities and in neighborhood meetings were associated with residents' perceptions of bonding social capital, linking social capital, and neighborhood norms and values. Household involvement in gardening/beautification and meetings had stronger associations with residents' perceptions of social capital than did neighborhood-level involvement measures. Results suggest involvement in neighborhood meetings augment the individual and neighborhood-wide perceptions of social capital associated with community gardening and beautification projects. Neighborhood community gardens' impact on neighborhood residents' perceptions of social capital can be enhanced by neighborhood-wide meetings.


A survey of gardeners in Minnesota found they get their information from friends and garden centers. Older gardeners were less likely to use the Internet. The highest interest was indicated for annuals, perennials, and containers, followed by trees and shrubs. Most participants had not attended a gardening class in the past year and indicated they learn best from talking with friends. Publications are of interest to gardeners, and they highly value color photos and illustrations. The University of Minnesota and Minnesota Landscape Arboretum were perceived as significantly more credible and trustworthy than garden centers, and participants felt these institutions should provide educational programs, even if survey respondents were not participating in these programs. About half the participants were not able to comment on the level of bias of the university and arboretum, and other traits (credible, trustworthy, expert, and knowledgeable) were unknown to one-third to one-half of the participants. Participants knew more about these traits for garden centers and home stores. Participants in this survey indicated they look for convenient sources of gardening information and, although many felt the land-grant university and arboretum were highly credible and knowledgeable, they were still more likely to use other sources for their gardening information. This poses a challenge to universities and arboreta to use new ways to reach gardeners.


Objectives The present literature review conceptualises landscape as a health resource that promotes physical, mental, and social well-being. Different health-promoting landscape characteristics are discussed. This article is based on a scoping study which represents a special kind of qualitative literature review. Over 120 studies have been reviewed in a five-step-procedure, resulting in a heuristic device. A set of meaningful pathways that link landscape and
health have been identified. Landscapes have the potential to promote mental well-being through attention restoration, stress reduction, and the evocation of positive emotions; physical well-being through the promotion of physical activity in daily life as well as leisure time and through walkable environments; and social well-being through social integration, social engagement and participation, and through social support and security. Conclusion This scoping study allows us to systematically describe the potential of landscape as a resource for physical, mental and social well-being. A heuristic framework is presented that can be applied in future studies, facilitating systematic and focused research approaches and informing practical public health interventions.


Determining consumers' preferences and willingness to pay (WTP) for organically grown and locally grown fresh produce is very important for stakeholders because it helps them figure out what type of fresh produce to grow and sell, what to emphasize in marketing efforts, and what are reasonable prices to charge. However, the literature that studies and compares consumers' preference and WTP for both organically and locally grown fresh produce is sparse. The objective of this study was to investigate consumers' WTP for organically grown and locally grown fresh produce and the marketing segmentation of these two types of produce. We combined a hypothetical experiment and nonhypothetical choice mechanism to investigate consumers' WTP for the attributes organic, local, and organic plus local for fresh produce. We found that when real products were used in the hypothetical experiment, the hypothetical bias (the difference between what people say they will pay and what they would actually pay) was not high. We found that consumers' WTP for the organic attribute was about the same as their WTP for the local attribute. Consumers' sociodemographics affected their choice between organically grown and locally grown produce. Furthermore, we found that consumers patronized different retail venues to purchase fresh produce with different attributes. The findings of the research have great importance for fresh produce stakeholders to make correct production and marketing decisions; the findings also contribute to experimental method choice in consumers' WTP research.


When mass-merchandisers began to sell ornamental plants, they offered consumers more choices and increased retail competition. We used consumer panel data collected by the American Floral Endowment from 1992 to 2005 to analyze consumers' choice of garden centers and mass-merchandisers. We found that over time there was a decrease in the percentage of transactions made in garden centers and an increase in the percentage of transactions that occurred in mass-merchandisers. However, mean expenditures in garden centers were significantly higher than in mass-merchandisers. There were some regional differences in consumers' choice of the two types of stores and in consumers' socio-demographics affected their choice. In addition, we found consumers bought different types of products in the two types of stores. They cited different reasons why they choose one type of store instead of the other and impulse purchasing behavior was more likely to occur in mass-merchandisers than garden centers.

The Green View index was developed to evaluate the visibility of urban forests. It was estimated through a combination of field surveys and photography interpretation and tested in Berkeley, California. The results showed that the overall Green View value in Berkeley was 24.79%. It has a strong correlation (R-squared = 0.86) with the canopy cover of tree/shrubs, which was 31.49%. Besides the absolute amount of canopy cover, Green View is also influenced by the distribution pattern of trees. The ANOVA analysis indicated that the size of trees, the distance between trees and viewers, the existence of vegetation other than trees and shrubs all had a significant impact on values of Green View. The study shows that the use of large-size trees is important for creating a view with more greenery in a city. Green View can be used to evaluate the visual impact of various planning and management practices on urban forests.


Strip malls (also known as mini-malls) are a common urban land use, historically promoted by U.S. zoning practices that concentrate retail and commercial development in a narrow band along arterials and major streets. More recently, communities are redeveloping mini-mall zones, expanding landscape plantings as biotechnology, and attempting to create a sense of place. This study assessed public response to urban forest and landscape options. Surveys depicted varied roadside, property-edge treatments. Residents of three major cities in the Pacific Northwest, U.S., were asked to indicate their preferences and perceptions concerning a four-concept framework: visual quality, retail perceptions, patronage behavior, and pricing for goods and services. Respondents preferred landscaped roadsides and report positive retail behavior such as willingness-to-pay 8.8% more for goods and services in well-landscaped malls. Roadside management guidelines are proposed based on the research results.


The role of vegetation in mitigating the effects of PM10 pollution has been highlighted as one potential benefit of urban greenspace. An integrated modelling approach is presented which utilises air dispersion (ADMS-Urban) and particulate interception (UFORE) to predict the PM10 concentrations both before and after greenspace establishment, using a 10 x 10 km area of East London Green Grid (ELGG) as a case study. The corresponding health benefits, in terms of premature mortality and respiratory hospital admissions, as a result of the reduced exposure of the local population are also modelled. PM10 capture from the scenario comprising 75% grassland, 20% sycamore maple (Acer pseudoplatanus L.) and 5% Douglas fir (Pseudotsuga menziesii (Mirb.) Franco) was estimated to be 90.41 t yr-1, equating to 0.009 t ha-1 yr-1 over the whole study area. The human health modelling estimated that 2 deaths and 2 hospital admissions would be averted per year.


In the general population, attention is reliably enhanced after exposure to certain physical environments, particularly natural environments. This study examined the impacts of
environments on attention in children with ADHD. Method: In this within subjects design, each participant experienced each of three treatments (environments) in single blind controlled trials. Seventeen children 7 to 12 years old professionally diagnosed with ADHD experienced each of three environments-a city park and two other well-kept urban settings-via individually guided 20-minute walks. Environments were experienced 1 week apart, with randomized assignment to treatment order. After each walk, concentration was measured using Digit Span Backwards. Results: Children with ADHD concentrated better after the walk in the park than after the downtown walk (p = .0229) or the neighborhood walk (p = .0072). Effect sizes were substantial (Cohen’s d = .52 and .77, respectively) and comparable to those reported for recent formulations of methylphenidate. Conclusion: Twenty minutes in a park setting was sufficient to elevate attention performance relative to the same amount of time in other settings. These findings indicate that environments can enhance attention not only in the general population but also in ADHD populations. "Doses of nature" might serve as a safe, inexpensive, widely accessible new tool in the tool kit for managing ADHD symptoms.


The relationship between society, land and landscape is deeply complex. Attitudes are reflected in behaviour, notably patterns of consumption through recreational activity, as well as in expressed preferences. Society attaches great importance to land. A large proportion of the population engages directly with it, through gardening and involvement in the management of allotments, community gardens and other public spaces. There is increasing evidence of the benefits of such engagement for individuals and communities. Society's attitudes and preferences have traditionally been dominated by expert or professional views, which have evolved over time and now place emphasis on everyday as well as special landscapes, and on urban greenspace and green infrastructure as much as on rural landscapes. The general public also seems to value the countryside as well as parks and green spaces nearer to home. Public attitudes are shaped by a number of different factors. Age, social and economic status, ethnic origin, familiarity, place of upbringing and residence, particularly whether urban or rural, are especially significant. Perhaps most important are environmental value orientations. At present, society seems to be polarised. At one extreme are older, more affluent, better educated, more environmentally aware people, often in social grades AB, who are often the most active users of the countryside and greenspaces. At the other extreme are younger age groups, ethnic minorities, and those who are in the DE social grades, who are often much less engaged. These groups have very different values and attitudes. But most people need to access and enjoy different types of landscape at different times and for different purposes, accessing what has been called a ‘portfolio of places’ that is particular to each person. It is by no means clear how the various factors that influence people's attitudes and preferences will play out in the future. Society may continue to become more detached from nature and landscape, and less caring about its future. Or there could be a rekindling of society's need to engage with the land and an increased desire to ensure that all sectors of society can benefit from green spaces and rural landscapes. This is likely to require interventions through education and campaigns to change attitudes and behaviour. Whether such initiatives can be effective in the face of competing drivers of attitudinal and behavioural change and over what timescale, may well determine how society's relationships with land and landscape evolve over the next 50 years.

Whilst biophysical, and increasingly economic, values are often used to define high priority hotspots in planning for conservation and environmental management, community values are rarely considered. The community values mapping method presented in this paper builds on the concept of natural capital and ecosystem services and the landscape values methodology to link local perception of place to a broader measure of environmental values at the landscape level. Based on in-depth interviews and a mapping task conducted with 56 natural resource management decision-makers and community representatives, we quantified and mapped values and threats to natural capital assets and ecosystem services in the South Australian Murray-Darling Basin region. GIS-based techniques were used to map the spatial distribution of natural capital and ecosystem service values and threats over the region and analyse the proportional differences at the sub-regional scale. Participants assigned the highest natural capital asset value to water and biota assets primarily for the production of cultural, regulating and provisioning services. The most highly valued ecosystem services were recreation and tourism, bequest, intrinsic and existence, fresh water provision, water regulation and food provision. Participants assigned the highest threat to regulating services associated with water and land assets. Natural capital asset and ecosystem service values varied at both sub-regional and place-specific scales. Respondents believed people were integral to the environment but also posed a high threat to natural capital and ecosystem services. The results have implications for the way values toward natural capital and ecosystem services may be integrated into planning for environmental management.


Medical and psychological measurements of surgical patients were tested to determine the influence of plants and flowers within hospital rooms. Eighty female patients recovering from a thyroidectomy were randomly assigned to either control or plant rooms. Patients in the plant room viewed 12 foliage and flowering plants during their postoperative recovery periods. Data collected for each patient included length of hospitalization, analgesics used for postoperative pain control, vital signs, ratings of pain intensity, pain distress, anxiety and fatigue, the State-Trait Anxiety Inventory Form Y-1, the Environmental Assessment Scale, and the Patient's Room Satisfaction Questionnaire. Patients in hospital rooms with plants and flowers had significantly shorter hospitalizations, fewer intakes of analgesics, lower ratings of pain, anxiety, and fatigue, and more positive feelings and higher satisfaction about their rooms when compared with patients in the control group. Findings of this research suggest the therapeutic value of plants in the hospital environment as an effective complementary medicine for surgical patients.


Background: Clinical trials have not been reported concerning the health benefits of viewing indoor plants on stress and recovery of surgical patients within a hospital setting. Using various medical and psychologic measurements, this study performed a randomized clinical trial with surgical patients to evaluate whether plants in hospital rooms have therapeutic influences.
Methods: Ninety (90) patients recovering from a hemorrhoidectomy were randomly assigned to either control or plant rooms. With half the patients, live plants were placed in their rooms during postoperative recovery periods. Data collected for each patient included length of hospitalization, analgesics used for postoperative pain control, vital signs, ratings of pain intensity, pain distress, anxiety and fatigue, the State-Trait Anxiety Inventory Form Y-1, the Environmental Assessment Scale, and the Patient's Room Satisfaction Questionnaire.

Results: Viewing plants during the recovery period had a positive influence linking directly to health outcomes of surgical patients. Patients in hospital rooms with plants and flowers had significantly more positive physiologic responses evidenced by lower systolic blood pressure, and lower ratings of pain, anxiety, and fatigue than patients in the control room. Patients with plants also felt more positively about their rooms and evaluated them with higher satisfaction when compared with patients in similar rooms without plants. Based on patients' comments, plants brightened up the room environment, reduced stress, and also conveyed positive impressions of hospital employees caring for patients.

Conclusions: Findings of this study confirmed the therapeutic value of plants in the hospital environment as a noninvasive, inexpensive, and effective complementary medicine for surgical patients. Health care professionals and hospital administrators need to consider the use of plants and flowers to enhance healing environments for patients.


It is widely believed that coming into contact with forest environments is somehow beneficial to human well-being and comfort. In Japan, “Shinrin-yoku” (taking in the atmosphere of a forest) has been proposed to be a relaxation activity associated with forest recreation. The purpose of this study was to examine the physiological effects of forest recreation on the autonomic nervous activity. The subjects were twelve male university students (21.8 ± 0.8 years old). On the first day of the experiment, six subjects were sent to a forest area, and the other six to a city area. On the second day, each subject was sent to the area he did not visit on the first day as a cross check. The subjects walked (15 minutes) around their assigned areas before noon, and sat on chairs viewing (15 minutes) the landscapes of their assigned areas in the afternoon. Heart rate variability (HRV), blood pressure, and pulse rate were measured as physiological indices. Measurements were taken at the place of accommodation in the morning, before and after walking, and before and after viewing at their assigned field areas. Pulse rate, diastolic blood pressure and LF/(LF+HF) (LF – low frequency, HF – high frequency) components of HRV were significantly lower in the forest area than in the city area. HF components of HRV tended to be higher in the forest than in the city. In conclusion, the results of the physiological measurements show that forest recreation enabled effective relaxation in people, both of the mind and body.


The authors investigate whether the percentage of green space in people's living environment affects their feelings of social safety positively or negatively. More specifically they investigate the extent to which this relationship varies between urban and rural areas, between groups in the community that can be identified as more or less vulnerable, and the extent to which different types of green space exert different influences. The study includes 83 736 Dutch citizens who were interviewed about their feelings of social safety. The percentage of green
space in the living environment of each respondent was calculated, and data analysed by use of a three-level latent variable model, controlled for individual and environmental background characteristics. The analyses suggest that more green space in people's living environment is associated with enhanced feelings of social safety except in very strongly urban areas, where enclosed green spaces are associated with reduced feelings of social safety. Contrary to the common image of green space as a dangerous hiding place for criminal activity which causes feelings of insecurity, the results suggest that green space generally enhances feelings of social safety. The results also suggest, however, that green space in the most urban areas is a matter of concern with respect to social safety.


Growing attention has been paid to the health-enhancing or therapeutic effects of natural environments, such as forests, and the requirement for an evidence-based approach has been pressing. However, there is a lack of evidence-based research in this field. In this study, the restorative effects of viewing real forest landscapes were examined through field experiments by comparing the effects of urban landscapes. Twelve Japanese male subjects in their twenties participated in a 3 day field experiment. The subjects were instructed to visit forest and urban environments randomly and to view each real landscape. Physiological and psychological data on each subject were collected four times a day. Significant differences between the responses of the subjects in forest compared with those in the urban environment were found. Forest environments had significantly lower values than urban environments after viewing in (1) salivary cortisol concentration (an index of stress response), (2) diastolic blood pressure, and (3) pulse rate. Further, subjects felt more comfortable, soothed and refreshed when viewing a forest landscape than an urban one. These findings support the idea that real forest landscapes may ameliorate stress, aid autonomic nervous system relaxation and increase positive emotion, and provide important scientific evidence of forest-guided health benefits.


Participatory modeling is increasingly recognized as an effective way to assist collective decision-making processes in the domain of natural resource management. This article introduces a framework for evaluating projects that have adopted a participatory modeling approach. This evaluation framework—known as the “Protocol of Canberra”—was developed through a collaboration between French and Australian researchers engaged in participatory modeling and evaluation research. The framework seeks to assess the extent to which different participatory modeling initiatives not only modify perceptions among and interactions between participants, but also contribute to collective decision-making. The article discusses the development of the framework and its application to three case-studies, two from Australia and one from the Pacific Island of the Republic of Kiribati. The article concludes with some comments for future use of the framework in a range of participatory modeling contexts.

Introduction: the development issues -- The nature of the industry -- Current essential oil production in the South-East Asia Pacific region -- The phyto-chemistry of essential oils -- The extraction of essential oils -- Developing essential oils -- The agricultural chemicals regulation law -- The development planning process -- The field development process -- The organic production of essential oils -- The application of essential oils manufacturing plant design -- Enterprise viability and new crop potential Tea tree (Australian).


Positive environmental determinants of exercise frequency remain poorly understood. Knowing that people often value exercise for psychological restoration, we investigated the restorative quality of indoor and outdoor exercise settings as predictors of exercise frequency. We surveyed 319 members of fitness centers in Zurich that offer indoor and outdoor exercise alternatives. Outdoor settings were rated as more restorative. For each type of environment, restorative quality predicted the frequency of exercise in the past 30 days, independent of socio-demographic characteristics, expectations of exercise benefits, and personal barriers. We discuss the results with regard to the provision of exercise settings for urban populations.


Consumption values are theoretically believed to be the antecedents of the outcomes of consumer purchase choice. In the floral market, even though the context of floral consumption values has been explored, the relationship between floral consumption values and consumer’s purchase choice regarding floral products remains unknown. This study, however, seeks to address this deficiency by attempting to evaluate the differences in floral consumption values across consumer groups that have different purchase choices for floral products. After collecting data from a consumer survey, which yielded 615 valid questionnaires, the statistical results indicated that consumers who revealed different purchase choices in regard to flowers had different floral consumption values. In descending order, showing care to others, emotion conditioning, and sensory hedonics were the floral consumption values most strongly recognized by the majority of the consumers. However, heavy users of flowers revealed different characteristics in that they more strongly recognized the psychological value of emotion conditioning rather than the social value of showing care to others. The main difference across consumer groups that had purchased flowers with different frequencies or that preferred to buy different types of flowers had to do with the epistemic value (i.e., curiosity fulfillment). The results of this study imply that consumers who have different choice behavior toward flowers possess different evaluative judgments in regard to floral products. Such differences not only lead consumers to have different purchase choices in regard to flowers, but are also very likely to influence the consumer’s behavior in regard to information search and variety seeking in the floral market, which in turn, impacts the effectiveness of commercial communication in the floral market.


In June to Oct. 2008, a U.S. floriculture survey was conducted to examine the factors affecting growers' willingness to adopt sustainable practices. The factors affecting adoption of
sustainable practices were evaluated in five areas: environmental regulations, customer value, growers' attitudes toward sustainability, age, and operation size. A logistic regression model was used to examine factors affecting growers' adoption of sustainable practices. Nearly two-thirds (65.2%) of respondents thought sustainability was very important to the environment. Similarly, more than half (63%) of the respondents had sustainable practices in their operations. Although respondents had positive attitudes toward sustainability and the environment, these positive attitudes alone were unable to predict adoption behaviors. The two most important factors that affected adoption of sustainable practices were the concerns about implementation and the risk perceived by growers. Neither perceived customer value nor the stringency of state regulations affected the adoption of sustainable practices. The results from this study provide original insight into growers' views of sustainability and identify the educational assistance needed by growers to overcome the factors affecting their adoption of sustainable practices.


It is concluded that an environment devoid of Nature may act as a "discord", i.e., have a negative effect. While the term mismatch is used for any difference between present living conditions and the environment of evolutionary adaptation, discords are mismatches with a potentially undesirable impact on health or quality of life. The problem is partly due to the visual absence of plants, and may be ameliorated by adding elements of Nature, e.g., by creating parks, by offering a view through windows, and by potted plants. The conclusion is based on an evaluation of some fifty relevant empirical studies.


Research has suggested that city environments with more green space may have lower crime levels. For this pilot study, 11 established community gardens in Houston, TX, were selected and mapped using ArcGIS 9.1 software. The numbers of property crimes reported in the 2005 crime data from the Houston Police Department surrounding the community garden areas at a distance of 1/8 mile were then tallied and mapped for the areas. The numbers of crimes were evaluated alongside demographic data from the 2000 U.S. Census. Statistical comparisons were made between community garden areas and randomly selected city areas that were within a 1-mile area surrounding each garden. Initial results of paired t tests indicated no statistically significant differences between the mean number of crime occurrences in community garden areas and the mean number of crimes in randomly selected areas. Results from a linear regression analysis also indicated that the presence of a community garden was not a predictor of a lower crime rate for a neighborhood. Adjustments were then made by removing randomly selected areas that were demographically least like their respective community gardens. Results from further analysis indicated that there were no crime number differences between the community garden areas and the randomly selected areas. However, interviews conducted with community garden representatives showed that community gardens appeared to have a positive influence on neighborhoods, with residents reporting neighborhood revitalization, perceived immunity from crime, and neighbors emulating gardening practices they saw at the community gardens.

The concept of ecosystems services has become an important model for linking the functioning of ecosystems to human welfare. Understanding this link is critical for a wide-range of decision-making contexts. While there have been several attempts to come up with a classification scheme for ecosystem services, there has not been an agreed upon, meaningful and consistent definition for ecosystem services. In this paper we offer a definition of ecosystem services that is likely to be operational for ecosystem service research and several classification schemes. We argue that any attempt at classifying ecosystem services should be based on both the characteristics of the ecosystems of interest and a decision context for which the concept of ecosystem services is being mobilized. Because of this there is not one classification scheme that will be adequate for the many contexts in which ecosystem service research may be utilized. We discuss several examples of how classification schemes will be a function of both ecosystem and ecosystem service characteristics and the decision-making context. (C) 2008 Elsevier B.V. All rights reserved.


The term nature-deficit disorder is credited to Richard Louv, the author of Last Child in the Woods (2008). It is not an official diagnosis in the International Classification of Diseases and Related Health Problems (ICD-10-CM). Instead, it is a label used to address the increasing cost to children as they are increasingly deprived of direct contact with nature and the experience of unstructured free play in the out-of-doors. Should pediatric nurses know about it? Yes.

Childhood has moved indoors, and children are paying the price. One recent study described today's children as the backseat generation (Karsten, 2005). These are the children escorted by car to and from school, after-school activities, sports team practices and games, dance classes, and other adult-supervised and structured events. Their experience of nature most often occurs from the inside of an automobile looking out or as they watch nature DVDs projected on car headrest screens directly in front of them (Louv, 2008). In 2004, Clements surveyed over 800 mothers in the United States and found that while mothers recognized the diverse benefits of outdoor play, they felt television, computers, and concerns about crime, safety, and injury were keeping their children inside. Louv shared that no child can truly know or benefit from nature if the natural world remains behind glass, seen only through windows or on screens and computer monitors.

Today, children between the ages of 8 and 18 years spend an average of 6.5 hr a day with electronic media (Roberts, Foehr, & Rideout, 2005; Roberts & Foehr, 2008). In one study, 8-year-old children were better able to identify Pikachu, Metapod, and Wigglytuff (characters from the Japanese card-trading game Pokémon) than common neighborhood flora or fauna, such as local oak trees (Balmford, Clegg, Coulson, & Taylor, 2002). Others report that young children can define global warming and describe the rainforest and the impact of deforestation in the Amazon Basin, but they have no idea what plants grow in their backyards or what watershed is affected if they litter in the street outside their house.

For this new generation of children, direct experiences with nature—whether in the backyard, in a neighborhood field or woods, or along a beach, stream, or lake—are slowly being replaced by indirect experience through electronic media and machinery (Louv, 2008). Children are losing their ability to experience the world directly, which in turn contributes to a growing
inability of children to relate to others’ life experience as well (Reed, 1996). In short, children are in some ways on house arrest and in danger of losing their capacity to think or learn about the world directly. Such changes in learning are now being examined as potential sources of stress and anxiety and may even contribute to increasing incidence of depression and other diagnoses in children (Ginsburg, 2007).

Research related to children's direct experience with nature is growing. In 2000, Wells reported that proximity to nature and exposure to natural settings enhanced children's cognitive abilities, especially in terms of executive function. She and others (Burdette & Whitaker, 2005) found that direct experience with/in nature increased children's attention spans and abilities to focus, their creative thought processes, problem-solving abilities, self-discipline, and self-regulation. She also found that access to natural play areas helped reduce stress in children (Wells, 2003). There is growing evidence that indicates direct exposure to nature is essential for children's physical and emotional health, improving their cognitive abilities and resistance to negative stresses and depression.

