Engaging with nature to promote health: bridging research silos to examine the evidence

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SUMMARY

While there is considerable research on environmental contamination and degradation, there is equally credible evidence on the healthful qualities of the environment. Being in and caring for nature can be health promoting for individuals, families, communities, ecosystems and the planet. In this paper, we use a conceptual model for nature-based health promotion and a socio-ecological model of health promotion to guide the scope, organization and critique of relevant literature on nature-based health promotion in several fields and generate recommendations for practice, policy and research. We conclude that participatory community-based research is needed to build local knowledge and create systemic change in practice and policy to support healthy living for people and the planet.

Key words: ecological health; environment and public health; evidence-based; health promotion discourse

INTRODUCTION

Connecting with nature through community walking trails, gardens, parks or other initiatives can be health promoting for individuals, families, communities and shared natural ecosystems. Research suggests that connecting with natural environments can restore cognitive attention (Kaplan, 1983, 1995; Kaplan and Kaplan, 1989; Cimprich and Ronis, 2003), positively influence blood pressure and self-esteem (Pretty et al., 2005), decrease symptoms of attention deficit disorder (Kuo and Taylor, 2004), facilitate recovery from surgery (Ulrich, 1984), increase perceptions of quality of life (Ogunseitan, 2005), strengthen community cohesion (Moore et al., 2006) and motivate pro-environmental behavior (Hartig et al., 2001) among other benefits. Nature-based outdoor therapies and interventions are rooted in a body of scientific evidence that is increasingly being used across health-related fields for the restorative effects on people and their shared natural environments (Burns, 1998; Beringer and Martin, 2003; Lundgren, 2004; Berger and McLeod, 2006). Nature provides conditions that foster human and environmental health from reducing stress and enabling physical activity to growing and consuming local produce.

Despite evidence that being in and caring for the natural environment is health promoting for people and our world, many argue that increasing numbers of citizens across the globe are disconnected from nature (Roszak et al., 1995; Kahn, 1999; Frumkin, 2001; Stilgoe, 2001) as they adopt increasingly consumptive lifestyles in technologically driven societies (Borgmann, 1984; Strong and Higgs, 2000; Marck, 2004).
This collective failure to connect with nature and its health promoting properties is accompanied by a preoccupation with disease and environmental threats (Hansen-Ketchum et al., 2009). It is time to re-examine our relationship with the natural world to identify valuable, underutilized implications for research, practice and policy in health promotion. A critical understanding of nature-based health promotion can help us change the way we use our natural and human resources and transform how we create healthy living conditions for people and the world. In this paper, we use a conceptual model of nature-based health promotion and socio-ecological thinking to critically review and synthesize research across several fields to clarify our health-promoting relationships with the natural world and generate implications for health promotion research, practice and policy.

**Conceptualizing nature-based health promotion**

For purposes of this paper, nature is defined as outdoor natural ecosystems such as trees, water and walking trails, found in everyday local contexts (Maller et al., 2008). Nature-based health promotion is founded in a strengths-based proactive perspective of health promotion that supports activities and conditions to enable health through access to nature (Hansen-Ketchum et al., 2009). Nature-based health promotion merges silos of human health promotion and environmental health and is tied to a complex array of factors, including our sensitivity to nature as well as our access to and on-going engagement with the natural world. Our literature review draws on the central constructs of nature-based health promotion to examine the linkages between health and human engagement with the natural environment.

**Socio-ecological thinking and health promotion**

The levels depicted in McLeroy et al.’s (McLeroy et al., 1988) socio-ecological model for health promotion are used in this paper to demonstrate the linkage between evidence and the multiple socio-political layers of health promotion including (i) the individual and family, (ii) the organization level and (iii) the community level. Within and between each of these levels, nature-based health promotion ‘accounts for the healthful qualities of natural ecosystems and the significance of our relationship to nature’ (Hansen-Ketchum et al., 2009, p. 1530).

Traditionally, health promotion in western society has focused heavily on individual education with the goal of changing health-related behaviors. A socio-ecological approach to health promotion combines behavior change and environmental-based interventions (McLeroy et al., 1988) to create sustainable conditions wherein healthy behaviors can occur regardless of income, education and physical location (Cummins and MacIntyre, 2002). This type of systems thinking is critical to a thorough examination of multi-disciplinary evidence relevant to the multi-level complexities of nature-based health promotion.

**EXAMINING THE EVIDENCE FOR NATURE-BASED HEALTH PROMOTION**

Research evidence in this section lends insight into the constructs of nature-based health promotion at the individual and family, organizational and community levels. Primary source peer-reviewed research reports were found through electronic and manual literature searches across a number of fields including nursing, public health, health promotion, medicine, biological sciences, environmental sciences, recreation and leisure, psychology, social sciences, health geography and urban planning. Key databases included CINAHL, Medline, Web of Science and Academic Search Premier. Search terms included: natural environment, restorative environment, nature, health, well-being, health promotion, spirituality and recreation. Inclusion criteria included: (1) English-language publications, (2) research that focused on the outcomes of engaging with nature in organizational and community contexts; (3) reports on findings with potential implications for human and ecosystem health. We excluded studies if they focused on animal-assisted therapy or horticultural therapy. Although we recognized their related contribution, they were beyond the scope of this paper. Further, studies were excluded if they had unclear implications for community-based health promotion interventions and were published before 1990. Although over 300 articles were reviewed, 15 were selected based on the above criteria to help exemplify the state of
current evidence on engaging with nature across fields and to provide insight into trans-disciplinary knowledge gaps relevant to health promotion. Table 1 provides a summary of the types of research examined for this review.