It is not surprising that it also appears to reduce symptoms in attention-deficit/hyperactivity disorder (ADHD) (Kuo & Taylor, 2004; Taylor, Kuo, & Sullivan, 2001). These studies on ADHD also report that the “greener” the natural setting, the greater the relief from symptoms. In contrast, indoor activities, such as watching TV, or outdoor play on paved, “nongreen” areas, increase ADHD symptoms (Louv, 2008). Kuo and Taylor also point out that prescribing “green time” as an adjunct in the treatment of ADHD may have other advantages as well. In contrast to prescription medications and behavioral therapy, green time is widely accessible, free from adverse side effects, is nonstigmatizing, and inexpensive, if not free.


The ways people perceive greenway trails in urban environments are not well studied. Trail layout and aspects of maintenance and design of trails in urban areas would benefit from better knowledge of how potential users perceive these places and what might encourage or discourage their use. The purpose of this study was to examine the relative influence of aesthetic response dimensions on the likeability of greenway trail scenes in an urban environment. A web-based 'virtual tour' was used to elicit responses to scenes of urban greenway environments in downtown Houston and Austin, Texas, USA. The 211 subjects who participated in the study were selected from an undergraduate student population. Participants viewed the scenes and responded to the survey in a controlled computer laboratory. Perceptions of the greenways supported the aesthetic dimensions that Nasar has suggested for broader urban environments. Our analysis resulted in the identification of five dimensions of aesthetic response to the greenway scenes that were interpreted as: maintenance, distinctiveness, naturalness, pleasantness and arousal. These represented both cognitive and affective responses to the environment and all five dimensions were significant positive predictors of the likeability of greenway scenes. The dimension of pleasantness had the greatest influence on likeability and maintenance had the least. The implications of the findings for urban design related to greenway trails and future research are discussed.

People have been bringing plants into residential and other indoor settings for centuries, but little is known about their psychological effects. In the present article, we critically review the experimental literature on the psychological benefits of indoor plants. We focus on benefits gained through passive interactions with indoor plants rather than on the effects of guided interactions with plants in horticultural therapy or the indirect effect of indoor plants as air purifiers or humidifiers. The reviewed experiments addressed a variety of outcomes, including emotional states, pain perception, creativity, task-performance, and indices of autonomic arousal. Some findings recur, such as enhanced pain management with plants present, but in general the results appear to be quite mixed. Sources of this heterogeneity include diversity in experimental manipulations, settings, samples, exposure durations, and measures. After addressing some overarching theoretical issues, we close with recommendations for further research with regard to experimental design, measurement, analysis, and reporting.


Empirical and anecdotal evidence suggests that landscapes with more vegetation have a positive impact on children's focus, attention, and cognitive development. In school, children are able to regain focus, suppress impulses, and pay attention in class longer after exposure to natural settings. Because children spend much of their time in school, the amount and types of vegetation on school grounds may influence their development. Public elementary schools in the Commonwealth of Virginia (N = 988) were surveyed to examine correlations between school ground vegetation and outside recess. The number of trees on school grounds, the size of the school grounds, and the presence of sports fields were modestly correlated with greater outside recess time. These correlations support common sense because sports fields facilitate supervised play and larger school grounds provide space for sports fields and playgrounds and additional opportunities for free play. More trees on school grounds provide a welcoming environment for students and teachers, and encourage outside play. These results may help school personnel design and maintain school grounds that increase outdoor recess time.

Competition among floral retailers has promulgated industrywide structural changes while giving consumers more choices in locations for purchase. Consumer panel data collected by the American Floral Endowment from 1992 to 2005 were used to evaluate consumers' choice of different floral retail outlets among box stores (BS), traditional freestanding floral outlets (TF), general retailer (GR), other stores (OS), and direct-to-consumer (DC) channels. Since 1992, market share and percentage of transactions decreased through TF but increased for BS. Mean expenditure per transaction in TF was higher than in BS and GR. Consumers who made floral gift purchases were more likely to patronize TF, but those who bought floral products for themselves were more likely to purchase from BS. Consumers patronizing TF or DC were more likely to buy arranged flowers rather than unarranged flowers. Consumers who purchased foliage plants and outdoor bedding or garden plants were more likely to buy them from BS. Reasons consumers who choose BS and GR cited for using those outlets included convenience and lower prices, whereas consumers who purchased from TF and DC cited delivery, reputation, and service as major drivers impacting their use. Demographic and geographic differences were also identified among consumers using the aforementioned outlets.


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The quality of life in the cities is constantly declining due to increasing urbanization, industrialization and mechanization. Noise, dust, gaseous pollution and summer peak temperature are major problems in urban areas. The value of green spaces within the urban fabric is increasingly being rediscovered. The present study was conducted to explore the possibilities of sustainable establishment of landscape in accordance with the perception of the people's and local conditions. Planting design was made considering soil condition, local environment and people's choice. The design received a quick response from the community and had great impact on the Faisalabad environment. All the wasteland in the interior city has been greatly improved
and it helped to curb pollution, enhance biodiversity and beautify the city at the same time. The results of the present study showed that 71% of the respondents mentioned that the landscape enhanced the beauty of the area, 17.5% opined that it controls pollution. Regarding the types of plants they liked in the central spine, 45% chose flowering plants followed by 33.3% shrubs. In road-side green spaces 51.7% wished to see shady trees followed by flowering plants (25%). In squares, 50% of the respondents chose flowering plants while 30.8% liked seasonal plants.


For agriculture to meet goals that include profitability, environmental integrity, and the production of ecosystem services beyond food, fuel, and fiber requires a comprehensive, systems-level research approach that is long-term and geographically scalable. This approach is largely lacking from the US agricultural research portfolio. It is time to add it. A long-term agricultural research program would substantially improve the delivery of agricultural products and other ecosystem services to a society that calls for agriculture to be safe, environmentally sound, and socially responsible.


Studies have shown that exposure to the natural environment, or so-called green space, has an independent effect on health and health-related behaviours. We postulated that income-related inequality in health would be less pronounced in populations with greater exposure to green space, since access to such areas can modify pathways through which low socioeconomic position can lead to disease. We classified the population of England at younger than retirement age (n=40?813?236) into groups on the basis of income deprivation and exposure to green space. We obtained individual mortality records (n=366?348) to establish whether the association between income deprivation, all-cause mortality, and cause-specific mortality (circulatory disease, lung cancer, and intentional self-harm) in 2001?05, varied by exposure to green space measured in 2001, with control for potential confounding factors. We used stratified models to identify the nature of this variation. The association between income deprivation and mortality differed significantly across the groups of exposure to green space for mortality from all causes (p<0·0001) and circulatory disease (p=0·0212), but not from lung cancer or intentional self-harm. Health inequalities related to income deprivation in all-cause mortality and mortality from circulatory diseases were lower in populations living in the greenest areas. The incidence rate ratio (IRR) for all-cause mortality for the most income deprived quartile compared with the least deprived was 1·93 (95% CI 1·86?2·01) in the least green areas, whereas it was 1·43 (1·34?1·53) in the most green. For circulatory diseases, the IRR was 2·19 (2·04?2·34) in the least green areas and 1·54 (1·38?1·73) in the most green. There was no effect for causes of death unlikely to be affected by green space, such as lung cancer and intentional self-harm. Populations that are exposed to the greenest environments also have lowest levels of health inequality related to income deprivation. Physical environments that promote good health might be important to reduce socioeconomic health inequalities.

Using various medical and psychological measurements, this study performed a randomized clinical trial with surgical patients to evaluate if plants in hospital rooms have therapeutic influences. Ninety patients recovering from an appendectomy were randomly assigned to hospital rooms with or without plants. Patients in the plant treatment room viewed eight species of foliage and flowering plants during their postoperative recovery periods. Data collected for each patient included length of hospitalization, analgesics used for postoperative pain control, vital signs, ratings of pain intensity, pain distress, anxiety, and fatigue, the State-Trait Anxiety Inventory Form Y-1, the Environmental Assessment Scale, and the Patient's Room Satisfaction Questionnaire. Patients in hospital rooms with plants and flowers had significantly fewer intakes of postoperative analgesics, more positive physiological responses evidenced by lower systolic blood pressure and heart rate, lower ratings of pain, anxiety, and fatigue, and more positive feelings and higher satisfaction about their rooms when compared with patients in the control group. Findings of this research suggested that plants in a hospital environment could be noninvasive, inexpensive, and an effective complementary medicine for patients recovering from abdominal surgery.


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Researchers have found that students' perception of their overall academic experience and the campus environment is related to academic accomplishment. Additionally, studies have found that the designed environment of the university can influence the degree of stress students may feel. The main objective of this study was to investigate the relationship between undergraduate university student use of campus green spaces and their perceptions of quality of life at a university in Texas. A total of 2334 students or 10% of the undergraduate student body received e-mails with information regarding the incentive for participation and instructions on accessing an online survey. The survey included questions that related to student use of campus green spaces, overall quality of life statements, an instrument to measure the quality of life of university students, and demographic questions. A total of 373 surveys was collected and analyzed to compare levels of quality of life of university students and the level of usage of campus green spaces. Demographic information collected allowed controlling for student grade classification, gender, and ethnicity. Frequency statistics determined that, on average, more than half the students were ranked as "high-users" of the campus green spaces, and very few students were considered "low-users." Frequency statistics also determined that most students rated their overall quality of life and quality of life of university students positively. Additionally, this study found that undergraduate student use of campus green spaces and perceptions of quality of life were related to each other.


Background: The aim of this study was to investigate whether physical activity (in general, and more specifically, walking and cycling during leisure time and for commuting purposes, sports and gardening) is an underlying mechanism in the relationship between the amount of green space in people's direct living environment and self-perceived health. To study this, we first investigated whether the amount of green space in the living environment is related to the level of physical activity. When an association between green space and physical activity was found, we analysed whether this could explain the relationship between green space and health.
Methods: The study includes 4,899 Dutch people who were interviewed about physical activity, self-perceived health and demographic and socioeconomic background. The amount of green space within a one-kilometre and a three-kilometre radius around the postal code coordinates was calculated for each individual. Multivariate multilevel analyses and multilevel logistic regression analyses were performed at two levels and with controls for socio-demographic characteristics and urbanicity.

Results: No relationship was found between the amount of green space in the living environment and whether or not people meet the Dutch public health recommendations for physical activity, sports and walking for commuting purposes. People with more green space in their living environment walked and cycled less often and fewer minutes during leisure time; people with more green space garden more often and spend more time on gardening. Furthermore, if people cycle for commuting purposes they spend more time on this if they live in a greener living environment. Whether or not people garden, the time spent on gardening and time spent on cycling for commuting purposes did not explain the relationship between green space and health.

Conclusion: Our study indicates that the amount of green space in the living environment is scarcely related to the level of physical activity. Furthermore, the amount of physical activity undertaken in greener living environments does not explain the relationship between green space and health.


Background: The prevalence of childhood asthma in the USA increased by 50% from 1980 to 2000, with especially high prevalence in poor urban communities.

Methods: Data on the prevalence of asthma among children aged 4–5 years and on hospitalisations for asthma among children less than 15 years old were available for 42 health service catchment areas within New York City. Street tree counts were provided by the New York City Department of Parks and Recreation. The proximity to pollution sources, sociodemographic characteristics and population density for each area were also measured.

Results: Controlling for potential confounders, an increase in tree density of 1 standard deviation (SD, 343 trees/km2) was associated with a lower prevalence of asthma (RR, 0.71 per SD of tree density; 95% CI, 0.64 to 0.79), but not with hospitalisations for asthma (RR, 0.89 per SD of tree density; 95% CI, 0.75 to 1.06).

Conclusions: Street trees were associated with a lower prevalence of early childhood asthma. This study does not permit inference that trees are causally related to asthma at the individual level. The PlaNYC sustainability initiative, which includes a commitment to plant one million trees by the year 2017, offers an opportunity for a large prospective evaluation.


We previously reported that a forest bathing trip enhanced human NK activity, number of NK cells, and intracellular anti-cancer proteins in lymphocytes. In the present study, we investigated how long the increased NK activity lasts and compared the effect of a forest bathing trip on NK activity with a trip to places in a city without forests. Twelve healthy male subjects, age 35-56 years, were selected with informed consent. The subjects experienced a three-day/two-night trip to forest fields and to a city, in which activity levels during both trips were matched.
On day 1, subjects walked for two hours in the afternoon in a forest field; and on day 2, they walked for two hours in the morning and afternoon, respectively, in two different forest fields; and on day 3, the subjects finished the trip and returned to Tokyo after drawing blood samples and completing the questionnaire. Blood and urine were sampled on the second and third days during the trips, and on days 7 and 30 after the trip, and NK activity, numbers of NK and T cells, and granulysin, perforin, and granzymes A/B-expressing lymphocytes in the blood samples, and the concentration of adrenaline in urine were measured. Similar measurements were made before the trips on a normal working day as the control. Phytoncide concentrations in forest and city air were measured. The forest bathing trip significantly increased NK activity and the numbers of NK, perforin, granulysin, and granzyme A/B-expressing cells and significantly decreased the concentration of adrenaline in urine. The increased NK activity lasted for more than 7 days after the trip. In contrast, a city tourist visit did not increase NK activity, numbers of NK cells, nor the expression of selected intracellular anti-cancer proteins, and did not decrease the concentration of adrenaline in urine. Phytoncides, such as alpha-pinene and beta-pinene were detected in forest air, but almost not in city air. These findings indicate that a forest bathing trip increased NK activity, number of NK cells, and levels of intracellular anti-cancer proteins, and that this effect lasted at least after the trip. Phytoncides released from trees and decreased stress hormone may partially contribute to the increased NK activity.


Anger and stress management have become important issues in the modern workplace. One out of four American workers report themselves to be chronically angry, which has been linked to negative outcomes such as retaliatory behavior, revenge, interpersonal aggression, poor work performance, absenteeism, and increased turnover. We hypothesized that people who work in office environments decorated with aesthetically engaging art posters would experience less stress and anger in response to task-related frustration. Two hundred and ten college students were randomly assigned to different office conditions where abstract and nature paintings were hung on the walls. Participants performed four mild anger-provoking computer tasks and then reported their levels of state anger and stress. Results indicate that different office conditions had a significant influence on state anger and stress for males but not for females. Males experienced less state anger and stress when art posters were present. Through mediation analysis, we found that increased proportions of nature paintings decreased state anger because of decreased levels of stress.


Urban settlements transform the natural environment so greatly that people tend to see the city only as an employment site, and economic and cultural center. Thus a growing number of people prefer to reside in greener suburbs or rural areas. This results in increased automobile commuter traffic, accompanied by traffic jams, accidents, stress, and ever more damage to the environment. Concepts of sustainable development or the ecological city represent strategies for changing these negative trends. The purpose for doing so is principally the well-being of a city’s residents. Often this entails bringing more of the natural environment back into the city, because urban green space fulfills several critical functions in an urban context that benefit people’s quality of life. There is a broad consensus about the importance, and therefore the value, of urban
green space in cities as currently constructed, in addition to its value in planning ecological cities. Steadily growing traffic and urban heat not only damage the environment, but also incur social and economic costs. As we explain further, we can save costs even by making small changes to existing situations. Furthermore, we maintain and show that an integrated approach is needed for designing and maintaining urban green space. The main thesis of this chapter, therefore, is as follows: To provide sufficient quality of life in high-density cities, it is important to maintain and restore an urban green space system; moreover, urban green space and a comfortable urban climate also produce social and economic benefits.


The natural environment affects human health through the provision of ecosystem services such as water purification, catastrophes such as tsunamis, and the harbouring of disease vectors, among other things. In recent decades, scientists have begun to research subjective aspects of the natural environment that are relevant to health, especially in urbanised societies. Our understanding of how the experience of nature might promote health has advanced through studies on environmental aesthetics, motivations for outdoor recreation, sources of residential satisfaction, and the affective and cognitive benefits of activities in gardens, parks, and wilderness areas.2–5 A distinct theme in this work is the value of natural environments for psychological restoration, such as psychophysiological stress reduction. This restorative value seems to stem from mutually reinforcing aspects of experiences of nature: distance from everyday demands, and possibilities for aesthetic appreciation and activity driven by interest.


There is growing evidence to support the notion that contact with nature is helpful for emotional states, attention, mental fatigue, behavior, and personal health. This study adopts a quasi-experimental approach to investigate the effects of limitedly visible indoor plants on students' psychology, physiology, and behavior and uses a control-series design covering one semester. Two classes of sophomores at a Taiwanese junior high school (eighth grade, N = 76), of which one served as the experimental group and the other as control, were surveyed once every 2 weeks. After six plants were placed at the back of the classroom, the experimental group had immediately and significantly stronger feelings of preference, comfort, and friendliness as compared to the control group. Also, the experimental group had significantly fewer hours of sick leave and punishment records due to misbehavior than the control group. In addition to the visual and psychological mechanisms that contributed to restoration, there may have been other factors at work.


Two field experiments examined the effectiveness of signs requesting hotel guests’ participation in an environmental conservation program. Appeals employing descriptive norms (e.g., “the majority of guests reuse their towels”) proved superior to a traditional appeal widely used by hotels that focused solely on environmental protection. Moreover, normative appeals
were most effective when describing group behavior that occurred in the setting that most closely matched individuals’ immediate situational circumstances (e.g., “the majority of guests in this room reuse their towels”), which we refer to as provincial norms. Theoretical and practical implications for managing proenvironmental efforts are discussed.


Quality psychosocial care for patients undergoing treatment for hematology/oncology disorders and their families serves to reduce the inevitable disruptions in life experienced during treatment. Horticultural therapy, a process through which plants and gardening activities are used as vehicles in professionally conducted programs of therapy is a program option that can address the psychosocial needs of patients in numerous medical situations. The horticultural therapy program at the Stephen D. Hassenfeld Children's Center for Cancer and Blood Disorders of New York University Langone Medical Center is designed to stimulate sensory, cognitive, and communication skills as well as increase knowledge and awareness of nature while providing a stress-reducing diversion during treatment. This program provides a range of benefits that complement other treatment options and serves to help minimize potential challenges in the quality of life for patients and their families.


A job satisfaction survey was posted on the Internet and administered to office workers in Texas and the Midwest. The survey included questions regarding job satisfaction, physical work environments, the presence or absence of live interior plants and windows, environmental preferences of the office workers, and demographic information. Approximately 450 completed responses were included in the final sample. Data were analyzed to compare levels of job satisfaction of employees who worked in office spaces with live interior plants or window views of exterior green spaces and employees who worked in office environments without live plants or windows. Statistically significant differences (P < 0.05) were found regarding perceptions of overall life quality, overall perceptions of job satisfaction, and in the job satisfaction subcategories of "nature of work," "supervision," and "coworkers" among employees who worked in office spaces with live interior plants or window views and those employees who worked in office environments without live plants or windows. Findings indicated that individuals who worked in offices with plants and windows reported that they felt better about their job and the work they performed. This study also provided evidence that those employees who worked in offices that had plants or windows reported higher overall quality-of-life scores. Multivariate analysis of variance comparisons indicated that there were no statistically significant differences among the categories of "age," "ethnicity," "salary," "education levels," and "position" among employees who worked in offices with or without plants or window views. However, there were gender differences in comparisons of males in that male participants in offices with plants rated job satisfaction statements higher when compared with males working in offices with no plants. No differences were found in comparisons of female respondents.

Objective: Natural elements in the built healthcare environment have shown to hold potential stress-reducing properties. In order to shed light on the underlying mechanism of stress-reducing effects of nature, the present study investigates whether the stress-reducing effects of indoor plants occur because such an environment is perceived as being more attractive.

Method: A single-factor between-subjects experimental design (nature: indoor plants vs. no plants) was used in which participants (n=77) were presented with a scenario describing hospitalization with a possible legionella diagnosis. The study was conducted from March to May 2007 in the Netherlands. Subsequently, they were exposed to a photo of a hospital room. In this room were either indoor plants, or there was a painting of an urban environment on the wall. Afterwards, perceived stress and the perceived attractiveness of the hospital room were measured.

Results: Participants exposed to the hospital room with indoor plants reported less stress than those in the control condition. Mediation analysis confirmed that indoor plants in a hospital room reduce feelings of stress through the perceived attractiveness of the room. CONCLUSION: This study confirms the stress-reducing properties of natural elements in the built healthcare environment. It also sheds light on the underlying mechanism causing this stress-reduction.


Just as conditions within our homes have important implications for our health, conditions in the neighborhoods surrounding our homes also can have major health effects. Social and economic features of neighborhoods have been linked with mortality, general health status, disability, birth outcomes, chronic conditions, health behaviors and other risk factors for chronic disease, as well as with mental health, injuries, violence and other important health indicators. Physical and social environments in neighborhoods can be overtly hazardous—for example, polluted or crime-infested. They also can severely limit the choices and resources available to individuals. For example, an individual’s ability—and motivation—to exercise and avoid smoking and excessive drinking can be constrained by living in a neighborhood that lacks safe areas for exercise, where intensive tobacco and alcohol advertising targets poorer and minority youth and liquor stores are plentiful, and where healthy role models are scarce. For example, studies have shown that a neighborhood’s socioeconomic conditions can affect whether its residents smoke,3,5 have healthy diets, 6,7 and practice safe reproductive behaviors.8 By the same token, aspects of neighborhood environments—such as the presence of sidewalks and playgrounds, after-school physical activity programs for children and youth, and availability of affordable nutritious food—can promote health by encouraging healthy behaviors and making it easier to adopt and maintain them. Similarly, people are more likely to receive recommended medical care when facilities are accessible from where they live, either because they are located nearby or because safe, convenient transportation is available.

The physical, social and service environments of neighborhoods can promote health or put health in jeopardy.

- The physical environment includes the “built environment”—the environment resulting from structures built by humans—as well as the natural environment.
- The social environment includes the quality of relationships—such as trust, connectedness and cooperation—among neighborhood residents.
The service environment includes neighborhood resources for education, employment, transportation, health care, grocery shopping, recreation and other services directly or indirectly tied to health.

Features of physical, social, and service environments often overlap (for example, neighborhood access to grocery stores reflects both the physical and service environments), but together they can create vastly different opportunities to be healthy. Social and economic conditions in neighborhoods can also influence health by affecting access to employment opportunities and public resources including efficient transportation, an effective police force, and good schools. Strong ties and trust among people within neighborhoods have been associated with better health. Not all neighborhoods enjoy these opportunities and resources equally, however, and access to neighborhoods with health-promoting conditions varies by a household’s economic and social resources; housing discrimination has limited the ability of many blacks and Hispanics to live in health-promoting neighborhoods. The concentration of substandard housing in less-advantaged neighborhoods further compounds racial and ethnic as well as socioeconomic disparities in health.

This issue brief examines the current state of knowledge about neighborhoods and their links with health, exploring the following questions:

- How could neighborhoods affect health?
- Are features of places really that important for health—or should we focus primarily on the individuals who live in them?
- Do all Americans have the opportunity to live in a healthy neighborhood?
- Could public and private policies improve neighborhoods in ways likely to improve America’s health?

The brief also includes several examples of public, private and joint public-private initiatives intended to make neighborhoods healthier places to live, learn and play.


The myriad of cultures around the world differ from continent to continent and within continents, regions, and even cities themselves. The cultural expectations are often aesthetics-based, but there are more reasons than just beauty for the popularity of ornamental plants. Growers and garden centers feature the new, the different, the plant breeder introductions, and the tried-and-true heritage varieties, but keeping up with change is difficult. Across America, and to a certain extent, Europe, the traditional customers are retiring and the next generation of customers is not willing to spend the time gardening that their parents did. In both the USA and Europe, increasing attention is paid to marketing and how to attract the 25- to 45-year-old customer. The market is changing from "Do It Yourself" to "Do It For Me," as the new generation, brought up on instantaneous gratification, wants it Now. In addition to the appeal of something new, the markets are promoting and sharing the knowledge of how valuable plants are in a home or workplace as stress relievers, air purifiers, environmental modifiers, health benefits, and symbols of feelings, friendship, and comfort. The support behind the commercial ornamental industries includes plant breeders and university and government researchers, but also industry organizations, marketplace gurus, psychologists, and social scientists. As cities reinvent their aging downtowns, the green industries play a huge role in enhancing the quality of life the urban dwellers experiences. Different strategies are needed for different target groups, but basic themes include "providing solutions," and contributing easy and instant applications. Growers must be
able to choose among the many new plants introduced each year to produce enough plants for the demand, but they must also be ready to switch to new products when that demand weakens. Keys to this include knowing the customer better and keeping up with the trends that influence plant selection and use.


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This study examined the relations between neighbourhood socio-economic status and features of public open spaces (POS) hypothesised to influence children's physical activity. Data were from the first follow-up of the Children Living in Active Neighbourhoods (CLAN) Study, which involved 540 families of 5–6 and 10–12-year-old children in Melbourne, Australia. The Socio-Economic Index for Areas Index (SEIFA) of Relative Socio-economic Advantage/Disadvantage was used to assign a socioeconomic index score to each child's neighbourhood, based on postcode. Participant addresses were geocoded using a Geographic Information System. The Open Space 2002 spatial data set was used to identify all POS within an 800 m radius of each participant's home. The features of each of these POS (1497) were audited. Variability of POS features was examined across quintiles of neighbourhood SEIFA. Compared with POS in lower socioeconomic neighbourhoods, POS in the highest socioeconomic neighbourhoods had more amenities (e.g. picnic tables and drink fountains) and were more likely to have trees that provided shade, a water feature (e.g. pond, creek), walking and cycling paths, lighting, signage regarding dog access and signage restricting other activities. There were no differences across neighbourhoods in the number of playgrounds or the number of recreation
facilities (e.g. number of sports catered for on courts and ovals, the presence of other facilities such as athletics tracks, skateboarding facility and swimming pool). This study suggests that POS in high socioeconomic neighbourhoods possess more features that are likely to promote physical activity amongst children.


This study used quantitative and qualitative methods to investigate the impact of indoor gardening on elderly residents of a low-income assisted living facility over a 4-week period. Mastery, self-rated health, and self-rated happiness were pre-, post-, and post-post measured to evaluate whether a short-term introduction of indoor gardening that involved individual plant-care responsibility would improve these measures that are predictive of health and quality of life. Eighteen residents participated in four 2-hour interactive horticulture classes taught by a social horticulturist and a sociologist. Class members showed a significant increase in mastery, self-rated health, and self-rated happiness. The results of this study indicate that a basic horticultural activity, as simple as learning how to maintain a houseplant and taking individual responsibility for one, can have a short-term positive impact on the quality of life and on primary indicators of future health outcomes of older adults residing in assisted living facilities.


Walking is important for the health of elderly people. Previous studies have found a relationship between neighbourhood characteristics, physical activity and related health aspects. The multivariate linear regression model presented here describes the relationships between the perceived attractiveness of streets for walking along and (physical) street characteristics. Two hundred and eighty-eight independently living elderly people (between 55 and 80 years old) participated in the study. Street characteristics were assessed along homogeneous street subsections defined as ‘links’. Positively related to perceived attractiveness of links were the following street characteristics: slopes and/or stairs, zebra crossings, trees along the route, front gardens, bus and tram stops, shops, business buildings, catering establishments, passing through parks or the city centre, and traffic volume. Litter on the street, high-rise buildings, and neighbourhood density of dwellings were negatively related to perceived link attractiveness. Overall, the results suggest that three main aspects affect perceived attractiveness of streets for walking, namely tidiness of the street, its scenic value and the presence of activity or other people along the street. The results are discussed within the context of these three aspects.


* Biodiversity benefits people through more than just its contribution to material welfare and livelihoods. Biodiversity contributes to security, resiliency, social relations, health, and freedom of choices and actions.
* Changes in biodiversity due to human activities were more rapid in the past 50 years than at any time in human history, and the drivers of change that cause biodiversity loss and lead to changes in ecosystem services are either steady, show no evidence of declining over time, or
are increasing in intensity. Under the four plausible future scenarios developed by the MA, these rates of change in biodiversity are projected to continue, or to accelerate.

* Many people have benefited over the last century from the conversion of natural ecosystems to human-dominated ecosystems and from the exploitation of biodiversity. At the same time, however, these gains have been achieved at growing costs in the form of losses in biodiversity, degradation of many ecosystem services, and the exacerbation of poverty for other groups of people.

* The most important direct drivers of biodiversity loss and ecosystem service changes are habitat change (such as and use changes, physical modification of rivers or water withdrawal from rivers, loss of coral reefs, and damage to sea floors due to trawling), climate change, invasive alien species, overexploitation, and pollution.

* Improved valuation techniques and information on ecosystem services demonstrate that although many individuals benefit from biodiversity loss and ecosystem change, the costs borne by society of such changes are often higher. Even in instances where knowledge of benefits and costs is incomplete, the use of the precautionary approach may be warranted when the costs associated with ecosystem changes may be high or the changes irreversible.

* To achieve greater progress toward biodiversity conservation to improve human well-being and reduce poverty, it will be necessary to strengthen response options that are designed with the conservation and sustainable use of biodiversity and ecosystem services as the primary goal. These responses will not be sufficient, however, unless the indirect and direct drivers of change are addressed and the enabling conditions for implementation of the full suite of responses are established.

* Trade-offs between achieving the 2015 targets of the Millennium Development Goals and the 2010 target of reducing the rate of biodiversity loss are likely, although there are also many potential synergies between the various internationally agreed targets relating to biodiversity, environmental sustainability, and development. Coordinated implementation of these goals and targets would facilitate the consideration of trade-offs and synergies.

* An unprecedented effort would be needed to achieve by 2010 a significant reduction in the rate of biodiversity loss at all levels.

* Short-term goals and targets are not sufficient for the conservation and sustainable use of biodiversity and ecosystems. Given the characteristic response times for political, socioeconomic, and ecological systems, longer-term goals and targets (such as for 2050) are needed to guide policy and actions.

* Improved capability to predict the consequences of changes in drivers for biodiversity, ecosystem functioning, and ecosystem services, together with improved measures of biodiversity, would aid decision-making at all levels.

* Science can help ensure that decisions are made with the best available information, but ultimately the future of biodiversity will be determined by society.


We compare the restorative effects on cognitive functioning of interactions with natural versus urban environments. Attention restoration theory (ART) provides an analysis of the kinds of environments that lead to improvements in directed-attention abilities. Nature, which is filled with intriguing stimuli, modestly grabs attention in a bottom-up fashion, allowing top-down directed-attention abilities a chance to replenish. Unlike natural environments, urban
environments are filled with stimulation that captures attention dramatically and additionally requires directed attention (e.g., to avoid being hit by a car), making them less restorative. We present two experiments that show that walking in nature or viewing pictures of nature can improve directed-attention abilities as measured with a backwards digit-span task and the Attention Network Task, thus validating attention restoration theory.


Retail sales of container gardens have increased dramatically in recent years, rising 8% from 2004 to 2005, to $1.3 billion. The objective of this study was to determine consumer preferences for three attributes of container gardens; color harmony, price, and amount of care information provided with the purchase. A hierarchical set of levels for each attribute was used in a 3 × 3 × 3 factorial conjoint analysis. A Web-based survey was conducted on 18 Oct. 2006 with 985 respondents. Survey participants were asked to complete a series of questions on a 7-point Likert scale. Survey participants also answered questions about past experiences with and future purchase intentions of container gardens as well as demographics. The three attributes accounted for 99.8% of the variance in container garden preference. Relative importance decreased from price (71%) to amount of care information (23%) to color harmony (6%). Survey participants preferred a container garden with a price point of $24.99, extensive care information, and complementary color harmony. A large portion (76%) of participants in this study indicated that they would be more likely to purchase a container garden if extensive care information was included with the purchase and 85% of participants said they would be willing to visit an Internet Web site that would provide more information on how to care for and maintain a container garden. Results of this study show that there is a potential to increase the value of a container garden through providing educational material with the purchase.


By environmental literature conducted recently, it has been evidently comprehended that urban life quality for mankind and others can be improved by serving these systems with green and living elements. This study is to investigate urban rocky habitats that have special natural characteristics and that can be implicated for urban green areas. But these habitats have been considered as nature splits withstand against the urban pressures by means of the unplanned build-up activities foremost, and road construction, poor quality or neglected remnants. Therefore, this study presents the environmental perception and preferences of urban rocky habitats which are threatening within excessive urbanization and human use of natural areas in the context of the city of Trabzon, Turkey. So, a total of 20 habitats selected from urban and surroundings were Surveyed by using a questionnaire and landscape assessment approach. With Surveying performed on 204 participants, visual preferences, landscape attributes and proposed management options for urban nature conservation were determined. The chi(2)-test results revealed clearly that demographic and expertise status of the participants were correlated with the preferences for types of rocky habitat scene and management options. The scenes with natural elements and less human disturbance obtained higher scores on visual preferences than any of the urban rocky scenes lacking these characteristics. Also, in the quantitative phase, factor analysis based on principal component structure revealed the 'visual and spatial effects', the 'usage and arrangement', the 'naturalness and ecological value', and the 'functionality'
components of the scenes. Consequently, some implications for the effective and efficient planning and development of urban nature conservation by assisting the letter understanding of the various patterns of landscape preference, choice and satisfaction in habitats under the present study were suggested.


This article explores the relationships among environmental health, social capital and collective action in the industrial city of Hamilton, Ontario, Canada. Survey results from 512 households are used to document intra-urban variation in levels of social capital (defined as norms, networks and trust) and collective action in the context of environmental health issues, and specifically air quality. Despite real differences between areas in terms of socio-demographic characteristics, little variation in either social capital or collective action by area was observed. Further, while social networks and community involvement were significant predictors of collective action, indicators of norms and trust were not. Hence, the conception of social capital as a unitary construct that produces place-specific benefits is not reflected in the example explored here.


Europe is a highly urbanised continent. The consequent loss and degradation of urban and peri-urban green space could adversely affect ecosystems as well as human health and well-being. The aim of this paper is to formulate a conceptual framework of associations between urban green space, and ecosystem and human health. Through an interdisciplinary literature review the concepts of Green Infrastructure, ecosystem health, and human health and well-being are discussed. The possible contributions of urban and peri-urban green space systems, or Green Infrastructure, on both ecosystem and human health are critically reviewed. Finally, based on a synthesis of the literature a conceptual framework is presented. The proposed conceptual framework highlights many dynamic factors, and their complex interactions, affecting ecosystem health and human health in urban areas. This framework forms the context into which extant and new research can be placed. In this way it forms the basis for a new interdisciplinary research agenda.

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**Timperio, A., et al. (2007). "Is availability of public open space equitable across areas?" Health Place 13.**

This study examined whether availability of public open spaces that can be used for recreation varies according to neighbourhood socio-economic disadvantage. Density and area of public open spaces were examined using a geographic information system and postal boundaries were used to define neighbourhoods. Neighbourhood socio-economic status (SES) was stratified into quintiles. Once neighbourhood population and geographic area were considered there were no differences in the number or total area of free-access, restricted access or sporting/recreation open spaces across quintiles of neighbourhood SES. Future research should examine whether the quality of public open spaces differ by neighbourhood SES.


Windows have been found to be a particularly salient feature of the workplace, not only as a matter of preference but also for health and well-being. Depending on what is in the view, looking out of the window may provide numerous opportunities for restoration. This study investigated the effect of window views on job satisfaction and stress. The impact of two specific influencing mechanisms was examined: existence of forest views through windows in workplaces, and absence of forest views through windows in workplaces. The sample consisted of 931 office workers in Seoul, South Korea, 481 who could see forest views from their workplaces and 450 who could not see forest views. A set of self-administered questionnaires including job satisfaction and job stress measures was distributed to the sample from April to September 2004. The results showed a significant direct effect of forest views from windows on job satisfaction and stress. Respondents’ personal information such as gender, age and job category did not influence on the window view effects. As expected, employees’ job satisfaction and job stress were highly and negatively correlated.

**Pearce, J., et al. (2007). "Are socially disadvantaged neighbourhoods deprived of health-related community resources?" Int J Epidemiol 36.**

Background: Recent work in a number of countries has identified growing geographical inequalities in health between deprived and non-deprived neighbourhoods. The health gaps observed cannot be entirely explained by differences in the characteristics of individuals living in those neighbourhoods, which has led to a concerted international public health research effort to determine what contextual features of neighbourhoods matter. This article reports on access to potentially health-promoting community resources across all neighbourhoods in New Zealand. Prevailing international opinion is that access to community resources is worse in deprived neighbourhoods.

Methods: Geographical Information Systems were used to calculate geographical access to 16 types of community resources (including recreational amenities, and shopping, educational and health facilities) in 38 350 small census areas across the country. The distribution of these access measures by neighbourhood socioeconomic deprivation was determined.

Results: For 15 out of 16 measures of community resources, access was clearly better in more deprived neighbourhoods. For example, the travel time to large supermarkets was ~80%
greater in the least deprived quintile of neighbourhoods compared with the most deprived quintile.

Conclusions: These results challenge the widely held, but largely untested, view that areas of high social disadvantage have poorer access to community resources. Poor locational access to community resources among deprived neighbourhoods in New Zealand does not appear to be an explanation of poorer health in these neighbourhoods. If anything, a pro-equity distribution of community resources may be preventing even wider disparities in neighbourhood inequalities in health.


Objectives: To determine the association between the percentage of greenspace in an area and the standardised rate of self-reported “not good” health, and to explore whether this association holds for areas exhibiting different combinations of urbanity and income deprivation.

Design and setting: Cross-sectional, ecological study in England.

Participants: All residents of England as at the 2001 Census.

Main outcome measures: Age and sex standardised rate of reporting “not good” health status.

Results: A higher proportion of greenspace in an area was generally associated with better population health. However, this association varied according to the combination of area income deprivation and urbanity. There was no significant association between greenspace and health in higher income suburban and higher income rural areas. In suburban lower income areas, a higher proportion of greenspace was associated with worse health.

Conclusions: Although, in general, higher proportion of greenspace in an area is associated with better health, the association depends on the degree of urbanity and level of income deprivation in an area. One interpretation of these analyses is that quality as well as quantity of greenspace may be significant in determining health benefits.

Macintyre, S. (2007). "Deprivation amplification revisited; or, is it always true that poorer places have poorer access to resources for healthy diets and physical activity?" Int J Behav Nutr Phys Act 4.

Background: It has commonly been suggested (including by this author) that individual or household deprivation (for example, low income) is amplified by area level deprivation (for example, lack of affordable nutritious food or facilities for physical activity in the neighbourhood).

Discussion: The idea of deprivation amplification has some intuitive attractiveness and helps divert attention away from purely individual determinants of diet and physical activity, and towards health promoting or health damaging features of the physical and social environment. Such environmental features may be modifiable, and environmental changes may help promote healthier behaviors. However, recent empirical examination of the distribution of facilities and resources shows that location does not always disadvantage poorer neighbourhoods. This suggests that we need: a) to ensure that theories and policies are based on up-to-date empirical evidence on the socio-economic distribution of neighbourhood resources, and b) to engage in further research on the relative importance of, and interactions between, individual and environmental factors in shaping behavior.
Summary: In this debate paper I suggest that it may not always be true that poorer
neighbourhoods are more likely to lack health promoting resources, and to be exposed to more
health damaging resources. The spatial distribution of environmental resources by area
socioeconomic status may vary between types of resource, countries, and time periods. It may
also be that the presence or absence of resources is less important than their quality, their social
meaning, or local perceptions of their accessibility and relevance.

The urban heat island effect, and its mostly negative consequences of modified
temperature, wind, precipitation, and air quality patterns, is the primary instigator of local
climate change. Continued urbanization of the global population will only hasten further change.
The increasing impact of urban heat islands on local climates may eventually translate to more
widespread climate change, possibly global, if left unchecked. Parks are the first and best line of
defense against these changes. Urban parks cool and clean the air, improve and modify local
wind circulations, and better regulate precipitation patterns. Well-vegetated parks, in a variety of
forms and sizes, mitigate the impact of the urban heat island and minimize local climate change.
Reduced impact of the urban heat island may prolong or even prevent more widespread global
climate change as cities continue to increase in both size and number.

Hansmann, R., et al. (2007). "Restoration and stress relief through physical activities in
A field survey assessed the restorative effects of visiting an urban forest and a city park in
Zurich, Switzerland. Respondents rated their headaches, level of stress, and how balanced they
felt both prior to visiting the outdoor location and at the time of being interviewed. Suffering
from headaches and stress decreased significantly, and feeling well-balanced increased
significantly. The recovery ratio for stress was 87%, and the reduction in headaches was 52%, in
terms of the possible improvements on five-point rating scales. With respect to feeling well-
balanced, the observed changes amounted to 40% of the possible enhancement. Positive effects
increased with length of visit, and individuals practising sports (e.g., jogging, biking, playing
ball) showed significantly higher improvements than those engaged in less strenuous activities
(e.g., taking a walk or relaxing). These findings support previous research on how exercise in
green spaces promotes well-being and recovery from stress.

Bringslimark, T., et al. (2007). "Psychological Benefits of Indoor Plants in Workplaces:
Putting Experimental Results into Context." HortScience 42(3): 581-587.
Laboratory experiments and quasi-experimental field studies have documented beneficial
effects of indoor plants on outcomes such as psychophysiological stress, task performance, and
symptoms of ill health. Such studies have taken an interest in the value of indoor plants in work
settings, but they typically have not considered how the effects of plants might compare with
effects of other workplace characteristics. The present study makes an initial attempt to situate
the potential benefits of indoor plants in a broader workplace context. With cross-sectional
survey data from 385 Norwegian office workers, we used hierarchical regression analyses to
estimate the associations that plants and several often-studied workplace factors have with
perceived stress, sick leave, and productivity. Other variables included in our models were
gender, age, physical workplace factors (e.g., noise, temperature, lighting, air quality), and
psychosocial workplace factors (demands, control, social support). After controlling for these
variables, the number of indoor plants proximal to a worker's desk had small but statistically reliable associations with sick leave and productivity. Although small, such associations can have substantial practical significance given aggregation over the large number of office workers over time.

Brethour, C., et al. (2007). Literature review of documented health and environmental benefits derived from ornamental horticulture products, Agriculture and Agri-Food Canada Markets and Trade, Ottawa, ON.

A review of the literature demonstrated that ornamental horticulture has a wider suite of benefits than expected. Plants can provide multiple benefits in terms of the economy, environment and human lifestyles. Many of these benefits, however, are not well known or understood within the general population. As a result, there is a considerable opportunity for the ornamental horticulture industry to sell more products based on the benefits identified throughout this literature review.


The objective of this study was to assess the potential contribution of car-borne flora to species dispersal in a suburban area in Flanders (Belgium). Therefore, motor vehicle-borne flora was evaluated monthly for a random sample of 20 cars between October 1988 and September 1989. At the end of the experiment 33 car-borne plant species, with a total of 690 seedlings were identified from mud, attached to these vehicles. There was considerable temporal variation in the mud mass attached to the vehicles and therefore also the size and composition of the vehicle-borne flora varied during the year. Because mud retention on cars is a crucial factor in seed dispersal, the number of emerging seedlings is negatively correlated with precipitation in the week preceding the sampling. The flora dispersed by vehicles consists mostly of species with small, light seeds and a persistent seed bank. Usually, they are pioneer species of nitrogen-rich habitats. The nature of the vehicle dispersed flora was compared with the local flora of road verges and differed significantly from this in, e.g., seed length, seed weight, ecological groups, Ellenberg indicator values for nitrogen supply, potential dispersal strategies and rarity. A larger resemblance with the flora of the zone immediately adjacent to the carriageway was found. We only found a low similarity to other motor vehicle-borne floras.


Social science methods can be used to assess how the public values context-sensitive solutions. The roadside landscape is a public lands resource that has many functions and provides many benefits. Diverse stakeholders may have varied expectations for roadside design. The urban forest is often a contested component of the urban roadside. Two research surveys based on landscape assessment literature were used to assess and quantify public preferences and perceptions with regard to trees in highspeed and freeway roadsides. One photo questionnaire was distributed in urban areas nationally and the other in Washington State. To elicit public attitudes about visual quality and community image, each survey included design visualizations constructed with digitally edited photographs. Research results were consistent across both studies. Respondents judged images with increasing amounts of roadside vegetation, including trees, to have a higher amenity value. The presence of more extensive community greening was
associated with positive consumer inferences and greater willingness to pay for goods and services. There was little variation in responses across respondent demographics. Results provide an empirical basis for flexible highway design and promote planning options for roadside urban forests that address multiple stakeholder interests.


Flowers preferred by humans increase Duchenne smiling and social behavior and decrease negative mood reports. Would a floral odor also affect emotional behavior? 123 participants (66 females) rated their own emotional state, rated the emotional response to short fear/anger videos and reported a recent memory in either a gardenia, peppermint or Etoh condition. There is no effect of odor on ratings of pleasantness or intensity (both odors are different from Etoh only). Condition did not effect self-rating of mood. There is an effect of emotional response to the fear/anger videos for positive emotion ($P < 0.002$) and negative emotion ($P < 0.02$); both gardenia and peppermint prompt higher positive emotion than Etoh but peppermint also prompts more negative emotion than Etoh. There is an effect of odor on social reference words in the memory narrative ($P < 0.02$); gardenia prompts more than Etoh. These results support the hypothesis that floral odor specializes in searches for positive emotion and social reference.


Silver birch (Betula pendula) is commonly used as a street tree in temperate climatic regions. However, the medical literature contains a wealth of reports on the health effects of pollen from silver birch. In many countries such as New Zealand, silver birch is the main tree that causes allergic symptoms, including seasonal hayfever, asthma, and other health conditions such as food allergies (the oral allergy syndrome). Exposure to pollen from silver birch is more likely to occur in cities because of the numbers of the trees and the human population density. Even if there were doubts about the extent of the problem and the costs associated with the problem, the precautionary principle should apply. The health-related problems of silver birch should be promulgated and trees should be removed.


Research on residents’ attitudes has shown that street trees are highly valued elements of the urban environment and that their benefits far outweigh their annoyances. Much of this research was done in communities in the United States, and it is uncertain whether the findings can be generalized to other communities or countries. We compared residents’ opinions of street trees, perceptions of the benefits and annoyances trees provide, and preferences for tree size, shape, and growth rate between three communities in the United States and the United Kingdom. Overall, opinions of nearby street trees were positive and did not differ between the two UK communities and the U.S. community. Respondents in the UK communities rated annoyances as more serious, shade as less of a benefit, and physical benefits as more significant than did the residents of the U.S. community. Respondents in the two UK communities also preferred smaller trees with slower growth rates. Although these comparisons cannot be used to make inferences about differences between the entire United Kingdom and United States, they do suggest some
specific ways in which community characteristics such as climate and proximity of trees to houses may contribute to variation in attitudes toward trees.


This paper investigates migrants' perceptions and experiences of urban greenspaces. The research used innovative participatory and visual (photography) methods and the 12 week programme included visits to 10 greenspaces in Sheffield. The participants were all asylum seekers and refugees from Asia and Africa. This paper discusses how and why the participants engaged or disengaged with local greenspace in the short and medium term. In particular, the importance of memory and nostalgia in participants' experiences; the significance of plants; the novelty of visiting British 'parks'; and the role of greenspace in enhancing the quality of life of immigrants are explored. The paper concludes that a positive impression of the local environment and meaningful participation in it can be a useful component of integration into a new society. Furthermore, recognition of landscape elements or characteristics can provide a conceptual link between former and new homes. However, for this refugee group many physical and psychological barriers must be overcome if the full benefits of urban public open space are to be realised.


The need for conservation of the natural environment is normally argued in economic or ethical terms. Little has been said about the potential emotional or health benefits. Yet there is evidence that exposure to nature can make a positive contribution to health, help people recover from stress and promote concentration and clearer thinking.


Environmental psychologists suggest that appropriately landscaped roadside scenes may have a reducing influence on travel-related stress or may improve attention, yet there is very little data available that establishes the nature of the relationship between roadside landscaping and driver safety. Traditional transportation researchers suggest that aesthetic enhancements are a problematic component of the roadside landscape because of the severity of vehicle/tree collisions and a perception that roadside aesthetics can distract the driver causing safety risk. Costly planning processes arise as members of the local communities debate with public utility and transportation management staff on the subject of appropriate roadside landscaping. To test the effect of landscape improvements on driver performance, this study used a comparison of before-and-after crashes as a quantitative measure of roadside greening. Researchers examined 61 road sections in Texas that were landscape designed as either urban arterials or state highways. The hypothesis tested was to determine whether landscape-improved sections of the roadway were safer compared to the same road section before landscape improvements at 10 sites were very well controlled as study sites. The findings of this study show a significant decrease in crash rate after landscape improvements were implemented at the 95% confidence level on 10 urban arterial or highway sites in Texas. The contribution of this study is to further investigate the effect that landscape features are having on driver behavior which appear to be
associated with positive changes in safety result from design. However, these findings need further research to verify a relationship between driver's visual perception according to travelway corridor landscape treatments. (c) 2005 Elsevier B.V. All rights reserved.


Study objectives: To investigate the strength of the relation between the amount of green space in people's living environment and their perceived general health. This relation is analysed for different age and socioeconomic groups. Furthermore, it is analysed separately for urban and more rural areas, because the strength of the relation was expected to vary with urbanity.

Design: The study includes 250 782 people registered with 1 04 general practices who filled in a self administered form on sociodemographic background and perceived general health. The percentage of green space (urban green space, agricultural space, natural green space) within a one kilometre and three kilometre radius around the postal code coordinates was calculated for each household.

Methods: Multilevel logistic regression analyses were performed at three levels - that is, individual level, family level, and practice level - controlled for sociodemographic characteristics.

Main results: The percentage of green space inside a one kilometre and a three kilometre radius had a significant relation to perceived general health. The relation was generally present at all degrees of urbanity. The overall relation is somewhat stronger for lower socioeconomic groups. Elderly, youth, and secondary educated people in large cities seem to benefit more from presence of green areas in their living environment than other groups in large cities.

Conclusions: This research shows that the percentage of green space in people's living environment has a positive association with the perceived general health of residents. Green space seems to be more than just a luxury and consequently the development of green space should be allocated a more central position in spatial planning policy.


Though genetically modified (GM) ornamental cut flowers are already available commercially, U.S. academics and Green Industry growers have not assessed consumer perception about GM ornamental plants for landscape use. Because we must make inferences from studies of GM foods, we risk misunderstanding and alienating stakeholders and clients. If we misjudge the end-user, we jeopardize the market for future GM ornamental plant introductions. To address this gap, we surveyed Tennessee Master Gardener Volunteers in 2004. Respondents (n = 607) revealed that concern and belief about GM ornamental plants parallel U.S. expectation about GM foods. Average Master Gardener volunteer responses predict that GM ornamental plants would provide only slight benefits to both the environment and human health once used in the landscape. Compared with non-GM plants, GM ornamental plants are expected to be about the same or less invasive in the landscape. While all types of GM ornamental plants were expected to provide slight benefits, plant types were perceived differently with male respondents expecting perennials to yield the most environmental benefits and females indicating grasses and turf. Men and women also differed in their relative acceptance of GM ornamental plants, if genes were added from different types of organisms to achieve a genetic transformation of an ornamental shrub. Our results suggest that academic outreach and Green Industry marketing to promote new GM plant products should emphasize...
attributes of benefit, rather than GM transformation processes. Regardless, about 73% of TN Master Gardener respondents reported interest in buying GM ornamental plants if sold commercially, but the majority advocated a requirement for GM plant product labeling at point-of-sale.


Although genetically modified (GM) ornamental cut flowers are now available commercially, we have no knowledge of consumer perception about GM ornamental plants for landscape use and must make inferences from models drawn for GM foods. If we misjudge the customer, and consumers object to GM ornamental plant products for moral reasons, governmental or scientific mistrust, or limited understanding about GM technology, the market for GM ornamental plant commodities will fail. A survey of Master Gardener volunteers was conducted in 2004 to address this gap. Although Master Gardener perceptions likely differ from those of general U.S. consumers, responses are expected provide insight about beliefs applicable to the gardening public. Results from 607 Tennessee respondents revealed that concerns about GM ornamental plants parallel those expressed in the United States about GM foods. On average, Master Gardeners anticipate slight benefits to both the environment and human health should GM ornamental plants be introduced into the landscape. Male respondents chose perennials to provide the most environmental benefits, whereas females indicated grasses and turf. Genetically modified ornamental plants are also expected to be about the same or less invasive in the landscape than non-GM plants. Of respondents who anticipated more potential for GM ornamental plant invasiveness, women were more likely than men to predict plant escape. Men and women differed in relative acceptance of genes added from different organisms as a method of achieving genetic transformations in plants. This result suggests that outreach and marketing to promote new GM plant products should emphasize attributes of benefit rather than processes used to accomplish the goal. Regardless, although {approx}73% of TN Master Gardener respondents reported interest in buying GM ornamental plants if sold commercially, participants advocated a requirement that GM plant products be clearly labeled at point-of-sale.


Horticulture is an ancient pursuit. Beginning some 10,000 years ago, our brilliant forebears discovered the horticultural craft secrets that are the basis of our profession. They initiated a revolution that changed forever the destiny of humans from scavenging, collecting, and hunting to agriculture. We all are the heirs and beneficiaries of this legacy from the past. Our roots derive from prehistoric gatherers, Sumerian, Egyptian, Chinese, and Korean farmers, Hellenic root diggers, medieval peasants, and gardeners everywhere who devised practical solutions to problems of plant growing for food, ornament, medicine, fiber, and shelter. The accumulated successes and improvements passed orally from parent to child, from artisan to apprentice, and became embedded in human consciousness via legend, craft secrets, and folk wisdom. It was stored in tales, almanacs, herbals, and histories and has become part of our common culture. More than practices and skills were involved as improved germplasm was selected and preserved via seed and graft from harvest to harvest and generation to generation.
Practically all of our cultivated crops were selected and improved by prehistoric farmers. An array of technological approaches from primitive tools fashioned during the Bronze and Iron Ages through the development of the horticultural arts – irrigation, propagation, cultivation, pruning and training, drying, and fermentation – were devised to accommodate the needs and desires of humankind. The sum total of these technologies makes up the traditional lore of horticulture. It represents a monumental achievement of our forebears, un- known and unsung. Horticultural technology has been continuous over the millennia but in the last 100 years dramatic changes have occurred that have transformed horticulture from a craft to a science, and these changes will be displayed in the present Congress. However, all these advances are based solidly on the foundation of ancient techniques.


This article investigates the role of urban political economy, private-public property relations, and race and ethnicity in the social production of Milwaukee’s urban forest. By integrating urban-forest canopy-cover data from aerial photography, United States Census data, and qualitative data collected through in-depth interviews, this analysis suggests that there is an inequitable distribution of urban canopy cover within Milwaukee. Since urban trees positively affect quality of life, the spatially inequitable distribution of urban trees in relation to race and ethnicity is yet another instance of urban environmental inequality that deserves greater consideration in light of contemporary and dynamic property relations within capitalist societies.


To examine the research evidence for the contribution of cultural participation to individual quality of life; to discuss the utility of different types of QOL conceptualization and measurement for cultural policy making.

A literature review of English language publications over the decade from 1995. There are few extant QOL studies, and very little empirical evidence to support the claims made by policymakers about culture and individual QOL. The article suggests that a multi-dimensional, rather than a global, conceptualization of QOL is best suited to the cultural policymaking context. Securing findings generalisable across all cultural forms, project types and all individuals or populations is not an achievable goal. Methodologies need to be developed and tested to understand how and why cultural participation affects individual QOL domains and these need to take into account differences in types of cultural participation, the quality of the experience, and between individuals in different social circumstances and in different life stages.


This paper reports the results of a literature study into the effects of plants on human wellbeing. Different studies from various countries show that there are many different settings in which humans interact with plants. Some of these settings have a therapeutic aim, others do not. This paper demonstrates that various target groups can benefit from working with plants. Little is
known, however, about the mechanisms behind horticultural therapy while the evidence is weak due to the methodological limitations of the studies.


This paper reports the results of a literature study into the effects of plants on human well-being. Different studies from various countries show that there are many different settings in which humans interact with plants. Some of these settings have a therapeutic aim, others do not. This paper demonstrates that various target groups can benefit from working with plants. Little is known, however, about the mechanisms behind horticultural therapy while the evidence is weak due to the methodological limitations of the studies.


In this article we extend the theory of community prediction by presenting seven hypotheses for predicting community structure in a directionally changing world. The first three address well-studied community responses to environmental and ecological change: ecological communities are most likely to exhibit threshold changes in structure when perturbations cause large changes in limiting soil or sediment resources, dominant or keystone species, or attributes of disturbance regime that influence community recruitment. Four additional hypotheses address social-ecological interactions and apply to both ecological communities and social-ecological systems. Human responsiveness to short-term and local costs and benefits often leads to human actions with unintended long-term impacts, particularly those that are far from the site of decision making or are geographically dispersed. Policies are usually based on past conditions of ecosystem services rather than expected future trends. Finally, institutions that strengthen negative feedbacks between human actions and social-ecological consequences can reduce human impacts through more responsive (and thus more effective) management of public ecosystem services. Because of the large role that humans play in modifying ecosystems and ecosystem services, it is particularly important to test and improve social-ecological hypotheses as a basis for shaping appropriate policies for long-term ecosystem resilience.


A multistudy research program has investigated how consumers respond to the urban forest in central business districts of cities of various sizes. Trees positively affect judgments of visual quality but, more significantly, may influence other consumer responses and behaviors. Survey respondents from all regions of the United States favored trees in business districts, and this preference was further reflected in positive district perceptions, patronage behavior, and product pricing. An overview of the research is provided, with implications for the economics of local communities.


Unless additional economic returns can be generated from ownership of forestlands, it will be difficult to simultaneously manage forests to include socially desired services while
creating sustainable development opportunities for rural communities. One unique economic return is to collect nontimber forest materials for use in renewable energy production systems because this is compatible with obtaining socially based environmental services from forests while providing new economic return to forest owners. Bioenergy systems that transform wood using sustainable chemical practices are environmentally CO(2)-neutral and are able to supply other nonforestry-based industrial platforms (e.g., electricity, biofuels, pharmaceutical precursors, etc.).


This study evaluates three healing gardens surrounding a pediatric cancer center. All gardens contained seating, flowers and plants, but varied in size, features, and in user groups' access to them. A post-occupancy evaluation (POE) yielded a dataset of 1400 garden-users for whom demographic information, activities, and length-of-stay were recorded. Results indicate differential usage patterns across gardens, user category (patient, visitor, or staff), and age (adults and children). The largest garden with most direct patient access was the most used. Staff mostly used the gardens to walk-through or to sit and eat, rarely interacting with features intended for active engagement. Despite patient and child-friendly designs, the overwhelming majority of visitors were adults who mostly engaged in sedentary activities. Children who did use the gardens interacted with garden features significantly more than adults. Although patient rooms are situated at ground-level around the gardens to promote window views of the gardens, the findings suggest an inverse relationship between patient window use and the number of people in the gardens. Finally, preliminary data suggest that emotional distress and pain are lower for all groups when in the gardens than when inside the hospital. Provisional design implications of these findings are discussed.


Urban parks have always been an important setting for arts and cultural programs. During the late 19th century, parks commonly hosted musical events. By the beginning of the 20th century, dance, theatre, and even the new medium of film began to be represented in parks programming. Today, there is a tremendous flowering of artistic and cultural activity in urban parks, from large-scale performing arts festivals to long-term residencies with arts organizations. Parks and the arts have become mutually beneficial: the arts can play an essential role in revitalizing a park, and parks in turn can help solve problems faced by artists and arts organizations. Since parks are the democratic spaces of a city, where communities can come together to express their identities, the marriage of parks and the arts makes perfect sense. Parks can be a vital place for the cultural expression of a community and a city.


For over 30 years, the Ramsar Convention has recognized the interdependence of people and their environment and is the only global intergovernmental convention addressing the interactions between water and wetland ecosystems. It has promoted the wise use of wetlands as a means of maintaining their “ecological character”—the ecosystem components and processes that comprise the wetland and that underpin the delivery of ecosystem services, such as fresh water and food.
Both physical activity and exposure to nature are known separately to have positive effects on physical and mental health. We have investigated whether there is a synergistic benefit in adopting physical activities whilst being directly exposed to nature (‘green exercise’). Five groups of 20 subjects were exposed to a sequence of 30 scenes projected on a wall whilst exercising on a treadmill. Four categories of scenes were tested: rural pleasant, rural unpleasant, urban pleasant and urban unpleasant. The control was running without exposure to images. Blood pressure and two psychological measures (self-esteem and mood) were measured before and after the intervention. There was a clear effect of both exercise and different scenes on blood pressure, self-esteem and mood. Exercise alone significantly reduced blood pressure, increased self-esteem, and had a positive significant effect on 4 of 6 mood measures. Both rural and urban pleasant scenes produced a significantly greater positive effect on self-esteem than the exercise-only control. This shows the synergistic effect of green exercise in both rural and urban environments. By contrast, both rural and urban unpleasant scenes reduced the positive effects of exercise on self-esteem. The rural unpleasant scenes had the most dramatic effect, depressing the beneficial effects of exercise on three different measures of mood. It appears that threats to the countryside depicted in rural unpleasant scenes have a greater negative effect on mood than already urban unpleasant scenes. We conclude that green exercise has important public and environmental health consequences.


Association between psychosocial job characteristics and insomnia: an investigation using two relevant job stress models - the demand-control-support (DCS) model and the effort-reward imbalance (ERI) model


A nationwide phone survey of attitudes toward urban trees, participation in civic or educational activities, and memories of childhood experiences with gardening and nature was conducted with 2004 adults in large urban areas. We analyzed the influence of 11 childhood experiences and five adult demographic characteristics on three items: "Trees in cities help people feel calmer," "Do trees have a particular personal, symbolic, or spiritual meaning to you?" and "During the past year, have you participated in a class or program about gardening?"

Growing up next to natural elements such as flower beds, visiting parks, taking environmental classes, and gardening during childhood were associated with stronger adult attitudes and more actions. Growing up next to urban elements, such as large buildings, had a small, but opposite, influence. Demographics played a role in adult attitudes and actions. While both passive and active interactions with plants during childhood were associated with positive adult values about trees, the strongest influence came from active gardening, such as picking flowers or planting trees. These results indicate that horticultural programs for children raised in urban surroundings with few or no plants can be effective in fostering an appreciation for gardening in adults.
In a survey, residents of the largest metropolitan areas in the continental United States rated the social, environmental, and practical benefits from trees in urban areas highly. They ranked the ability of trees to shade and cool surroundings highest. The potential of trees to help people feel calmer was ranked second highest. Survey respondents were not very concerned about potential problems with trees in cities, and felt that trees should be planted in cities regardless of any annoyance. Practical problems with trees, such as causing allergies, were bigger concerns than were financial issues. Responses varied slightly, based on childhood background and current demographic factors. For example, people who grew up with a garden near their home or actively worked with plants during childhood were more likely to appreciate the potential benefits of trees than were those who did not have such early experiences. People who strongly agreed that trees were important to their quality of life and those who did not strongly agree ranked the tree benefits and problems similarly, however. Those who strongly agreed that trees were important to their quality of life rated the benefits of trees more highly than people who did not strongly agree.


In the September issue of the Journal, Kuo and Faber Taylor suggest that activities in green (i.e., natural) surroundings are “widely effective” in reducing symptoms associated with attention-deficit/hyperactivity disorder (ADHD). However, because this Internet-based study is rife with methodological limitations, it does not offer convincing scientific evidence of this treatment’s effectiveness. For example, participants were designated as having ADHD not on the basis of research criteria but on the basis of parental reports of a professional diagnosis. Given long-appreciated inconsistencies in how care-givers in the community evaluate children for ADHD, the sample must have been highly heterogeneous in symptom presentation and impairment level.


We present evidence that there can be substantial variation in species richness in residential areas differing in their socioeconomic and cultural characteristics. Many analyses of the impacts of urbanization on biodiversity rely on traditional "urban-to-rural" gradient measures, such as distance from urban center or population density, and thus can fail to account for the ways in which human socioeconomic and cultural characteristics are shaping the human-environment interaction and ecological outcomes. This influence of residential values and economic resources on biodiversity within the urban matrix has implications for human quality of life, for urban conservation strategies, and for urban planning.


Background. This study examined whether job stress (work demand and decision latitude) is associated with smoking, blood pressure, lipid level (total cholesterol, triglyceride,
HDL cholesterol), and homocystein as risk factors for cardiovascular disease in Korean male workers.

Methods. Study subjects of this study were recruited from a sample of 1,071 workers in 20 companies of W city and H counties, and they were grouped into four categories (high strain group, active group, passive group, and low strain group) based on the postulation of Karasek’s Job Strain Model. Of them, we invited 160 male workers (40 people each subgroup) using a stratified sampling, and finally, 152 eligible participants were analyzed.

Results. In multivariate analyses, we found that decision latitude was associated with cholesterol, triglyceride, and homocystein and that work demand was related to smoking and systolic blood pressure. Job strain (the combination of high work demand with low decision latitude) was significantly related to higher levels of homocystein after controlling for age, BMI, smoking, and social support at workplace.

Conclusions. These results indicate that job stress is associated with cardiovascular risk factors and might contribute to the development of cardiovascular disease. Some considerations for the future research were discussed.


For more than 5000 years, people have cultivated flowers although there is no known reward for this costly behavior. In three different studies we show that flowers are a powerful positive emotion “inducer”. In Study 1, flowers, upon presentation to women, always elicited the Duchenne or true smile. Women who received flowers reported more positive moods 3 days later. In Study 2, a flower given to men or women in an elevator elicited more positive social behavior than other stimuli. In Study 3, flowers presented to elderly participants (55+ age) elicited positive mood reports and improved episodic memory. Flowers have immediate and long-term effects on emotional reactions, mood, social behaviors and even memory for both males and females. There is little existing theory in any discipline that explains these findings. We suggest that cultivated flowers are rewarding because they have evolved to rapidly induce positive emotion in humans, just as other plants have evolved to induce varying behavioral responses in a wide variety of species leading to the dispersal or propagation of the plants.


Obesity levels are high and increasing worldwide. Being overweight is linked with increased death rates and contributes to a wide range of conditions, including ischaemic heart disease, hypertension, stroke, diabetes, certain cancers, and diseases of the gall bladder. The principal cause of obesity is an imbalance between energy intake and energy expenditure. And there is growing recognition that, independently of individual characteristics, place of residence may be associated with health outcomes, including body size and health related behaviours, such as level of physical exercise.

Few studies have explored which features of the local neighbourhood might be related to these outcomes or behaviours, although perceived attractive- ness has been found to be related to levels of physical activity. Levels of incivilities, such as litter and graffiti, are associated with poorer health outcomes such as general wellbeing but not, to our knowledge, with levels of physical activity. Few studies use objectively measured indicators of the residential environment.
or similar research instruments across different settings. Based on our previous work, we hypothesised that areas which are pleasant with lots of greenery and few incivilities might encourage people to take exercise and thereby influence levels of obesity.


Research on human issues in horticulture focuses on the human dimension of horticulture in an effort to maximize the benefits of plants and nature in general, for human well-being. A key issue is the need for scientific evidence of such benefits and for rigorous research methods to reveal the mechanics of the interaction between people and plants. Conjoint analysis, a methodology with obvious potential for successful application in the area of human issues in horticulture, is widely used in consumer research to estimate the structure of people's reactions to multi-attribute objects or services. This paper discusses the steps involved in implementing conjoint analysis and describes how it can be applied to people-plant research.


Parks are commonly thought of as the venue for "fun and games," but that is only one role they play in a metropolitan environment. Urban parks, which broadly include parkland, plazas, landscaped boulevards, waterfront promenades, and public gardens, significantly define the layout, real estate value, traffic flow, public events, and the civic culture of our communities. With open spaces, our cities and neighborhoods take on structure, beauty, breathing room, and value. Public understanding of the pivotal role that parks play in enhancing the quality of life in our cities is growing, along with an understanding of the links between the quality of city parks and sprawling growth on the fringe of cities. City parks are an important element of smart growth that addresses both the public's need for greenspace and the role of greenspace in mitigating higher development density. The smart growth concerns of the public create opportunities for both public agencies and private foundations to leverage support for smart growth, "by making and "re-making" city parks that both strengthen urban cores and protect the fringe.


We have recently developed a new type of acceleration plethysmography (APG) machine and software. This APG system functions to indicate heart rate variability, by using the coefficient of the variation of the a-a intervals (CVaa%). We tried to evaluate the validity of the APG system to estimate heart rate variability, instead of using ECG.

**Methods** We simultaneously recorded an ECG and an APG by using a 2-channel APG system. We examined the difference between the a-a intervals (Taa) of an APG and the R-R interval of an ECG. Next, APG waveforms of 121 healthy people and 26 diabetics were recorded, and the mean CVaa% in each age category for healthy people and diabetics were calculated.

**Results** 1) All differences between the Taa and the R-R interval were within 10 msec., and the multiple correlation coefficient was 0.999175. 2) The mean CVaa% was 0.2 to 1.5% bigger than the mean coefficient of the variation of the R-R intervals (CVRR%) in all age categories. 3) The mean CVaa% decreased by age. 4) In ages 40-60, meanCVaa% of diabetics was significantly lower than that of healthy people.
Conclusion The APG system is suitable to estimate heart rate variability. And, when we want to evaluate heart rate variability by CVaa% of an APG instead of CVRR% of an ECG, a standard value of CVaa% in each age is necessary. The APG system has some possibilities for explanation of a mechanism of autonomic-nerve-related diseases.


In this study, we investigated the effect of an indoor plant on task performance and on mood. Three room arrangements were used as independent variables: a room with (1) a plant, or (2) a magazine rack with magazines placed in front of the participants, or (3) a room with neither of these objects. Undergraduate students (M= 35, F= 55) performed a task of associating up to 30 words with each of 20 specified words in a room with one of the three room arrangements. Task performance scores showed that female participants performed better in view of the plant in comparison to the magazine rack (p < 0.05). Moreover, mood was better with the plant or the magazine rack in the room compared to the no object condition (p < 0.05). However, the difference in task performance was highly influenced by the evaluation about the plant or the magazine rack. It is suggested that the compatibility between task demand and the environment is an important factor in facilitating task performances.


This paper reports on a study on the evolutionary impact of vegetation in a newly built square in Milan designed by V. Gregotti. The aim of the work is to evaluate the impact of vegetation growth on users’ comfort. The methodology adopted involves: sets of field measures (air and radiant temperature, wind velocity and relative humidity); a simplified thermal comfort evaluation with the energy budget method COMFA; and a scenario for the vegetation growth. When trees become adult we can observe different phenomena. The shading effect under an aged tree canopy clearly shows a reduction of the absorbed radiation by users, generating an energy budget very close to comfort (under 50 W/m2) even with a high air temperature. In the case of points exposed to direct sunlight all day long, tree growth reveals two phenomena of the global radiation absorbed by a user: (1) reduction, by the tree screening effect, of absorption of the diffuse solar global radiation, and (2) increase, by the elevation of the objects viewed in the sky hemisphere, in absorption of the terrestrial radiation.


While gardening is seen, essentially, as a leisure activity it has also been suggested that the cultivation of a garden plot offers a simple way of harnessing the healing power of nature (The therapeutic garden, Bantam Press, London, 2000). One implication of this is that gardens and gardening activity may offer a key site of comfort and a vital opportunity for an individual's emotional, physical and spiritual renewal. Understanding the extent to which this supposition may be grounded in evidence underpins this paper. In particular, we examine how communal gardening activity on allotments might contribute to the maintenance of health and well being amongst older people. Drawing on recently completed research in northern England, we examine firstly the importance of the wider landscape and the domestic garden in the lives of older people. We then turn our attention to gardening activity on allotments. Based on the findings of
our study, we illustrate the sense of achievement, satisfaction and aesthetic pleasure that older people can gain from their gardening activity. However, while older people continue to enjoy the pursuit of gardening, the physical shortcomings attached to the aging process means they may increasingly require support to do so. Communal gardening on allotment sites, we maintain, creates inclusionary spaces in which older people benefit from gardening activity in a mutually supportive environment that combats social isolation and contributes to the development of their social networks. By enhancing the quality of life and emotional well being of older people, we maintain that communal gardening sites offer one practical way in which it may be possible to develop a ‘therapeutic landscape’.


The relationship between the amount of vegetation and the level of property crime within the City of Tallahassee was evaluated. Results indicated a statistically significant negative relationship between the incidence of property crime committed in the city and the amount of vegetation as measured using Normalized Difference Vegetation Index (NDVI) within the area in which those crimes occurred. Areas with less than the average mean NDVI level had an increased frequency of crime. Results indicated statistically significant relationships between the amount of vegetation and traditional social-economic variables (i.e., income level, unemployment, housing density), and level of property crimes committed. Results also indicated that the amount of vegetation could predict the likelihood of a household becoming a victim of property crime.


Objectives: We examined the impact of relatively "green" or natural settings on attention-deficit/hyperactivity disorder (ADHD) symptoms across diverse sub-populations of children.

Methods: Parents nationwide rated the aftereffects of 49 common after-school and weekend activities on children's symptoms. Aftereffects were compared for activities conducted in green outdoor settings versus those conducted in both built outdoor and indoor settings.

Results: In this national, nonprobability sample, green outdoor activities reduced symptoms significantly more than did activities conducted in other settings, even when activities were matched across settings. Findings were consistent across age, gender, and income groups; community types; geographic regions; and diagnoses.

Conclusions: Green outdoor settings appear to reduce ADHD symptoms in children across a wide range of individual, residential, and case characteristics.


Can horticulture contribute significantly to human well-being and mental health? Increasing evidence suggests it can. These findings come from scientific studies with diverse populations, including residents of poor inner city neighborhoods, ecological restoration volunteers, and children with Attention Deficit/Hyperactivity Disorder. Moreover, the findings come from studies of diverse outcomes, including lower rates of violent and property crime,
lower incidence of aggression, greater ability to cope with poverty, better life functioning, greater life satisfaction, reduced attention deficit symptoms, greater strength of community, and others. This presentation gives an overview of the evidence for horticultural contributions to human mental health and well-being, with a particular focus on its implications for children, the poor, and other vulnerable populations.


This article is a literature review of empirical research on the relationship between exposure to nature and the well-being of city inhabitants. Two scales of nature are discussed – urban green space and wilderness. Urban green space may reduce physiological stress levels, restore mental abilities, and foster neighborhood social ties. Wilderness experiences may provide the stress-reducing and attention-restoring benefits of everyday nature in a longer-lasting way. They are also associated with a variety of spiritual/transcendent experiences that provide benefits such as greater self-confidence, a sense of belonging to something greater than oneself, and renewed clarity on “what really matters.” At each scale, the article considers the physical features key to the natural area’s benefits on well-being and the implications of the research for urban planning. The article concludes that providing both types of restorative natural environments in cities will make urban life more livable and environmental protection more instinctual.


A survey was administered to assess plant characteristics that consumers consider important when selecting landscape plants for purchase. Visitors to home and garden shows in Knoxville and Nashville, Tenn.; Detroit, Mich.; and Jackson, Miss., completed 610 questionnaires. Respondents also indicated their familiarity with integrated pest management (IPM) concepts, pest control philosophy, recognition of flowering dogwood (Cornus florida) pests and diseases, including dogwood powdery mildew (Microsphaera pulchra), and willingness-to-pay a price differential for a powdery-mildew-resistant flowering dogwood. Fewer than half of the respondents in any city indicated familiarity with IPM, although they were familiar with organic farming and pest scouting components of an IPM program. Willingness-to-pay was relatively consistent across all four locations. The uniformity of average tree premiums, which ranged from $11.87 in Jackson to $16.38 in Detroit, supports the proposition that customers are willing to pay a substantially higher price for a landscape tree that will maintain a healthier appearance without the use of chemical sprays. Factors affecting consumer demand for landscape nursery products and services can be paired with consumer awareness of IPM terminology and practices to create an effective market strategy for newly developed powdery-mildew-resistant dogwood cultivars.


A framework for urban storm-water management that moves beyond flood control to improve societal and ecological services will maximize the functions and benefits of water
resources management. Theoretical constructs for such work originate from the integration of ecological engineering, ecohydrology and service learning paradigms. Implementation consists of simulating, monitoring and reporting how storm-water design decisions to infiltrate or directly discharge runoff result in a complex set of linked adjustments to the dynamics of the water table, soil chemistry concentrations, plant stress/viability, terrestrial habitat, river loads/flows, and aquatic habitat patterns. Coordination of a socio-ecological-based urban storm-water management programme is discussed using a case study in the Onondaga Creek watershed that drains through the City of Syracuse, NY, USA. In Onondaga Creek, service learning-directed research gathered findings on the geomorphological characterization of a healthy stream, flood impacts of storm sewer separation, and channel stability with concrete removal. Unfortunately, linkages between systems will remain unexplored until the development of more tightly coupled channel-watershed simulation models.


This study addresses social-ecological dynamics in the greater metropolitan area of Stockholm County, Sweden, with special focus on the National Urban Park (NUP). It is part of the Millennium Ecosystem Assessment (MA) and has the following specific objectives: (1) to provide scientific information on biodiversity patterns, ecosystem dynamics, and ecosystem services generated; (2) to map interplay between actors and institutions involved in management of ecosystem services; and (3) to identify strategies for strengthening social-ecological resilience. The green areas in Stockholm County deliver numerous ecosystem services, for example, air filtration, regulation of microclimate, noise reduction, surface water drainage, recreational and cultural values, nutrient retention, and pollination and seed dispersal. Recreation is among the most important services and NUP, for example, has more than 15 million visitors per year. More than 65 organizations representing 175,000 members are involved in management of ecosystem services. However, because of population increase and urban growth during the last three decades, the region displays a quite dramatic loss of green areas and biodiversity. An important future focus is how management may reduce increasing isolation of urban green areas and enhance connectivity. Comanagement should be considered where locally managed green space may function as buffer zones and for management of weak links that connect larger green areas; for example, there are three such areas around NUP identified. Preliminary results indicate that areas of informal management represent centers on which to base adaptive co-management, with the potential to strengthen biodiversity management and resilience in the landscape.


Conversion of rural lands to urban and other built-up uses affects the mix of commodities and services produced from the built-up uses global land base. In the United States, there was a 34% increase in the amount of land devoted to urban and built between 1982 and 1997. This increase came predominantly from the conversion of croplands and forestland, with the largest increases in developed area happening in the southern region of the country. In an analysis of drivers influencing developed land uses in the US, we found results that were consistent with hypothesized relationships, including significant increases in development as a result of increases in population density and personal income. From these results, we projected changes in potential
future urbanization and development by 2025 given estimated increases in population and real personal income. The projections suggest continued urban expansion over the next 25 years, with the magnitude of increase varying by region. US developed area is projected to increase by 79%, raising the proportion of the total land base that is developed from 5.2 to 9.2%. Because much of the growth is expected in areas relatively stressed with respect to human-environment interactions, such as some coastal counties, implications for landscape and urban planning include potential impacts on sensitive watersheds, riparian areas, wildlife habitat, and water supplies.


This paper provides a framework in which to consider social benefits of urban and community forestry projects. The framework clarifies who gets the benefits-An individual? An organization? A community? Further, the benefits can be derived from passive and/or active experience of the urban forest. Examples of social benefits in each category are reviewed. The paper also presents findings from a research project that investigated practitioner claims for social benefits of urban greening projects. Practitioner assessments of the benefits received modest support in the research findings, but their assessments were not entirely accurate, leading to some true and some false claims of social benefits. Empowerment theory structured the investigation and analysis and provided insight for implementation of projects that aim for providing social benefits. The concepts of empowering versus empowered people were particularly helpful. Specifically, the empowering nature of each site's project organizer, the openness of the project process, and the overall organizing history of the block were important to achieving empowerment outcomes. The paper concludes with recommendations for practitioners interested in fostering empowerment through urban and community forestry projects.


With the increasing demand for plant products as medicine, we need a set of principles to guide our actions. Medical ethics, which until now has focused only on human concerns, must expand to include notions about the relationship of humans and plants. This paper presents an overview of 3 major environmental ethical models: anthropocentric, pragmatic, and ecocentric. The conflicts and inadequacies of these models are examined. We present for the first time the ethical principles for gathering plants as taught by an indigenous Native North American healer, Keewaydinoquay Peschel (Anishinaabe). Her principles are applied to 2 well-known medicinal plant cases: goldenseal, an endangered species, and the Pacific yew, the source of paclitaxel, a novel anticancer treatment. The actions of individuals, corporations, and government are examined in light of indigenous gathering ethics. Suggestions are made for incorporating these ethics into the practice of complementary, alternative, and integrative medicine.


This study used an experimental design and multiple measures to ascertain whether stress in healthcare consumers undergoing a procedure known to be stressful - blood donation - would be affected by modest changes in a clinic environment. Four different environmental conditions
were presented to 872 blood donors (68% males; 32% females; mean age = 40.4 years) using wall-mounted television monitors: a videotape of nature settings (Nature); a tape of urban environments (Urban); daytime television (Television); or a blank monitor (No Television). Findings from physiological measures (blood pressure, pulse rate) provided a pattern of evidence that the environmental conditions had significantly different effects on donor stress. Consistent with arousal/stimulation theory, the blood-pressure and pulse-rate findings converged to indicate that stress was lower during No Television than Television, and during Low Stimulation (No Television + Nature) than High Stimulation (Television + Urban). In line with evolutionary theory, pulse rates were markedly lower during Nature than Urban. An important clinical implication of the findings is that the common practice of playing uncontrollable daytime television in healthcare waiting areas where stress is a problem may actually have stressful, not stress-reducing, influences on many patients/consumers. Healthcare environments should tend to be more restorative and supportive for stressed outpatients when Nature is prominently present, and environmental stimulation levels are low rather than high and intrusive.


Landscape-level assessments of biodiversity strive to guide land-use planning and conservation activities by providing information about areas of high biodiversity value and low protection status. I developed a methodology to assess the level of threat to conservation of biodiversity to help guide conservation action. This method incorporates socioeconomic indicators of risk, including developed and roaded areas, and measures the proportion of conservation lands affected by developed areas. In addition, I developed a metric called conservation potential to measure the degree of fragmentation of patches caused by development. As an illustration I applied this methodology to Colorado (U. S. A.). Protection levels were determined by examining land ownership, resulting in protected lands (status levels 1 and 2) and unprotected lands (status levels 3 and 4). Areas were considered threatened (at risk) if a land-cover patch had >20% roaded area, >15% developed area, or was highly fragmented. Although 24 of 43 natural land-cover types were unprotected (49% of the state), 9 additional types were threatened. Combining conservation-status protection levels with patterns of threat targets the geographic area where conservation action is needed, provides a way to determine where so-called protected areas are at risk, and allows conservation strategies to be better refined.


Childhood is a holistic process, different for each individual child. Many children do not learn effectively exclusively within a classroom. They need alternative, hands-on learning environments to match their varied learning styles. Test-driven education mandates often do not emphasize children's emotional and social needs and opportunities for creativity. This limits the development of unique talents and the fulfillment of individual lives, and deprives society of practical, problem-solving intelligence. City parks, greenways, and naturalized school grounds can be a crucial antidote to these unhealthy trends. They can motivate young people to learn through the natural environment (which includes learning about the natural environment), bringing environmental education into the mainstream of state-mandated instructional programs. The informal learning, non-formal programs, and formal instruction associated with parks can reinforce each other, enhancing academic achievement.
For those concerned that green spaces may foster crime and illegal activity, evidence now exists that the opposite may be true. When adjacent to residential areas, green spaces have been shown to create neighborhoods with fewer violent and property crimes and where neighbors tend to support and protect one another. These are the findings of scientists at the Human-Environment Research Laboratory of the University of Illinois at Urbana-Champaign who studied green space alongside public housing in Chicago. Other researchers who are conducting similar studies across the country are finding similar results. The factors that explain these findings emphasize the importance of greenery in community and personal wellness. Time spent in natural surroundings relieves mental fatigue, which in turn relieves inattentiveness, irritability, and impulsivity, recognized by psychologists as precursors to violence. Green spaces also support frequent, casual contact among neighbors. This leads to the formation of neighborhood social ties, the building blocks of strong, secure neighborhoods where people tend to support, care about, and protect one another.


In urban communities, arboriculture clearly contributes to the health of the biological ecosystem; does it contribute to the health of the social ecosystem as well? Evidence from studies in inner-city Chicago suggests so. In a series of studies involving over 1,300 person–space observations, 400 interviews, housing authority records, and 2 years of police crime reports, tree and grass cover were systematically linked to a wide range of social ecosystem indicators. These indicators included stronger ties among neighbors, greater sense of safety and adjustment, more supervision of children in outdoor spaces, healthier patterns of children’s play, more use of neighborhood common spaces, fewer incivilities, fewer property crimes, and fewer violent crimes. The link between arboriculture and a healthier social ecosystem turns out to be surprisingly simple to explain. In residential areas, barren, treeless spaces often become “no man’s lands,” which discourage resident interaction and invite crime. The presence of trees and well-maintained grass can transform these no man’s lands into pleasant, welcoming, well-used spaces. Vital, well used neighborhood common spaces serve to both strengthen ties among residents and deter crime, thereby creating healthier, safer neighborhoods.


Managed landscapes are an intricate blend of woody and herbaceous ornamentals, turfgrass, organic and mineral groundcovers, and a vast array of manufactured elements, generically referred to as "hardscape." When properly designed, installed, and maintained, "built landscapes" provide countless economic and quality-of-life benefits for people in rural, suburban, and urban areas. But the journey from drafting table to finished landscape often is poorly defined and fraught with challenges, frustrations, and misconceptions. Functional and sustainable landscapes are created when attention is paid to minimizing or alleviating abiotic and biotic stress along the continuum from plant production and selection, to installation, and finally maintenance of established plants. Topics for discussion include selection and use of superior taxa for managed landscapes, nursery crop production techniques for enhanced transplant
success, installation and post-plant maintenance protocols to minimize stress, and intervention/rescue treatments for established plants with compromised root systems.


We compared psychophysiological stress recovery and directed attention restoration in natural and urban field settings using repeated measures of ambulatory blood pressure, emotion, and attention collected from 112 randomly assigned young adults. To vary restoration needs, we had half of the subjects begin the environmental treatment directly after driving to the field site. The other half completed attentionally demanding tasks just before the treatment. After the drive or the tasks, sitting in a room with tree views promoted more rapid decline in diastolic blood pressure than sitting in a viewless room. Subsequently walking in a nature reserve initially fostered blood pressure change that indicated greater stress reduction than afforded by walking in the urban surroundings. Performance on an attentional test improved slightly from the pretest to the midpoint of the walk in the nature reserve, while it declined in the urban setting. This opened a performance gap that persisted after the walk. Positive affect increased and anger decreased in the nature reserve by the end of the walk; the opposite pattern emerged in the urban environment. The task manipulation affected emotional self-reports. We discuss implications of the results for theories about restorative environments and environmental health promotion measures.

Frumkin, H. and M. E. Eysenbach (2003, 08/06/2010). "How cities use parks to improve public health."

People value the time they spend in city parks, whether walking a dog, playing basketball, or having a picnic. Along with these expected leisure amenities, parks can also provide measurable health benefits, from providing direct contact with nature and a cleaner environment, to opportunities for physical activity and social interaction. A telephone survey conducted for the American Public Health Association found that 75 percent of adults believe parks and recreation must play an important role in addressing America's obesity crisis. Because of the different ways people experience parks, cities need to provide all types, from neighborhood facilities to large natural areas. In fact, many of the health benefits described below can be best achieved through small-scale, readily accessible sites. A full reckoning of the benefits of parks will better inform public policy about parks and provide a useful public health tool.


Are people living in greener areas healthier than people living in less green areas? This hypothesis was empirically tested by combining Dutch data on the self-reported health of over 10,000 people with land-use data on the amount of greenspace in their living environment. In the multilevel analysis we controlled for socioeconomic and demographic characteristics, as well as urbanity. Living in a green environment was positively related to all three available health indicators, even stronger than urbanity at the municipal level. Analyses on subgroups showed that the relationship between greenspace and one of the health indicators was somewhat stronger for housewives and the elderly, two groups that are assumed to be more dependent on, and therefore exposed to, the local environment. Furthermore, for all three health indicators the
A relationship with greenspace was somewhat stronger for lower educated people. Implications for policymaking and spatial planning are discussed briefly.


Literature on place makes use of concepts like authenticity and is often structured around a critique of homogeneity or placelessness. This critique is reinforced by the discourse of conservation biology with its emphasis on protecting biodiversity and condemning some non-native species. However, a common emotional response of humans, when they are displaced, is to make where they are like where they felt at home. The debate around invasive species needs careful handling for both ecological and social reasons. This paper addresses a gap in that debate by taking account of the emotional involvement of humans with plants and their caring for the immediate environment through the activity of gardening.


Objectives: Outdoor environments might amplify or hinder psychological benefits of exercise. Using types of outdoor environment commonly available for exercise, we assessed the moderating effect of environment on attentional and emotional restoration during a run.

Design: We conducted a field experiment with environment (park, urban), occasion (first run, second run), and time (pre-run, post-run) as within-subjects factors, and gender as a between-subjects factor.

Methods: Twelve regular runners (6 female, 6 male; mean age = 39.7 years) provided self-reports of emotions and behavioral measures of attention before and after each of two 1-hour runs in each of the two environments. The routes differed in amount of greenery, proximity to water, and presence of traffic, buildings, and other people. We also obtained background measures of stress and evaluations of the running environments.

Results: Characteristic of restoration, running reduced anxiety/depression and anger. It had inconsistent effects on attention. No Time x Environment interactions reached statistical significance. However, those for tranquility and anxiety/depression had medium-sized effects (rs ≈ 0.30) and were consistent with the hypothesis that the park would promote restoration while running to a greater degree than the urban environment. The runners preferred the park over the urban environment and perceived it as more psychologically restorative.

Conclusions: The findings encourage replication with greater statistical power. The study provides a point of departure for further research on potential moderating effects of commonly accessible outdoor environments on the psychological benefits of exercise.


Just as growing communities need to upgrade and expand their built infrastructure of roads, sewers, and utilities, they also need to upgrade and expand their green infrastructure, the interconnected system of green spaces that conserves natural ecosystem values and functions, sustains clear air and water, and provides a wide array of benefits to people and wildlife. Green infrastructure is a community's natural life support system, the ecological framework needed for environmental and economic sustainability. In their role as green infrastructure, parks and open space are a community necessity. By planning and managing urban parks as parts of an
interconnected green space system, cities can reduce flood control and stormwater management costs. Parks can also protect biological diversity and preserve essential ecological functions while serving as a place for recreation and civic engagement. They can even help shape urban form and reduce opposition to development, especially when planned in concert with other open spaces.


This study investigated the effects of indoor horticulture activities on the current psychological well-being of older people in two long-term care facilities over a 7-week period. Thirty-one participants at one facility served as the control group. Thirty-one participants at another facility served as the horticulture group. Participants in both facilities continued with their normal daily routine and activities over the 7-week period; however, the horticulture group participated in a 1-hour horticulture activity session once a week over the 7-week period and the control group did not. The control group and horticulture group did not differ significantly in psychological well-being prior to the start of the study. After the 7-week program, the horticulture group had a significant increase in psychological well-being, whereas the control group had a slight decrease in psychological well-being. The results of this study indicate that horticulture activities may have a beneficial effect on the current psychological well-being of older people in a long-term care facility.


Children growing up in the inner city are at risk of academic underachievement, juvenile delinquency, teenage pregnancy, and other important negative outcomes. Avoiding these outcomes requires self-discipline. Self-discipline, in turn, may draw on directed attention, a limited resource that can be renewed through contact with nature. This study examined the relationship between near-home nature and three forms of self-discipline in 169 inner city girls and boys randomly assigned to 12 architecturally identical high-rise buildings with varying levels of nearby nature. Parent ratings of the naturalness of the view from home were used to predict childrens performance on tests of concentration, impulse inhibition, and delay of gratification. Regressions indicated that, on average, the more natural a girls view from home, the better her performance at each of these forms of self-discipline. For girls, view accounted for 20% of the variance in scores on the combined self-discipline index. For boys, who typically spend less time playing in and around their homes, view from home showed no relationship to performance on any measure. These findings suggest that, for girls, green space immediately outside the home can help them lead more effective, self-disciplined lives. For boys, perhaps more distant green spaces are equally important.


To study the association between greenery filled public areas that are nearby a residence and easy to walk in and the longevity of senior citizens in a densely populated, developed megacity. Design: Cohort study. Methods: The authors analysed the five year survival of 3144 participants...
people born in 1903, 1908, 1913, or 1918 who consented to a follow up survey from the records of registered Tokyo citizens in relation to baseline residential environment characteristics in 1992.

The survival of 2211 and the death of 897 (98.9% follow up) were confirmed. The probability of five year survival of the senior citizens studied increased in accordance with the space for taking a stroll near the residence (p<0.01), parks and tree lined streets near the residence (p<0.05), and their preference to continue to live in their current community (p<0.01). The principal component analysis from the baseline residential environment characteristics identified two environment related factors: the factor of walkable green streets and spaces near the residence and the factor of a positive attitude to a person’s own community. After controlling the effects of the residents’ age, sex, marital status, and socioeconomic status, the factor of walkable green streets and spaces near the residence showed significant predictive value for the survival of the urban senior citizens over the following five years (p<0.01).

Living in areas with walkable green spaces positively influenced the longevity of urban senior citizens independent of their age, sex, marital status, baseline functional status, and socioeconomic status. Greenery filled public areas that are nearby and easy to walk in should be further emphasised in urban planning for the development and re-development of densely populated areas in a megacity. Close collaboration should be undertaken among the health, construction, civil engineering, planning, and other concerned sectors in the context of the healthy urban policy, so as to promote the health of senior citizens.


In this study we investigate the effect of leafy plants on subjects' task performance and mood. As independent variables, two types of tasks and several room arrangements were used. There was an association or a sorting task and the room was arranged either with the plant placed in front of the subjects, to the side of the subjects, or with no plant placed in the room. Gender was also considered as a variable for analysis. Undergraduate students (F = 63, M = 83) performed either the association task or the sorting task under one of the three room arrangements. The association task was to create no more than 30 words for 20 different items. The sorting task was to sort 180 index cards into Japanese syllabary order.

As for the task performance, Room×Gender interaction was significant in the scores of the association task (p<0.05). Male subjects working without plants performed worse than female subjects under the same conditions (p<0.01). Moreover, the task performances of the male subjects using the front arrangement were higher than that of the male subjects working without plants (p<0.10). It was concluded that the presence of the plants affected the association task more than the sorting task, and male subjects more than female subjects. It was also suggested that the presence of the leafy plants might affects creative work positively.


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As the level of urbanization has increased, many people in Korea have begun to recognize the beneficial effects of plants in our immediate surroundings and involvement in horticultural activities. Today, an increasing number of Koreans attempt to improve the quality of life and enhance educational effectiveness through horticultural activities. Kindergarten, elementary, middle, and high schools have initiated garden-based programs. Some universities include courses focusing on horticulture applications to human well-being in their regular graduate programs or in their social education curricula. A few general hospitals, psychiatric hospitals, and rehabilitation centers have begun applying horticulture as a means of treatment. Most of the research articles in Korea on various aspects of human issues in horticulture have been published since the foundation of two academic societies, the Korean Horticultural Therapy Association and the Korean Society for Plants, People, and Environment. These articles are primarily focused on the areas of school gardening, healing gardens, and psychological or physiological effects of horticultural activities. For the future development of human issues in horticulture in Korea, several areas need to be enhanced including: interdisciplinary studies of horticulture and social education; development of different skills, techniques, and scales to validate the effects of horticultural therapy, healing gardens, and gardening as a teaching tool in public education; and an organization empowered to certify horticultural therapists.


Stress has been characterized as an epidemic and has been found to play an important role in causing many diseases. In contrast, people often seek out nature and green spaces to help cope with life stress. Botanic gardens provide opportunities for people to immerse in nature, explore their horticultural interests, and experience recreation and leisure. The literature suggests that all of these activities are effective coping strategies against life stress. This study explored the effectiveness of botanic garden visits as a coping strategy. The findings of this study suggest that botanic gardens could be a place for coping with the effects of stress. Botanic garden visitation, along with gender, stressful life events, perceived health, and self-esteem, was found to be important in explaining reported levels of depression. Data also showed that visitors who received the most benefit of stress reduction were those most needing a coping strategy.

Three separate marketing studies were conducted during 2000 to determine consumer purchase behavior, use, and potential for purchasing edible flowers. First, a telephone survey was administered to 423 randomly selected residences in the Metro-Detroit area. Participants with some college education were more likely to have eaten edible flowers, would be more likely to eat them, and would be more likely to buy them. A second survey conducted with 25 Michigan Master Gardeners collected more detailed responses about edible flower purchase and use. Females were more likely to purchase edible flowers than males. Single-person households were less likely to have grown edible flowers than larger households. Participants with an annual income $39,999 were half as likely to have purchased edible flowers as the higher income group. A third consumer survey was conducted over a 6-week period with three Metro-Detroit area grocery stores where consumers purchased containers of edible flowers with an attached survey form. A total of 243 of 360 containers of edible flowers were sold, and we received a 27% response rate. All respondents (100%) with an annual income 30,001 were likely to like the flavor of the flowers. Across all three studies, there were few significant differences between demographic characteristics, which indicates that a homogeneous marketing strategy may effectively reach consumers. Based on these results, there appears to be is consumer interest in edible flowers, some consumers have had experience using and serving them, and will purchase them in grocery stores if marketed to attract the consumers interest.


Horticultural therapy (HT) is used across the lifespan with individuals with a wide range of physical, social, and cognitive abilities. Older adults make up a large group of participants in horticultural activities. As the population of older adults grows, more adults face the risk of experiencing a dementing illness. Many families turn to institutional care programs, such as nursing homes and adult day service (ADS) programs, for assistance with the care of their relative with dementia. HT may be an appropriate activity to incorporate into dementia care activity programs, but formal evaluations of such programs are limited. The current study evaluated a 10-week HT program conducted with adults with dementia at an ADS program. Observations indicated that participants engaged in the horticultural activities for greater periods of time than the nonhorticultural activities. Participant affect during the horticultural and nonhorticultural activities was comparable. HT is appropriate for dementia care programs serving adults with a wide range of cognitive, physical, and social needs, and it should be considered as a viable alternative to more typical dementia care program activities.


Parks are complex elements of a city. They can serve scores of different uses, may be specialized in their function, or can simply provide visual appeal for residents. However, they work, they act to define the shape and feel of a city and its neighborhoods. They also function as a conscious tool for revitalization. Parks can stem the downturn of a commercial area, support the stabilization of faltering neighborhoods, and provide a landmark element and a point of pride for constituents. For all these things to happen, the city needs to be open and aware of parks' potential to spur revival, and support the elements that are needed to make that happen.

Environmental determinants of health are receiving growing attention in the literature, although there is little empirical research in this area. The Study on Environmental and Individual Determinants of Physical Activity (known as the SEID project) was a social ecological project that examined the relative influence of individual, social environmental and physical environmental determinants of recreational physical activity. It involved a community survey of 1803 healthy workers and home-makers aged 18–59 years living in a 408 km2 area of metropolitan Perth, Western Australia. Physical environmental determinants were mainly conceptualised as spatial access to popular recreational facilities. Overall, 59% of respondents exercised as recommended. Recreational facilities located near home were used by more respondents than facilities located elsewhere. The most frequently used facilities were informal: the streets (45.6%); public open space (28.8%) and the beach (22.7%). The physical environment’s directs the influence on exercising as recommended was found to be secondary to individual and social environmental determinants. Nevertheless, accessible facilities determined whether or not they were used and in this way, support and enhance the achievement of recommended levels of physical activity behaviour by providing opportunities. The results suggest that access to a supportive physical environment is necessary, but may be insufficient to increase recommended levels of physical activity in the community. Complementary strategies are required that aim to influence individual and social environmental factors. Given the popularity of walking in the community, it is recommended that greater emphasis be placed on creating streetscapes that enhance walking for recreation and transport.

Community engagement is the process of working collaboratively with individuals and groups to achieve specific goals. For parks and open spaces, community engagement allows mayors and public officials to directly involve their constituencies in the ongoing design, planning, and management of these resources. This process results in informed and engaged residents that feel better connected to their communities. While sometimes contentious, but more often productive and rewarding, community engagement is an essential ingredient of making successful urban open space. Parks support community engagement by providing residents with a venue for participation in and attachment to their communities. They also provide a sense of place and offer essential life-enhancing qualities that aid community and individual well-being. By understanding the community benefits of parks, decision makers can develop constituencies that can sustain their urban park systems over time.

Baron, J. S., et al. (2002). "Meeting ecological and societal needs for freshwater."
Human society has used freshwater from rivers, lakes, groundwater, and wetlands for many different urban, agricultural, and industrial activities, but in doing so has overlooked its value in supporting ecosystems. Freshwater is vital to human life and societal well-being, and thus its utilization for consumption, irrigation, and transport has long taken precedence over other commodities and services provided by freshwater ecosystems. However, there is growing recognition that functionally intact and biologically complex aquatic ecosystems provide many economically valuable services and long-term benefits to society. The short-term benefits include ecosystem goods and services, such as food supply, flood control, purification of human and industrial wastes, and habitat for plant and animal life—and these are costly, if, not impossible, to replace. Long-term benefits include the sustained provision of those goods and services, as well
as the adaptive capacity of aquatic ecosystems to respond to future environmental alterations, such as climate change. Thus, maintenance of the processes and properties that support freshwater ecosystem integrity should be included in debates over sustainable water resource allocation. The purpose of this report is to explain how the integrity of freshwater ecosystems depends upon adequate quantity, quality, timing, and temporal variability of water flow. Defining these requirements in a comprehensive but general manner provides a better foundation for their inclusion in current and future debates about allocation of water resources. In this way the needs of freshwater ecosystems can be legitimately recognized and addressed. We also recommend ways in which freshwater ecosystems can be protected, maintained, and restored. Freshwater ecosystem structure and function are tightly linked to the watershed or catchment of which they are a part. Because riverine networks, lakes, wetlands, and their connecting groundwaters, are literally the "sinks" into 'Which landscapes drain, they are greatly influenced by terrestrial processes, including many human uses or modifications of land and water. Freshwater ecosystems, whether lakes, wetlands, or rivers, have specific requirements in terms of quantity, quality, and seasonality of their water supplies. Sustainability normally requires these systems to fluctuate within a natural range of variation. Flow regime, sediment and organic matter inputs, thermal and light characteristics, chemical and nutrient characteristics, and biotic assemblages are fundamental defining attributes of freshwater ecosystems. These attributes impart relatively unique characteristics of productivity and biodiversity to each ecosystem. The natural range of variation in each of these attributes is critical to maintaining the integrity and dynamic potential of aquatic ecosystems; therefore, management should allow for dynamic change. Piecemeal approaches cannot solve the problems confronting freshwater ecosystems. Scientific definitions of the requirements to protect and maintain aquatic ecosystems are necessary but insufficient for establishing the appropriate distribution between societal and ecosystem water needs. For scientific knowledge to be implemented science must be connected to a political agenda for sustainable development. We offer these recommendations as a beginning to redress how water is viewed and managed in the United States: (1) Frame national and regional water management policies to explicitly incorporate freshwater ecosystem needs, particularly those related to naturally variable flow regimes and to the linking of water quality with water quantity; (2) Define water resources to include watersheds, so that freshwaters are viewed within a landscape, or systems context; (3) Increase communication and education across disciplines, especially among engineers, hydrologists, economists, and ecologists to facilitate an integrated view of freshwater resources; (4) Increase restoration efforts, using well-grounded ecological principles as guidelines; (5) Maintain and protect the remaining freshwater ecosystems that have high integrity; and (6) Recognize the dependence of human society on naturally functioning ecosystems.


Small city central business districts undergoing revitalization must carefully weigh their choices for improvements, given limited resources. One option, an urban forest and streetscape program, should include planning for both tree and human factors. This qualitative research specifies the human dynamics of successful programs. Forest professionals assisting communities should consider civic process as well as arboricultural choices and practices. Planning, implementation and ongoing maintenance strategies often involve public and private partnerships. Each program contributor has different capacities for tree installation and care.
Appropriate technical choices must be accompanied by personal commitment. Finally, implementation of the tree program must acknowledge the needs of all interests in the district.


We are two botanists and biology educators who are committed to exploring and investigating why people in the US tend to be less interested in plants than in animals, and why they often fail to notice the plants that are present in their own environment (Wandersee & Schussler, 1999a). We think such knowledge, once gained, may be useful in a variety of settings—from teaching an introductory biology course, to planning a public education program at a botanic garden, to writing a children’s book about plants, to pursuing new botanical research. We also hope that the answers to these questions will ultimately lead to improvement of the nation’s scientific literacy level, and to greater public understanding of plants (Flannery, 1999). The future of US research in the plant sciences depends, to a large extent, on the support of a botanically literate citizenry (Niklas, 1995).


Attention Restoration Theory suggests that contact with nature supports attentional functioning, and a number of studies have found contact with everyday nature to be related to attention in adults. Is contact with everyday nature also related to the attentional functioning of children? This question was addressed through a study focusing on children with Attention Deficit Disorder (ADD). This study examined the relationship between children's nature exposure through leisure activities and their attentional functioning using both within- and between-subjects comparisons. Parents were surveyed regarding their child's attentional functioning after activities in several settings. Results indicate that children function better than usual after activities in green settings and that the "greener" a child's play area, the less severe his or her attention deficit symptoms. Thus, contact with nature may support attentional functioning in a population of children who desperately need attentional support.


We investigated the effects of foliage plants on participants' task performance, fatigue, and mood. Two room conditions (one in which plants were arranged in the room and the other without plants) were created. Undergraduate students (M=33, F=37) performed 2 sessions of a key response task under one of the two room conditions. As for task performance, Plant Session interaction was significant (p<.05). The task scores in the first session did not show any significant difference between plant and no plant conditions. Although it was not significant, the scores in the second session showed higher scores under the plant condition than in the no-plant condition. The plant condition and the no-plant condition did not show any differential effects on the deterioration of task scores in each session. Though the plants affected task scores, they did not show any effects on subjects' moods or fatigue. It was concluded that the presence of the plant might have influenced recovery from mental fatigue.

Background: A farming environment protects against development of asthma, hay fever, and atopic sensitisation in children. We aimed to establish whether increased exposure to microbial compounds has to occur early in life to affect maturation of the immune system and thereby reduces risk for development of allergic diseases.

Methods: We did a cross-sectional survey in rural areas of Austria, Germany, and Switzerland. 2618 (75%) of 3504 parents of 6–13-year-old children completed a standardised questionnaire on asthma, hay fever, and atopic eczema. Children from farming families, and a random sample of non-farmers’ children, who gave consent for blood samples to be obtained for measurements of specific serum IgE antibodies to common allergens were invited to participate (n=901).

Findings: Exposure of children younger than 1 year, compared with those aged 1–5 years, to stables and consumption of farm milk was associated with lower frequencies of asthma (1% [3/218] vs 11% [15/138]), hay fever (3% [7] vs 13% [18]), and atopic sensitisation (12% [27] vs 29% [40]). Protection against development of asthma was independent from effect on atopic sensitisation. Continual long-term exposure to stables until age 5 years was associated with the lowest frequencies of asthma (0.8% [1/122]), hay fever (0.8% [1]), and atopic sensitisation (8.2% [10]).

Interpretation Long-term and early-life exposure to stables and farm milk induces a strong protective effect against development of asthma, hay fever, and atopic sensitisation.


In this qualitative research conducted in Finland, 12 residents in sheltered housing for aged people were interviewed to explore the meanings they associate with the growing of plants. Growing plants had both individual and social meanings for the interviewees. The individual meanings were categorized into three groups: one's own growing skills, the continuity of time, and creating experiences. The category "one's own growing skills" was coded into three subcategories: individual settings and growing methods, interpretation of the plants' needs and responses, and adaptation to current situation. The social meanings identified in the data were also divided into three categories: significant acts undertaken for other people, indications about the gardener, and the feeling of togetherness. The results of the research suggest that growing plants may have an effect on the well-being of the elderly who have a rural background and are living in institutional settings, especially for those aspects threatened by institutional environments: autonomy, a sense of control, identity, and the opportunity to form social relationships.


This study provides a profile of six juvenile offenders' responses to a vocational horticulture curriculum. The results indicate that vocational horticulture curricula may be a tool to strengthen a delinquent individual's bonds with society and, subsequently, evoke changes in attitudes about personal success and perceptions of personal job preparedness. The youths in this study increased their social bonds in all six categories addressed by the pretest and posttests, and were motivated to think more practically about their careers. Due to the limitations on size and scope of the study, it is exploratory in nature and provides ideas for future research and possible assessment methods for further research.

Community gardens are widely recognized as an effective grassroots response to urban disinvestment and decay. There has been remarkably little attention paid, however, to the differences among community gardens as physical and social spaces. This paper suggests that variations among gardens reflect and reproduce differing interpretations of the meaning of both community and garden in the city. A comparative discussion of three community gardens in Minneapolis, Minnesota, highlights the concept that at the intersection of notions of community and garden are the issues of enclosure, inclusion and exclusion. Decisions about whether and how to enclose community gardens shape the role that community gardens play in urban neighborhoods. [Key words: community gardens, neighborhood revitalization, urban activism.]


S. Kaplan suggested that one outcome of mental fatigue may be an increased propensity for outbursts of anger and even violence. If so, contact with nature, which appears to mitigate mental fatigue, may reduce aggression and violence. This study investigated that possibility in a setting and population with relatively high rates of aggression: inner-city urban public housing residents. Levels of aggression were compared for 145 urban public housing residents randomly assigned to buildings with varying levels of nearby nature (trees and grass). Attentional functioning was assessed as an index of mental fatigue. Residents living in relatively barren buildings reported more aggression and violence than did their counterparts in greener buildings. Moreover, levels of mental fatigue were higher in barren buildings, and aggression accompanied mental fatigue. Tests for the proposed mechanism and for alternative mechanisms indicated that the relationship between nearby nature and aggression was fully mediated through attentional functioning.


Although vegetation has been positively linked to fear of crime and crime in a number of settings, recent findings in urban residential areas have hinted at a possible negative relationship: Residents living in "greener" surroundings report lower levels of fear, fewer incivilities, and less aggressive and violent behavior. Ibis study used police crime reports to examine the relationship between vegetation and crime in an inner-city neighborhood. Crime rates for 98 apartment buildings with varying levels of nearby vegetation were compared. Results indicate that although residents were randomly assigned to different levels of nearby vegetation, the greener a building's surroundings were, the fewer crimes reported. Furthermore, this pattern held for both property crimes and violent crimes. The relationship of vegetation to crime held after the number of apartments per building, building height, vacancy rate, and number of occupied units per building were accounted for.


Considerable evidence suggests that exposure to "green" environments can enhance human effectiveness and make life's demands seem manageable. Does this phenomenon extend
to poor inner cities, where green space is minimal and life's demands may be overwhelming? In 145 urban public housing residents randomly assigned to buildings with and without nearby nature, attentional functioning and effectiveness in managing major life issues were compared. Residents living in buildings without nearby trees and grass reported more procrastination in facing their major issues and assessed their issues as more severe, less soluble, and more long-standing than did their counterparts living in greener surroundings. Mediation tests and extensive tests for possible confounds supported the attention restoration hypothesis—that green space enhances residents' effectiveness by reducing mental fatigue. These findings suggest that urban public housing environments could be configured to enhance residents' psychological resources for coping with poverty.


The authors report further evidence bearing on the relations among restorative experiences, self-regulation, and place attachment. University students (n = 101) described their favorite places and experiences in them, and 98 other students described unpleasant places. Natural settings were overrepresented among favorite places and underrepresented among the unpleasant places. In open-ended accounts, frequent mention of being relaxed, being away from everyday life, forgetting worries, and reflecting on personal matters indicated a link between favorite places and restorative experience. Restoration was particularly typical of natural favorite places. Structured evaluations of being away, fascination, coherence, and compatibility indicated they were experienced to a high degree in the favorite places, although fascination to a lesser degree than compatibility. The favorite and unpleasant places differed substantially in all four restorative qualities but especially in being away and compatibility. Self-referencing appears to be more characteristic of favorite place experiences than engaging or interesting environmental properties.


Two identical surveys were conducted with separate samples to determine consumer perceptions of the quality of five edible flower species. Participants were either members of a class that reviewed the history and uses of edible flowers at an annual, 1-day event (Garden Days) or Michigan Master Gardeners who attended a similar class. Participants were shown a randomized series of projected photographic slides of five edible flower species and asked to indicate whether they found the flower quality acceptable. The slides depicted a range of ratings of mechanical damage, insect damage, or flower senescence on a Likert reference scale (1 through 5) developed by the researchers. A flower rated 5 was flawless, while a flower rated 1 had substantial damage. Nearly one-half of all participants had eaten edible flowers before the study, and 57% to 59% had grown them for their own consumption, indicating many individuals had previous experience. Both samples rated flower quality equally and found pansy (Viola xwittrockiana `Accord Banner Clear Mixture'), tuberous begonia (Begonia xtuberhybrida `Ornament Pink'), and viola (Viola tricolor `Helen Mount') acceptable from stage 5 to 3. Both groups found the nasturtium (Tropaeolum majus `Jewel Mix') flowers acceptable at only rating 5. Garden Days participants rated borage (Borago officinalis) acceptable from ratings 5 to 3, while the Master Gardeners rated their acceptability from only 5 to 4. Participants also rated flower color (yellow, orange, and blue) as equally acceptable.

This study examined how avid gardeners experience a public garden. Phenomenological interviewing was used to collect data from six avid gardeners who frequently visited a public garden. Data about the gardeners' beliefs and actions regarding gardening history, gardening practices, and involvement with public gardens were gathered. From inductive analysis, a model of a gardener's world composed of four conceptual themes: 1) personal history, 2) social connections, 3) human well-being, and 4) learning experiences was delineated. The conceptual themes of a gardener's world are the personal learning constructs through which gardeners experience the plant world. Each of the four conceptual themes influenced how participants in this study experienced a public garden. Participants used a public garden to socially interact with others, enhance their human well-being, strengthen their gardening background, and extend their gardening knowledge and skill. Several subthemes emerged within the four conceptual themes of an avid gardener's world to inform us how gardening plays an integral role in gardeners' lives.


Three intercept surveys were conducted at the Southeast Research and Extension Center in Landisville, Pa., at three separate field days during the period of 28 July to 4 Aug. 2004 to determine grower (n = 78), retailer/landscaper (n = 52), and consumer (n = 55) interest in annual planters. Survey participants were self-selected and asked to answer questions evaluating their preferences and past experience with annual planters. Consumer participants also evaluated planters based on flower-color harmony, container style, and price on a scale of 1 to 7 (1 = very unlikely to purchase, 7 = very likely to purchase) and answered sociographic and demographic questions. Container evaluations were analyzed using conjoint analysis to determine consumer preferences. Price was found to be the most important factor, accounting for 43.1% of the decision to purchase an annual planter. No significance was found comparing the lowest ($19.98) and middle ($29.98) prices; however, both were significantly more preferred than the highest price point ($39.98). Color harmony was the next most important factor, accounting for 34.9% of the decision to purchase followed by container style (22.0%). When asked what they would pay, on average, for the containers on display, consumer participants responded with a price of $25.68. A majority of retail/landscape participants in this study had never sold annual planters within their company (75.0%), whereas a majority of grower participants had produced annual planters in the past (75.0%). Retailer/landscape participants also indicated that they would charge their customers an average retail price of $31.67, which was 14% less than the growers’ suggested average retail price of $36.83 based on the $21.68 wholesale price they assigned.


A survey, targeting adults working with youth in garden situations, was designed for delivery on the KinderGARDEN World Wide Web site. The goal of this survey was to investigate adults who are actively involved in gardening with children in school, community or home gardens on their perceptions of the benefits of children participating in gardening. Three hundred-twenty completed surveys were returned via e-mail during a period of 9 months. Fourteen questions were included on the survey requesting information concerning what types of
gardening situations in which children were participants and the demographics of the children involved in gardening. Results of the study cover 128,836 children (youth under 18 years old) involved in gardening, primarily with teachers in school gardens. The children involved were generally 12 years of age or under and were growing food crops. Adults gardening with children reported benefits to children's self-esteem and reduction in stress levels. Adults were also interested in learning more about the psychological, nutritional and physical benefits of gardening. Comparisons between those adults involved in gardening found that parents' and teachers' ideas differed concerning the most important aspects of the gardening experience. Parents viewed food production as most important while teachers thought socializing and learning about plants were most important.


Background: The prevalence of atopic diseases is on the rise. Traditional lifestyles may be associated with a reduced risk of atopy. The objective was to test the hypothesis that children living on a farm have lower prevalences of atopic diseases. To identify differences in living conditions between farmers and other families which are associated with the development of atopic conditions.

Design: Cross-sectional survey among children entering school (aged 5±7 years). A written questionnaire including the ISAAC core questions and asking for exposures on a farm and elsewhere was administered to the parents. Setting: School health entry examination in two Bavarian districts with extensive farming activity. Subjects: 10,163 children. Main outcome measures: The prevalence of doctor's diagnoses and symptoms of hay fever, asthma and eczema as assessed by parental report.

Results: Farmers' children had lower prevalences of hay fever (adjusted odds ratio 0.52, 95% CI 0.28±0.99), asthma (0.65, 0.39±1.09), and wheeze (0.55, 0.36±0.86) than their peers not living in an agricultural environment. The reduction in risk was stronger for children whose families were running the farm on a full-time basis as compared with families with part-time farming activity. Among farmers' children increasing exposure to livestock was related to a decreasing prevalence of atopic diseases (aOR 0.41, 95% CI 0.23 ± 0.74).

Conclusions: Factors related to environmental influences on a farm such as increased exposure to bacterial compounds in stables where livestock is kept prevent the development of allergic disorders in children.


The Korean Society for Plants, People and Environment held its first International Symposium on Plant and People Interactions in Human Health and Quality of Life in May 1998. Three speakers, invited from abroad, were among those who made presentations. A summary is presented.


Many of the research questions that have been posed regarding the effects of plants on people can only be answered using methodologies from the social sciences. Lack of familiarity with these methods and their underlying concepts has limited the role that horticulturists have
taken in this research. Horticulturists, because of their particular sensitivity to the various aspects of plants and the nature of the ways that people interact with plants, must be involved in this type of research to generate the information that is needed by horticultural industries. This paper reviews many of the common methods that have been used in research on human issues in horticulture and presents examples of studies that have been conducted using these techniques. Quantitative and qualitative methods are discussed.


This report examines the behavior of elderly adults and preschool children during horticultural therapy (HT) activities to determine if combining intergenerational groups would complement or detract from the HT goals for each group separately. During a 10-week observation period, data were collected on video documenting attendance, participation time and pattern during separate age group and intergenerational activities. These data were used to determine if interactions changed over time or in response to different activities. Participation appeared to be affected by activity design, difficulty level, individual ability, and availability of assistance from volunteers. Children's participation during separate age group activities appeared to be affected mainly by the difficulty level and activity design. Elderly adults' participation during separate age group activities appeared to be affected by individual ability limitation and availability of assistance. Children's intergenerational participation scores appeared to show an increase in the category of "working with direct assistance", while elderly adults' intergenerational scores appeared to show an increase in the categories of "no participation" and "independent participation". In part, the change in intergenerational participation appeared to be due to a decrease in assistance available from volunteers for each individual. For some individuals, the introduction of intergenerational groups appeared to detract from personal participation in horticulture activities. If the goal of the HT is directly related to the individual's activity in horticulture (i.e., increased self-esteem from successfully designing and building a terrarium), the intergenerational element appears to reduce the potential for that benefit. The percentage of total social interaction time between the generations during activities increased over time. The intergenerational activities involving plant-based activities seemed to be more successful at increasing intergenerational exchange than the craft-type activities. Therefore, horticulture may be a useful activity for programs with a goal of increased intergenerational interaction.


Interiorscaping has been prevalent in office environments in the United States since the 1960s. Historically, proponents of interior plantings have cited numerous benefits, including improved employee morale, increased productivity, and reduced absenteeism when plants are added to the workplace, despite little scientific research to support these claims. Contemporary research is beginning to document some of these purported benefits of interior plantings on human comfort, well-being, and productivity. If researchers continue to provide concrete evidence that interaction with plants is directly linked to improved human health and well-being, this information will provide further justification for the use of interior plants in a variety of indoor work settings. With an ever-increasing emphasis by business managers on minimizing
costs, it is important for industry professionals to provide quantifiable justification for the inclusion of plants in modern work environments.


Plants and horticulture play an integral role in the cultural heritage of eastern societies. Plants are deemed as important in many ways besides being a source of food and shelter. The present study summarizes information on research and trends in the value and application of horticulture collected from professionals in Asian countries, focusing on the work in human-horticulture relationships in Korea and Japan.


A well-known research report showed that being in a hospital room with a view of trees rather than a view of a building was linked to the use of fewer pain-reducing medications by patients recovering from surgery. The experiment reported here was designed to further examine the role of plants in pain perception. We found that more subjects were willing to keep a hand submerged in ice water for 5 min if they were in a room with plants present than if they were in a room without plants. This was found to be true even when the room without plants had other colorful objects that might help the subject focus on something other than the discomfort. Results from a room assessment survey confirmed that the room with colorful, nonplant objects was as interesting and colorful as the room with plants present, but the presence of plants was perceived as making the air in the room fresher.


Plants are widely used in building environments; however, studies reporting the health and discomfort symptoms of people in response to indoor foliage plants are few. The objective of the presented studies was to assess the effect of foliage plants or a combination of foliage plants and full-spectrum fluorescent lamps on self-reported health and discomfort complaints in three different work environments: an office building, an X-ray department in a Norwegian hospital, and a junior high school. Health and discomfort symptoms were found to be 21% to 25% lower during the period when subjects had plants or plants and full-spectrum lighting present compared to a period without plants. Neuropsychological symptoms, such as fatigue and headache, and mucous membrane symptoms, such as dry and hoarse throat, seemed to be more affected by the treatments than skin symptoms, such as itching skin.


Approaches using human issues in horticulture (HIH) offer new possibilities to develop nearby nature in cities, especially during a period of rapid urbanization in Finland. New initiatives have been developed in school gardening, environmental education, gardening in training programs for disabled people, therapeutic environments in hospitals and institutions, and in the University of Helsinki horticultural education and research programs. At the University of Helsinki, two contact teaching courses and national seminars were organized in 1996 and 1998.
Initial studies in the HIH approach have three main themes: 1) gardening as a tool for better quality of life in homes for the elderly, 2) ecology, native plants and extensive maintenance in parks, and 3) the use of horticulture in environment and science education at the lower level of the comprehensive school.


Private gardens occupy a significant proportion of the total surface area of a British city. For many people, the garden represents their only contact with nature and their chance to express themselves creatively. Yet relatively little research has been carried out on the role and value of such gardens to human well-being. We report in this paper on a major survey on the role of private, urban gardens in human well-being, conducted with a wide cross-section of randomly selected garden owners from the city of Sheffield, England, over the summer of 1995. In particular, we discuss the perceived value that gardens have to the well-being of people, both individually through the enjoyment of their own gardens and collectively through the contribution of city gardens to environmental enhancement. We relate these values to age, gender and social demographics.


The work identifies and attempts to value urban woodlands according to their social significance to the user. Using questionnaires, interviews and focus groups, it examines the usage patterns and perceptions of the public to an urban forest complex. Results point towards the high social value of urban woods providing that they meet specific requirements and raise some fundamental issues regarding the location, size and structure of urban woodlands for everyday public use, the relationship between the communities and the woodlands that serve them and major differences between professional and public attitudes to woodlands. Findings point to a severe undervaluing of the social importance of woods by professionals in favour of general nature conservation guidelines which fail to recognise the nature of urban woodland/community interaction. Key parameters are that woodlands should be 5-10 min walk from the home, be of a suitable size to create a woodland environment (minimum of 2 ha) and have an open structure. Species was not a significant factor. Woodland interaction is highly personal where even 25-year old plantations are regarded as static long-term structures. As such, they are used as a context for a variety of life events and functions, where the relationship is defined by social parameters and social need, which are derived from the urban populations that they serve. To promote and establish an effective urban forestry strategy requires an understanding of these dimensions, however, any evidence for such an understanding among professionals was not found.


Participants from eight countries met in Australia in July 1998 for the International People-Plant Symposium titled "Towards a New Millennium in People-Plant Relationships." There were about 75 presentations arranged under three general headings: 1) plants, cultural diversity, and environmental quality, 2) plants for human health and well-being, and 3) plant and horticultural education--community and schools. The symposium represented another step in the dissemination of information and awareness on people-plant relationships.

Human awareness of plants in Australia goes back 50,000 years when the aboriginal first began using plants to treat, clothe and feed themselves. The European influence came in 1778 with the First Fleet landing in New South Wales. Australia's earliest records of using horticulture for therapy and rehabilitation were in institutions for people with intellectual disabilities or who were incarcerated. Eventually, legislation created greater awareness in the government and community for the needs of persons with disabilities, and many worthwhile projects, programs and organizations were established or gained greater recognition. Horticultural therapy programs may be found in nursing homes, rehabilitation centers, adult training support services, hospitals, day centers, community centers and gardens, educational institutions, supported employment, and the prisons system. This article reviews the history and development of Australian horticulture as a therapy in the treatment of disabilities and social disadvantaged groups, and includes an overview of programs offered for special populations and of Australia's horticultural therapy associations. It also discusses opportunities for research, teaching and extension for horticultural therapy in Australia.


Changes in human emotions were investigated during exposure to three different indoor conditions: floral display present, foliage display present, and no display present. There were 20 subjects (10 males and 10 females) in each condition. The subjects were shown a video that introduced the University of Reading and included scenes of landscapes. It was shown that a floral display had positive effects on human emotions, such as composition and confidence, however, some evidence of a significant increase in annoyance was also found for this treatment. The foliage display had a somewhat negative effect by slightly increasing bad temper, and the foliage display tended to have a positive effect on clear-headedness. Investigations of psychological responses to nature are complex, and many opportunities for more work exist.


With the increasing concern about job stress, there is a growing body of literature addressing psychosocial job stress and its adverse effects on health in Japan. This paper reviews research findings over the past 15 years concerning the assessment of job stress, the relationship of job stress to mental and physical health, and the effects of worksite stress reduction activities in Japan. Although studies were conducted in the past using ad-hoc job stress questionnaires, well-established job stressor scales have since been translated into Japanese, their psychometric properties tested and these scales extensively used in recent epidemiologic studies. While the impact of overtime and quantitative job overload on mental health seems moderate, job control, skill use and worksite support, as well as qualitative job demands, had greater effects on psychological distress and drinking problems in cross-sectional and prospective studies. These job stressors also indicated a strong association with psychiatric disorders, including major depression, even with a prospective study design. Long working hours were associated with a higher risk of myocardial infarction, diabetes mellitus and hypertension. There is evidence that the job demands-control model, as well as the use of new technology at work, is associated with
higher levels of blood pressure and serum lipids among Japanese working populations. Fibrinolytic activity, blood glucose levels, immune functions and medical consultation rates were also affected by job stressors. It is further suggested that Japanese workers tend to suppress expression of positive feelings, which results in apparently higher psychological distress and lower job satisfaction among Japanese workers compared with workers in the U.S. Future epidemiologic studies in Japan should focus more on a prospective study design, theoretical models of job stress, job stress among women, and cultural difference and well-designed intervention studies of various types of worksite stress reduction.


Gardening is increasing in use as the focus of interdisciplinary teaching units in the elementary school curriculum and as a stratagem for student therapeutic, recreational, and social experiences. Elementary school teachers, identified as experienced in using gardening as a teaching tool, were surveyed and interviewed to determine successful strategies for integration of gardening into elementary school curricula. The most important factors determined by these teachers for the successful use of gardening in the curriculum were 1) student and faculty ownership or commitment to integrating gardening in their curriculum, 2) availability of physical resources, and 3) faculty knowledge and skill in the application of gardening to enhance an interdisciplinary curriculum. Educators who incorporate school gardening into their curriculum report that school gardening is a somewhat successful (35.2%) or very successful (60.6%) teaching tool that enhances the learning of their students. Most (92%) teachers surveyed requested additional school gardening education for themselves.


Researchers often investigate consumer preferences by examining variables consecutively, rather than simultaneously. Conjoint analysis facilitates simultaneous investigation of multiple variables. Cluster analysis facilitates development of actionable market segments. Our objective was to identify relative importance and consumer preferences for flower color, leaf variegation, and price of geraniums (Pelargonium xhortorum L.H. Bail.) and to identify several actionable market segments. We also evaluated the desirability of a hypothetical blue geranium. Photographic images were digitized and manipulated to produce plants similar in flower area, but varying in flower color (red, lavender, pink, white, and blue), leaf variegation (plain green, dark green zone, and white zone), and price ($1.39 to $2.79). Conjoint analysis revealed that flower color was the primary consideration in the purchase decision, followed by leaf variegation and price. A cluster analysis that excluded blue geraniums yielded four actionable consumer segments. When preferences for the blue geranium were included, six consumer segments were identified.


A survey was designed to investigate children's perceptions of the benefits of gardening and is posted on the KinderGARDEN Web page within the Aggie Horticulture network. The KinderGARDEN Web page was developed as a resource for parents and teachers to help them incorporate the garden into the home and school lives of children. The Web site additionally
attracts young visitors with a "Fun Page." The "Fun Page" has descriptions of garden activities that children can experiment with at home or school, garden literature for children and garden Web links. The survey is included on this page. Children respond to the survey via e-mail. The survey requests information about the type of gardening situations in which each respondent participates, the number of children with whom they generally garden, what they feel they learn from gardening and what benefits they feel they gain from gardening. Children responded positively on the value of the garden to their recreation, while also mentioning educational, environmental, aesthetic, social and economic benefits in the survey. Results showed that 81% of children felt they were learning about the environment by working in the garden. Fifty-four percent of children mentioned that the garden taught them about plants and plant-related concepts. Other benefits children mentioned as important to them included recreation and/or "having fun" (31%) and socialization with friends and family (15%).


A considerable body of folklore and scientific research alludes to the efficacy of the vernacular environment to influence both aesthetic experience and general well-being. To examine explicitly whether stress recovery and/or immunization varies as a function of the roadside environment, 160 college-age participants, both male and female, viewed one of four different video-taped simulated drives through outdoor environments immediately following and preceding mildly stressful events. Overall, it was anticipated that participants who viewed artifact-dominated drives, relative to participants who viewed nature-dominated drives, would show greater autonomic activity indicative of stress (e.g. elevated blood pressure and electrodermal activity), as well as show altered somatic activity indicative of greater negative affect (e.g. elevated electromyographic (EMG) activity over the brow region and decreased activity over the cheek region). In addition, it was expected that participants who viewed nature-dominated drives would experience quicker recovery from stress and greater immunization to subsequent stress than participants who viewed artifact-dominated drives. The overall pattern of results is consistent with both hypotheses and the findings are interpreted to support postulating a sympathetic-specific mechanism that underlies the effect of nature on stress recovery and immunization.


Master Gardeners (MGs) have proven to be effective judges for vocational horticulture student demonstrations of industry skills in 1996 Virginia and National FFA competitions. In a survey, the MG judges indicated a wide variety of backgrounds, with many being first-year MGs having no prior experience in judging or youth programs. Overall, they rated the student performance as better than expected and their own judging standard as neither lenient nor rigorous. Training is a critical part of their effectiveness as judges, and it was found that multiple formats are needed. Overall, most rated judging the FFA events as a very appropriate match to the MG educational goals, and there was a 100% affirmative response to the questions would they accept an invitation to judge again and would they encourage other MGs to volunteer as judges for FFA horticulture events.

For older adults, social integration and the strength of social ties are profoundly important predictors of well-being and longevity. Can the physical environment be designed to promote older adults' social integration with their neighbors? We examined this possibility by testing the relationships between varying amount of exposure to green outdoor common spaces and the strength of ties among neighbors. Results of interviews with 91 older adults (between the ages of 64 and 91 years) from one inner-city neighborhood show that the use of green outdoor common spaces predicted both the strength of neighborhood social ties and sense of community. Although the strength of these relationships were modest, the findings suggest that the characteristics of outdoor common spaces can play a role in the formation and maintenance of social ties among older adult residents of inner-city neighborhoods. The results have implications for designers, managers, and residents of housing developments.


Research suggests that the formation of neighborhood social ties (NSTs) may substantially depend on the informal social contact which occurs in neighborhood common spaces, and that in inner-city neighborhoods where common spaces are often barren no-man's lands, the presence of trees and grass supports common space use and informal social contact among neighbors. We found that for 145 urban public housing residents randomly assigned to 28 architecturally identical buildings, levels of vegetation in common spaces predict both use of common spaces and NSTs; further use of common spaces mediated the relationship between vegetation and NSTs. In addition, vegetation and NSTs were significantly related to residents' senses of safety and adjustment. These findings suggest that the use and characteristics of common spaces may play a vital role in the natural growth of community, and that improving common spaces may be an especially productive focus for community organizing efforts in inner-city neighborhoods.


To determine if and how plant materials were used in Virginia elementary school curricula, a survey was conducted on horticulture or gardening in elementary [Kindergarten-sixth grade (K-6)] education. To do this, 10 questionnaires and cover letters were sent to each of 100 randomly chosen elementary schools throughout Virginia. Based on a 34% response rate from a self-selected group of K-6 teachers, there was a relatively high level of interest (88%) regarding using horticulture or gardening in the classroom. A major goal of this survey was to determine what would encourage or facilitate incorporating horticulture or gardening into the curriculum.


A new technique for time series analysis, which is a combination of the maximum entropy method (MEM) for spectral analysis and the non-linear least squares method (LSM) for fitting analysis, is described. In this technique, the MEM power spectral density (MEMPSD) is calculated using a very large lag that could diminish the lag dependence of dominant periods
estimated by the MEM analysis. The validity of this large lag is confirmed by the LSM, given that the ten dominant MEM periods are known quantities. To validate the MEM plus LSM technique, it is compared with autoregressive (AR) modelling, by analysing heart rate variability under pharmacological interventions (phenylephrine and trinitroglycerine), using 16 young males. The results indicate that the MEMPSD, when compared with the ARPSD, has numerous periods that could reproduce the original time series much more accurately, as revealed by the LSM analysis. However, both the low- and high-frequency powers with MEMPSD and ARPSDs shift in the expected directions in accordance with the pharmacological effects on the cardiovascular system. The implications of these results are discussed from the theoretical and practical standpoints of the MEM plus LSM technique, compared with AR modelling.


The Virginia Cooperative Extension (VCE) Advanced Master Gardener-Tree Steward (AMGTS) program provides advanced training in leadership development and arboriculture to MG volunteer educators so they may expand the influence of extension through leadership in community forestry. A statewide survey of agents, MGs, and foresters served as the basis for developing the training package, which was funded in part by the Virginia Department of Forestry. According to a statewide survey, 70% of VCE MGs and extension agents with MG programs would like to be involved in community tree programming, while only 26% was currently involved. Typically, agents cited limited staff and volunteer resources as the primary factors in restricting program expansion. Furthermore, 90% of municipal foresters indicated they would like to work with trained volunteers. The AMGTS program simultaneously answers the desire of MGs to expand their role in the community landscape and the need of VCE to expand its outreach with increasingly limited resources. AMGTS training, guided by a 10-unit resource book, integrates technical and program management expertise to foster volunteer pride and self-sufficiency. This allows MG tree stewards to coordinate much of their own training and recruit and manage non-MG volunteers to whom they can provide limited training for specific projects, thus allowing program expansion without additional staff. The training is designed for delivery by knowledgeable professionals in the local community, such as arborists, horticulturists, college professors, extension specialists, MGs, and others who can provide quality training following the program guidelines.


This study examines how the availability of nature influences the use of outdoor public spaces in two Chicago public housing developments. Ninety-six observations were collected of the presence and location of trees and the presence and location of youth and adults in semiprivate spaces at one high-rise and one low-rise public housing development Results consistently indicated that natural landscaping encourages greater use of outdoor areas by residents. Spaces with trees attracted larger groups of people, as well as more mixed groups of youth and adults, than did spaces devoid of nature. In addition, more dense groupings of trees and trees that are located close to public housing buildings attracted larger groups of people. These findings suggest that natural elements such as trees promote increased opportunities for social interactions, monitoring of outdoor areas, and supervision of children in impoverished urban neighborhoods.

Consumers in five U.S. markets evaluated photographs of geranium plants with regard to purchase likelihood. Photographic images were colored electronically to produce uniform geranium plants with five flower colors (pink, white, red, lavender, and blue) and three leaf variegation patterns (dark zone, white zone, and no zonal pattern). Photographs were mounted on cards with five selected price points ranging from ($1.39 to $2.79). We randomly generated an orthogonal array, partial-factorial design for consumers to rate a reduced number of choices. Consumers shopping in cooperating garden centers located in Dallas, Tex.; Montgomery, Ala.; Athens, Ga.; Charlotte, N.C.; and Wilmington, Dela., rated 25 photographs on the basis of their likelihood to purchase the plants shown. Conjoint analysis revealed that customers in the Georgia garden center placed the highest proportion of their decision to buy on leaf variegation (29%), while customers in the Alabama outlet placed the most emphasis on price (46% of the decision). Shoppers in Texas valued flower color most highly (58% of their decision to buy). Demographic characteristics and past purchase behavior also varied widely, suggesting diverse marketing strategies for geraniums.


In Green Nature/Human Nature Charles A. Lewis describes the psychological, sociological, and physiological responses of people to vegetation in cities and forests, as well as in horticultural therapy programs in hospitals, geriatric institutions, physical rehabilitation centers, drug rehabilitation programs, and correctional institutions. He presents an evolutionary basis for the human attraction to plants. People-plant interactions are presented from two perspectives: participatory, in which the individual is involved in planting and maintaining the vegetation, and observational, in which the individual bears no responsibility for establishing or maintaining the vegetation. In what amounts to a straightforward catalog of well-documented and tangible benefits, Lewis brings the latest and best research into plant/human interaction to bear on questions of how green nature is intertwined with the human psyche and how that interaction can lead to enhanced well-being and an appreciation of the human dimension in environmental concerns.


Research on psychological restoration and restorative environments is a needed complement to work on stress and environmental stressors. Two laboratory experiments tested the utility of two restorative environments theories, one concerned with directed attention capacity renewal and the other with stress reduction and associated changes in emotion. Various strategies were employed to distinguish restorative effects from other effects, to limit the role of arousal reduction in attentional restoration, and to begin mapping the time course for the emergence of outcomes. Both experiments tested for differential emotional and performance effects as a function of photographic environmental simulation (natural or urban environment). Across the experiments the natural environment simulation engendered generally more positive emotional self-reports. That consistent performance effects were not found in either study suggests that attentional restoration as reflected in performance is a more time-intensive process.
Traditionally, the term horticultural therapy has been associated with plant cultivation as a tool of occupational therapy. Today, a broader range of definitions are recognized, ranging from plant cultivation to the appreciation of landscape. The level of interest in the subject is illustrated by a diversity of concerned professions from architects to providers of care and support for people with disabilities. Research at the University of Bath ranged from techniques of plant cultivation to landscape designs suitable for a wide range of people, including those with learning difficulties, physical disabilities, and the frail and the elderly. The underlying aim was to encourage active and/or passive involvement with plants, to produce systems successful enough to give therapists confidence in using horticulture as a therapeutic tool or to provide settings where people are able to develop their own interests and improve their quality of life.

Demographic trends in Britain have resulted in an increase in the proportion of elderly people in the population and most significantly in the very old. In later years the research at Bath focused on the design and modification of landscape and gardens for older people. Current research at the Research Institute for Care of the Elderly is progressing this work by exploring older people's attitudes to, and preferences for, the outdoor environment. Work at Reading University is also exploring the influences of contact with nature on human psychological well-being, and the role urban landscapes can play in promoting environmental care and enabling sustainable development. There is increasing interest in the benefits of landscapes and plants to children, both as part of the education curriculum and as an agent for improved social, psychological and physical development. Current research at Learning through Landscapes is looking at the design, use and management of school grounds for children with special needs.


Research to understand the interaction between people and plants will have a direct influence on the development of environmentally sound and humanly healthful urban landscapes; the understanding of the role of greenspace in interior as well as exterior settings; the involvement of school children in gardening; and the use of cut flowers, pot plants, and food crops to improve human life quality. This increased understanding of what people expect from plants and the garden can directly influence horticultural products and techniques. Coupled with communications to make the public aware of the findings, this research will increase the appreciation and use of plants, thus the benefits that people gain from plants. Research results will serve as a powerful marketing tool to increase the demand for horticultural products and services, leading to an increase in the number of jobs in the industry and, ultimately, the demand and funding for traditional horticultural research and education.


Culture changes landscapes and culture is embodied by landscapes. Both aspects of this dynamic are encompassed by landscape ecology, but neither has been examined sufficiently to produce cultural theory within the field. This paper describes four broad cultural principles for
landscape ecology, under which more precise principles might be organized. A central underlying premise is that culture and landscape interact in a feed-back loop in which culture structures landscapes and landscapes inculcate culture. The following broad principles are proposed: 1. Human landscape perception, cognition, and values directly affect the landscape and are affected by the landscape. 2. Cultural conventions powerfully influence landscape pattern in both inhabited and apparently natural landscapes. 3. Cultural concepts of nature are different from scientific concepts of ecological function. 4. The appearance of landscapes communicates cultural values. Both the study of landscapes at a human scale and experimentation with possible landscapes, landscape patterns invented to accommodate ecological function, are recommended as means of achieving more precise cultural principles.


The burgeoning incidence of stress-related illness and attendant costs to both society and individuals, is an issue of concern in realms from the institutional to the private. Simultaneously there is an increasing rejection of the model of health which posits separation of mind (and emotion) from body and bodily experience. Several recent studies have endeavored to increase our understanding of the role that settings can play in peoples' "self-help" choices when responding to stress or other emotional upsets in their lives. It is important for designers and environmental policy makers to comprehend, as fully as possible, the healing role that places may play in peoples' lives.


A model of quality of life is proposed that integrates objective and subjective indicators, a broad range of life domains, and individual values. It takes account of concerns that externally derived norms should not be applied without reference to individual differences. It also allows for objective comparisons to be made between the situations of particular groups and what is normative. Considerable agreement exists that quality of life is multidimensional. Coverage may be categorised within five dimensions: physical wellbeing, material wellbeing, social wellbeing, emotional wellbeing, and development and activity. A research agenda is discussed as are the particular problems caused by difficulties in understanding and communicating.


In Spring 1991, the U.S. Environmental Protection Agency convened an expert group of ecologists, economists and other social scientists for the purpose of advancing the state of the art of ecosystem valuation methods. This Ecosystem Valuation Forum was organized as a dialogue because it has been clear from the outset that agreement even on the meaning of the term "ecosystem valuation" could not be taken for granted. Individuals from diverse disciplines, and from industry, environmental groups and government agencies disagree about what information about ecosystem services is needed, how it should be used and, therefore, what would constitute an advance in the methods that analysts should employ. The Forum discussed the varied ways in which experts from different disciplines approach valuation, what ecosystem attributes or services are important to value, and the factors that complicate the task of assigning values to ecosystem attributes. The Forum placed particular importance on approaching the problem of
ecosystem valuation from the perspective of decision makers. Therefore, members discussed the variety of decision makers who might need valuation information, the controversy over where balancing decisions about costs and benefits should be made, and the implications for what information is needed within different institutional constraints. In addition, agency decision makers operate under real time and resource constraints. Thus, the Forum discussed the need to develop protocols that would guide analysts in a search for decisive information. The Forum concluded that the time is ripe for making new progress in solving some of these problems, while acknowledging that it may not be possible to develop a single unifying definition of value. Instead, the goal would be to understand how various concepts of value are structured, how they relate to each other, and how they can guide us toward a more integrated valuation process. The Forum recommended that next steps in addressing these issues be organized around case studies, particularly those that would enable researchers to improve linkages between ecological and economic methods and to develop improved protocols for valuation studies.


Two studies were done comparing the preferences of high and low sensation seekers for nature paintings representing different styles. The paintings had been previously rated for qualities of complexity and tension. Factor analyses established five stylistic categories among the paintings. In both studies high sensation seekers had a relatively greater liking for high tension paintings whereas the lows had a relatively greater liking for low tension paintings. In both studies high sensation seekers had a relatively greater liking for expressionist style paintings, and in the second study the lows had a greater preference for the realistic, low tension pastoral scenes than the high sensation seekers. Men liked complex, high tension, realistic paintings more than women did. Complexity did not interact with personality, but was subordinate to other qualities of the paintings. High sensation seekers like tension evoking paintings and are more tolerant of ambiguity in style than low sensation seekers.


Twenty-two potential correlates of children's physical activity were examined. Two hundred and one Mexican-American and 146 Anglo-American families with 4-year-old children were studied. Children's physical activity was directly observed in the evening at home on 4 visits for 1 hr each time. Anglo-American children and male children were found to be more active. Demographic variables explained 11% of the variance in children's physical activity. After adjusting for demographics, 3 children's variables and 6 social-family variables did not account for significantly more variance. Five environmental variables accounted for 11% additional variance. Variables observed concurrently with physical activity, such as time spent outdoors and prompts to be active, were highly associated with children's physical activity.


“Nature and I are two,” filmmaker Woody Allen once said, and apparently the two have not gotten together yet (Lax, 1992, pp. 39–40). Allen is known to take extraordinary precautions to limit bodily and mental contact with rural flora and fauna. He does not go in natural lakes, for
example, because “there are live things in there.” The nature Allen does find comfortable is that of New York City, a modest enough standard for wildness.

Allen’s aversion to nature, what can be called biophobia, is increasingly common among people raised with television, Walkman radios attached to their heads, and video games and living amidst shopping malls, freeways, and dense urban or suburban settings where nature is permitted tastefully, as decoration. More than ever we dwell in and among our own creations and are increasingly uncomfortable with nature lying beyond our direct control. Biophobia ranges from discomfort in “natural” places to active scorn for whatever is not manmade, managed, or air-conditioned. Biophobia, in short, is the culturally acquired urge to affiliate with technology, human artifacts, and solely with human interests regarding the natural world. I intend the word broadly to include as well those who regard nature “objectively” as nothing more than “resources” to be used any way the favored among the present generation see fit.

Is biophobia a problem as, say, misanthropy or sociopathy, or is it merely a personal preference; one plausible view of nature among many? Is it OK that Woody Allen feels little or no sympathy or kinship with nature? Does it matter that a growing number of other people do not like it or like it only in the abstract as nothing more than resources to be managed or as television nature specials? Does it matter that we are increasingly separated from the conditions of nature? If these things do matter, how do they matter and why? And why have so many come to think that the created world is inadequate? Inadequate to what and for what?

At the other end of the continuum of possible orientation toward nature is “biophilia,” which E. O. Wilson (1984) has defined as “the urge to affiliate with other forms of life” (p. 85). Erich Fromm (1973) once defined it more broadly as “the passionate love of life and of all that is alive” (pp. 365–366). Both agree, however, that biophilia is innate and a sign of mental and physical health. To what extent are our biological prospects and our sanity now dependent on our capacity for biophilia? To that degree it is important that we understand how biophilia comes to be, how it thrives, what competencies and abilities it requires of us, and how these are to be learned.

Biophilia is not all that tugs at us. The affinity for life or biophilia competes with other drives and affinities, including biophobia disguised beneath the abstractions and presumptions of progress found in economics, management, and technology. Whatever is in our genes, then, the affinity for life is now a choice we must make. Compared with earlier cultures, our distinction lies in the fact that technology now allows us to move much further toward total domination of nature than ever before. Serious and well-funded people talk about reweaving the fabric of life on earth through genetic engineering and nanotechnologies, others talk of leaving the earth altogether for space colonies, and still others talk of reshaping human consciousness to fit “virtual reality.” If we are to preserve a world in which biophilia can be expressed and can flourish, we will have to decide to make such a world.


Florida homes use approximately 819 trillion Btu (a heat unit called British thermal unit) of energy every year. As much as 80 trillion Btu of this energy could be saved by effective management of the microclimate that surrounds our homes. Eighty trillion Btu is enough energy to power approximately 529,000 homes in Florida. This energy savings would reduce the strain on individual pocketbooks and the state’s bank account. Florida currently imports from other states approximately 98 percent of the petroleum and 100 percent of the coal burned at the power
plants to make our electricity. This energy savings would reduce the strain on our environment, too, by reducing the quantities of greenhouse gases and pollutants produced when fossil fuels are burned.


This past year, Lake County Nursery (LCN) committed itself to shaping the future of our world through beautification. In September LCN, the Ohio Dept. of Natural Resources, the Cleveland Electric Illuminating Co., and CLEAN-LAND, OHIO cohosted a Beautification Stewards Conference at Lake Erie College. The conference’s theme was “How to Increase Tax Revenues and Lessen Crime by the Proper Planting of Trees and Flowering Plants.” A group of nationally known speakers made presentations to attendees from across the United States. The following will retrace how we became a catalyst for people-plant interactions through beautification in our community in the past decade.


The effects of plants in the workplace on the opinions and attitudes of workers was assessed. Attitudes of employees regarding plants were favorable, and most surveyed agreed that plants in the office made it a more desirable place to work. Office workers were aware of the benefits, such as improving air quality, that plants provide. No behavioral changes in response to the addition of plants to the office environment were demonstrated. There were no significant differences between gender, position in the corporation, and age regarding perceptions of plants in the office environment.


Recently there has been an increased interest in the role of plants in human well-being and in the general public's perception of the value of plants. Knowing the nature and extent of the value of plants to people can affect the way plants are used in public and private landscapes, the amount of money invested in the establishment and maintenance of plants, and the satisfaction derived from the plantings. In conjunction with the annual National Gardening Association consumer market study, a question was asked to determine if observations from previous, limited studies were applicable to a wide range of American households.


In the first issue of HortTechnology, the term “horticulture” was defined as the science and art of growing fruits, vegetables, flowers, or ornamental plants. It was discussed at length within the context of horticulture as a science and technology, with the tomato serving as a case study, to understand the role of horticulture in crop production (Tigchelaar and Foley, 1991). This issue will look at the other side of horticulture-the art of horticulture, and the role it plays in human well-being.

Urban greenspace provides many environmental and social services that contribute to the quality of life in cities. Economic approaches used to estimate value of greenspace services include travel cost, willingness to pay, hedonic pricing, and tree valuation. These methods have limited utility for policy-makers, planners, and managers because the underlying values they estimate only indirectly reflect the flow of multiple benefits and costs. A greenspace accounting approach to partially address this deficiency is described using benefit-cost analysis for a proposed tree-planting project in Tucson, AZ. The approach directly connects vegetation structure with the spatial-temporal flow of functional benefits and costs. Prices are assigned to each cost (i.e. planting, pruning, removal, irrigation) and benefit (i.e. cooling energy savings, interception of particulates, stormwater runoff reduction) through direct estimation and implied valuation of benefits as environmental externalities. The approach can be used to evaluate net economic benefits associated with capital investments in urban forests vs. other investments in the urban infrastructure or traditional environmental control technologies.


Good moods matter. Our moods have significant impacts on many aspects of our day-to-day lives. Moods, for example, affect productivity and health. When in a "good" mood, the cup looks half full, performance on inclusive, creative cognitive tasks is enhanced, self-esteem is high, and the immune system is strongest. When in a "bad" mood the cup looks half empty, performance on inclusive, creative tasks is impaired, self-esteem is low, and immune system resilience may be down (1, 2, 3, 4, 5, 9, 14).

Because moods have tangible and significant consequences, factors that influence moods deserve our attention. In particular, moods impacting office productivity and health have direct and potentially significant implications for urban forestry because they have fiscal implications. The purpose of this paper is to explore the impact on mood of brief visits to an urban park and to suggest potential implications of this impact for urban forestry.


Horticultural therapy programs can benefit from the services of Master Gardeners. Trained through the U.S. Cooperative Extension Service, Master Gardeners are skilled in practical plant sciences and committed to volunteerism. A nationwide survey has determined that 374 Master Gardeners in 21 states are helping to bring structured horticultural activities to individuals in nursing homes, hospitals, rehabilitation centers, prisons, and other special service facilities.


Different conceptual perspectives converge to predict that if individuals are stressed, an encounter with most unthreatening natural environments will have a stress reducing or restorative influence, whereas many urban environments will hamper recuperation. Hypotheses regarding emotional, attentional and physiological aspects of stress reducing influences of nature are derived from a psycho-evolutionary theory. To investigate these hypotheses, 120 subjects first viewed a stressful movie, and then were exposed to color/sound videotapes of one of six different natural and urban settings. Data concerning stress recovery during the environmental
presentations were obtained from self-ratings of affective states and a battery of physiological measures: heart period, muscle tension, skin conductance and pulse transit time, a non-invasive measure that correlates with systolic blood pressure. Findings from the physiological and verbal measures converged to indicate that recovery was faster and more complete when subjects were exposed to natural rather than urban environments. The pattern of physiological findings raised the possibility that responses to nature had a salient parasympathetic nervous system component; however, there was no evidence of pronounced parasympathetic involvement in responses to the urban settings. There were directional differences in cardiac responses to the natural vs urban settings, suggesting that attention/intake was higher during the natural exposures. However, both the stressor film and the nature settings elicited high levels of involuntary or automatic attention, which contradicts the notion that restorative influences of nature stem from involuntary attention or fascination. Findings were consistent with the predictions of the psycho-evolutionary theory that restorative influences of nature involve a shift towards a more positively-toned emotional state, positive changes in physiological activity levels, and that these changes are accompanied by sustained attention/intake. Content differences in terms of natural vs human-made properties appeared decisive in accounting for the differences in recuperation and perceptual intake.


The role of plants in developing a healthy atmosphere is very desirable in the context of deteriorating environment resulting from increased urbanization, industrialization and improper environmental management. This investigation has attempted to screen plants for their ability to improve the design and development of healthy environments around buildings and urban centres of Hyderabad. Ability index values were computed on the basis of canopy area, physiological characters of trees growing in polluted environments, pollution stress and population load. Azadirachta indica, Pithecolobium dulce and Cassia fistula are suggested for plantations around buildings and urban centres for minimizing pollution. Certain susceptible trees like Pongamia glabra and Polyalthia longifolia have been suggested in the diagnosis and investigation of air quality through biological means.


The relation between inhalation of ambient concentrations of ozone and airway reactivity to inhaled allergens may be important in asthma, since both agents can produce inflammatory changes in the airways. Seven asthmatic patients (mean age 40 [SD 13] years), with seasonal symptoms of asthma and positive skin tests for ragweed or grass, took part in a study to investigate whether exposure to low concentrations of ozone potentiates the airway allergic response. The patients were studied during 4 separate weeks in the winter. In each week there were 3 study days: on days 1 and 3 methacholine challenges were carried out; and on day 2 the subject received one of four combined challenges in a single-blind design—air breathing followed by inhalation of allergen diluent (placebo); ozone followed by inhalation of allergen diluent; air followed by allergen; or ozone followed by allergen. The ozone concentration was 0·12 ppm during 1 h of tidal breathing at rest, and allergens were inhaled until the forced expiratory volume in 1 s (FEV$_1$) had fallen by 15% (PC$_{15}$). There were no significant differences in baseline FEV$_1$after exposure to ozone but PC$_{15}$ was significantly reduced when allergen was preceded by ozone inhalation: the mean PC$_{15}$ after air was 0·013 (SD 0·017) mg/ml compared
with 0.0056 (0.0062) mg/ml after ozone (p = 0.042). Thus, low ozone concentrations, similar to those commonly occurring in urban areas, can increase the bronchial responsiveness to allergen in atopic asthmatic subjects. This effect does not seem to be the result of changes in baseline airway function.


To evaluate the Philadelphia Urban Gardening Project, 144 gardeners were selected from a stratified random sample of garden sites throughout the city. Sixty-seven non-gardening controls were selected from the neighborhoods surrounding these sites. Data collected during home or garden interviews included demographic variables, food frequencies and dietary habits, measures of life satisfaction, and neighborhood involvement. The yield of 151 garden plots was assessed and the economic value calculated, based on retail produce prices. Garden sites yielded an average of $160 worth of produce. Gardeners ate 6 out of 14 vegetable categories significantly more frequently, and milk products, citrus, sweet foods and drinks less frequently. Except for citrus, the reduced gardener consumption remained significant when other key variables were controlled. Gardening was positively associated with community involvement and life satisfaction.


We determined the influence of demographic characteristics and floral knowledge (measured as product experience) on the type of floral product purchased. A sample of 401 Pennsylvania residents was divided into fresh flower and flowering plant consumer segments. Results of discriminant analyses showed the two segments were moderately distinct. Purchasers of fresh flowers were younger and more likely employed outside the home than those who purchased flowering plants, but the latter had more blooming plants in their homes than did consumers of fresh flowers. Consumers of flowering plants and of fresh flowers did not differ in their level of floral knowledge or demographic characteristics. Minor differences were found between the two segments that were not substantial enough to justify distinct marketing strategies.


The POMS (Profile of Mood States) was translated into Japanese, and reliability and validity of the Japanese edition was assessed on 354 healthy males aged 20 to 59 years (mean 42). The following findings were obtained. 1) Reliability coefficients (Cronbach’s alpha) were 0.779-0.926 for six mood scales measured by the Japanese edition, i.e. "Depression-Dejection", "Vigor", "Anger-Hostility", "Fatigue", "Tension-Anxiety" and "Confusion." 2) Five factors were extracted by factor analysis for the 65 items of the POMS. "Vigor" and "Anger-Hostility" were solely explained by their respective factors, indicating that these two scales had the highest factorial validity. "Fatigue" had the second highest factorial validity; and "Tension-Anxiety" was third. "Confusion" and "Depression-Dejection" were related to the same one factor. 3) In 33 of the subjects, the scores for mood measured by the POMS were significantly correlated to ratings
by a psychiatrist, indicating that the POMS had good criterion-related validity, except for "Anger-Hostility".


A study of the natural environment, people, and the relationship between them. The authors offer a research-based analysis of the vital psychological role that nature plays. They try to understand how people perceive nature and what kinds of natural environments they prefer.


This paper is a review of the role that urban vegetation plays in regard to human behavior and the perception of urban environments. This includes a review of the functions or benefits of urban vegetation to human use-economic benefits, instrumental or physiological functions and perceptual functions including visual, sensory benefits and symbolic aspects. The second part of the paper reviews the roles of urban vegetation in performing these various functions at different environmental scales and in different contexts. Finally, there is a review of means to assess change in the quality of urban vegetation in the environment as well as using vegetation to improve urban environmental perceptual quality.


Efforts to manage the urban forest may be hampered by inadequate budgets and unsympathetic politicians. Public involvement may reduce these obstacles by cutting operating costs and increasing opportunities for program funding. This paper describes a community forestry planning process that was implemented by citizens with little previous urban forestry experience. Major components of the process are described and illustrated using a case-study example.


The rapidly expanding research record concerning aesthetic, emotional and physiological response to visual landscapes is summarized, with emphasis on aesthetic preferences for views containing trees and other vegetation. The survey is set within a conceptual perspective suggesting that affective responses such as aesthetic preference are central to a landscape observer's thoughts, conscious experience and behavior. Substantial progress has been made in developing models that relate aesthetic responses to specific visual properties of environments. When aesthetic preferences are compared for urban and unspectacular natural views, American and European adult groups evidence a strong tendency to prefer nature. However, liking for urban scenes usually increases when trees and other vegetation are present. Views of nature, compared to most urban scenes lacking natural elements such as trees, appear to have more positive influences on emotional and physiological states. The benefits of visual encounters with vegetation may be greatest for individuals experiencing stress or anxiety. Recent research demonstrates that responses to trees and other vegetation can be linked directly to health, and in turn related to economic benefits of visual quality.

This paper describes how Poisson regressions techniques can be used to examine the relationship between mortality and possible explanatory variables over a series of areas in cases where the number of deaths involved is relatively low. As an example an analysis is carried out on deaths from ischaemic heart disease among young adults in the county boroughs of England and Wales during 1969–1973. The results of the study indicate that the number of deaths was higher for males than females and was positively related to age, the size of the ‘at risk’ population and crowding, but negatively associated with water hardness and the size of the New Commonwealth population. A comparison of the Poisson and log-normal regression models clearly shows that the latter provides an inferior goodness of fit and unreliable results. It is therefore concluded that when the number of deaths is small there are both theoretical and practical advantages in using Poisson regression to analyse mortality data.


This paper both reintroduces the concept of soundscape and provides a case study of it. In the field of environmental aesthetics, the auditory and other nonvisual senses have been largely ignored. Sound studies to date have been primarily noise studies. Soundscape is defined as the overall sonic environment of an area, from a room to a region. The soundscape of the South Fairfield urban neighborhood (Victoria, British Columbia, Canada) was investigated and re- gionalized objectively (by machine recording and analysis and expert listening) and subjectively (by means of a survey of residents based on a community sound list developed from the objective study). Traffic was the most ubiquitous "ground" sound, had the strongest positive relationship with sound pressure level, occa- sionally masked "figure" or keynote sounds, and was usually negatively per- ceived. Natural sounds were most preferred, but informational sounds were also appreciated. Problems of methodology and of congruence between objective and subjective results are outlined, and the qualitative nature of soundscape is em- phasized.


Records on recovery after cholecystectomy of patients in a suburban Pennsylvania hospital between 1972 and 1981 were examined to determine whether assignment to a room with a window view of a natural setting might have restorative influences. Twenty-three surgical patients assigned to rooms with windows looking out on a natural scene had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses' notes, and took fewer potent analgesics than 23 matched patients in similar rooms with windows facing a brick building wall.


The stresses and strains of the urban environment are widely acknowledged. The means for recovery, for recuperation, are perhaps less evident. In particular, the role of environmental configurations in this process is often neglected in the measurement of quality of life. The urban natural environment can provide the setting for such restorative experiences, both physically and conceptually. A theoretical analysis is presented that focuses on the importance of fascination
and coherence as essential processes in the powerful effects of the nature context. When these are both afforded by the setting, many of the benefits available in more remote natural settings may be available in the nearby urban context as well. The bits and pieces of urban nature are significant not only in terms of active recreational encounters. The view of trees and birds, the thought of spring to come, and the plans for summer’s window box can all help in the restorative experience.


Affect is central to conscious experience and behavior in any environment, whether natural or built, crowded or unpopulated. Because virtually no meaningful thoughts, actions, or environmental encounters occur without affect (Ittelson, 1973, p. 16; Izard, 1977; Zajonc, 1980), an affective state is an important indicator of the nature and significance of a person’s ongoing interaction with an environment (Lazarus, Kanner, & Folkman, 1980, p. 190). Research concerning affective and aesthetic response, therefore, may have a central role in advancing our understanding of human interactions with the natural environment and could prove pivotal in the development of comprehensive theories. Further, this area of research relates to important questions in environmental planning and design, including, for instance, visual landscape assessment, the provision of vegetation and parks in cities, and issues of wilderness management and recreation. Concerning the latter, it appears that aesthetic and emotional experiences are the most important benefits realized by many recreationists in the natural environment.


The psychological and active recreation benefits of a residential park near a university were examined. Although the enjoyment of a natural environment was rated highly by respondents, the importance of the park’s recreation and social benefits surpassed those of other more costly facilities.


Subjects viewed sixty color slides of either (1) nature with water, (2) nature dominated by vegetation, or (3) urban environments without water or vegetation. The information rates of the three slide samples were equivalent. Measurements were taken of the effects of the slide presentations on alpha amplitude, heart rate, and emotional states. Results revealed several significant differences as a function of environment, which together indicate that the two categories of nature views had more positive influences on psychophysiological states than the urban scenes. Alpha was significantly higher during the vegetation as opposed to urban slides; similarly, alpha was higher on the average when subjects viewed water rather than urban content. There was also a consistent pattern for nature, especially water, to have more positive influences on emotional states. A salient finding was that water, and to a lesser extent vegetation views, held attention and interest more effectively than the urban scenes. Implications of the findings for theory development in environmental aesthetics are discussed.

A workshop for health professionals and volunteers on Horticulture-as-therapy was conducted at the Royal Botanical Gardens Hamilton, Ontario in 1976 and again in 1977. An evaluation of the 1977 workshop is described. The workshop had five objectives which formed the basis for the evaluation criteria. The 15 participants were asked to complete a questionnaire before and after the six sessions of the workshop. The change between the two questionnaires is presented and discussed. There was a change in the participants' knowledge in four of the five areas evaluated, and on this basis the workshop was judged to be effective in meeting its objectives.


The study tested for the existence of a set of mood factors, replicated the factors, and determined their sensitivity to brief chemotherapy and psychotherapy. 5 moods were hypothesized, identified in 1 study, and replicated in 2 studies involving large groups of psychiatric outpatients. These moods were: Tension, Anger, Depression, Vigor, and Fatigue. 2 additional moods, Friendliness and Confusion, were identified but have not been confirmed. Evidence is presented for the factorial and concurrent validity of the mood factors and for their sensitivity to various treatment effects. A cross-study comparison is made of mood factors in the literature. The mood scales are thus shown to provide a useful method for assessing mood profiles in psychiatric outpatients. (19 ref.)


Neighborhood greenspace improves mental health of urban-dwelling populations, but its putative neurobehavioral benefits in adolescents remain unclear. We conducted a prospective study on urban-dwelling adolescents to examine the association between greenspace in residential neighborhood and aggressive behaviors.

Wilson, M. R. "Green Play & ADHD: A neurobehavioral study on the effects of outdoor play on sustained-attention and hypervigilance regulation."

One in ten U.S. children has been diagnosed with Attention Deficit/Hyperactivity Disorder (ADHD). ADHD children are characterized by their inability to hold sustained-attention and regulate their hypervigilance. Previous studies have shown that exposure to greenspace can reduce ADHD symptoms. This study examined whether 30 minutes of play in a greenspace aided in increasing sustained-attention ability and hypervigilance regulation. Methods: Eleven children ages 7 to 13 years old participated in a neurological test which included a pre and post electroencephalogram scan (EEG) to measure their theta beta ratio (TBR). Children then participated in a continuous performance test (CPT) to measure their behavioral functioning and a perceived restorative scale (PRS-ii) to measure their perceptions of the greenspace. Results: EEG scans were inconclusive, and numerous ideas for further research are reported. CPT results suggest that children who participate in green play have increased sustained-ability when compared to other studies noted in the literature. The PRS-ii results suggested that the children found the greenspace restorative. Conclusions: These findings
suggest that while ADHD children deem green play restorative further evidence of the effects of greenspace on neurological and behavioral functioning is needed.


Water security is becoming an increasing concern for communities in the southwestern United States. Projected decreases in water availability due to climate change combined with increased demands from a rapidly growing population have many concerned about the sustainability of the water supply in coming years. As water availability becomes an increasing concern, greater efficiencies must be made to increase the resilience of the water supply system. This dissertation analyzes the efforts of Tucson, Arizona households to conserve water during the hottest and driest decade in the city's recorded history, between 2000 and 2009. This study utilizes survey data to statistically examine the motivations for household adoption of five conservation methods: rainwater harvesting systems, graywater systems, xeriscaping, high-efficiency devices and volunteerism for public water conservation projects. Following the statistical analysis, interviews were conducted with participants to provide further context for analyzing the results. This mixed method approach reveals that drought alone did little to directly encourage household water conservation over the decade. However, public water conservation initiatives that were launched during the decade made a significant contribution to increasing household water conservation. Households consistently cited a desire for more information about the implications of the current drought status as well as additional information about their individual household's water use.

Callaghan, A. and S. Mallory-Hill "SBE16 Toronto TITLE: BIOPHILIA AND NATURE-BASED FEATURES TO SUPPORT STRESS REDUCTION IN KNOWLEDGE WORKERS."

According to Duxbury and Higgins, 57% of full time office employees reported high levels of stress. Stress impacts the productivity, health and well-being of individuals, and the bottom line of employers. A growing body of research suggests that exposure to nature mitigates stress stimuli and therefore has restorative effects on memory and attention resulting in health, well-being and productivity benefits. This paper summarizes the findings of a 2015 MID thesis study that brings together information drawn from the neurosciences and environmental psychology including: attention restoration theory (ART), psycho-evolutionary theory, biophilic design, survival- advantageous characteristics, current case studies, and experience drawn from design practice. In this review, the authors highlight six key biophilic design strategies for stress reduction in office knowledge workers: locating in or near nature, movement in nature, maximizing daylight and views to nature, use of natural materials, plants and natural scents. These strategies focus particularly on providing workers with the most direct and indirect exposure to nature and, therefore, are likely to have the strongest impact on mitigating the stress response. Each strategy is shown in current applications in existing workplaces, where they are used in combination or independent of each other, depending on site conditions and opportunities.

The substantial importance of cultural benefits as a source of human well-being is increasingly recognised in society-environment interactions. The integration of cultural ecosystem services (CES) into the ecosystem services framework remains a challenge due to the difficulties associated with defining, articulating and measuring CES. We operationalise a novel framework developed by the UK National Ecosystem Assessment that identifies CES as the interactions between environmental spaces (i.e. physical localities or landscapes), and the activities that occur there. We evaluate the benefits of the CES provided by 151 UK marine sites to recreational sea anglers and divers, using subjective well-being indicators. Factor analysis of an online questionnaire with 1220 participants revealed multiple CES benefits that contribute to human wellbeing e.g. including ‘engagement with nature’, ‘place identity’ and ‘therapeutic value’. In addition to regional differences, we also found that biophysical attributes of sites, such as the presence of charismatic species and species diversity, were positively associated with provision of CES benefits. The study provides evidence that could be used to inform designation of protected areas. The indicators used in the study may also be adapted for use across a range of marine and terrestrial spaces for improved integration of CES in environmental decision-making.