A description of this relevant literature is described next; for a listing of additional research on the health benefits of connecting with nature, refer to the comprehensive report by Maller et al. (Maller et al., 2008).

### Individual and family levels of nature-based health promotion

A number of studies offered evidence of the individual effects of connecting with nature and the influence on pro-environmental behavior.

Parsons et al. experimental study provided insight into individuals’ physiological response to nature-dominated roadside environments (Parsons et al., 1998). College students \((n = 160)\) were exposed to mild and active stressors and one of four video-simulated scenic drives through outdoor environments (e.g. natural artifact dominated urban and rural settings). Stress recovery, measured by facial muscle activation, blood pressure and electro-dermal activity were recorded before and after exposure. Although not all outcomes were statistically significant, evidence showed that participants experienced quicker recovery from stress with routes through nature compared to artifact-dominated roadside environments. Participants’ narrative accounts of past and present experiences in similar settings would have helped interpret the results.

Cimprich and Ronis used a longitudinal intervention study to examine the effects of connecting with nature on attention and mental fatigue in women diagnosed with breast cancer \((n = 185)\) who were randomly assigned to an intervention or non-intervention group (Cimprich and Ronis, 2003). Members of the intervention group were asked to engage in nature-based activities at home or in the community (e.g. 120 min per week visiting a botanical garden or scenic spot). Analysis revealed a significant effect of the natural restorative intervention on total attention scores for those in the intervention group \((p < 0.001)\). Data about what enabled or challenged engagement with nature would have helped understand ways to strengthen and sustain the intervention.

Wells examined the influence of nature on the cognitive functioning of children in low income urban families (Wells, 2000). Using a longitudinal design, Wells assessed the attentional capacities of seventeen children living in houses devoid of natural restorative resources and then again with these same children after they relocated to houses with better access to nature. Instruments were used to assess naturalness (e.g. view from the windows), housing quality characteristics and mothers’ perceptions of their children’s cognitive function and ability to focus their attention. Results from hierarchal regression analyses suggested that the naturalness of housing was a statistically significant \((p < 0.01)\) predictor of children’s attentional capacity.

Hartig et al. used structural equation modeling to analyze questionnaire data on perceived restorativeness of nature-based places and related pro-environmental behaviors from university students \((n = 488)\) in biology and social ecology (Hartig et al., 2001). Data were used to test a structural equation model and analysis confirmed the hypotheses that pro-environmental behaviors such as recycling were more likely among those who valued the restorative qualities of nature; 23% of the variance in behaviors was predicted by perceptions of restorativeness. Statistically significant correlations were found between fascination with restorative places and pro-environmental behaviors.
Moore et al. studied the effect of involvement in nature conservation groups on human health, well-being and social connectedness (Moore et al., 2006). The sample included 102 people: 51 members of land conservation groups in rural communities and 51 control participants (matched by age and gender) not involved in conservation activities. Questionnaires for health and well-being and community cohesion were used in face–face interviews. Members of conservation groups rated their health higher compared to participants in the control group \((p = 0.028)\) with a statistically significant difference among those aged 45–65 years \((p = 0.017)\). Members also reported an increased sense of belonging \((p = 0.005)\) and a greater willingness to improve their community \((p = 0.010)\) compared to those in the control group. Although these findings provided evidence on the benefits of conservation activities, the sample size was small and it was uncertain whether conservation group members had higher scores prior to their involvement in nature conservation; perhaps healthy or community-minded people were more apt to participate in conservation initiatives.

Despite the limitations, research relevant to the individual and family level in this section suggests that engaging with nature has the potential to foster recovery from stress, improve cognitive attention, influence health and well-being and shape pro-environmental behavior.

**Organizational level**

Studies linked to the organizational level in this review provide evidence for the formal and informal institutional-based factors that support, or not, engagement with nature and the promotion of health.

Wilkes et al. used a quasi-experimental design (time series) to analyze the effect of a special care unit on the agitation behaviors of 23 participants living in a nursing home (Wilkes et al., 2005). The special care unit provided unrestricted access to a garden and outdoor paths among other new features. Agitated behavior, cognitive function and physical activity were measured prior to and after residents moved to the special care unit. Although scores for aggressive behaviors did not significantly change over time, scores for overall agitated behavior and verbal aggression significantly decreased when the difference between pre-move and 3-month scores were analyzed \((p \leq 0.001)\). The study did not provide details on staffing, models of care or other contextual data that could have helped interpret the findings.

In a similar study, Cox et al. (Cox et al., 2004) used mixed methods to examine the effects of two types of multi-sensory environments (e.g. a Snoezelen room with balls and bubbles and a landscaped garden) for older individuals living with dementia in a nursing home. Twenty-four residents were observed over time in each of the environments with their affect rated for signs of pleasure, interest and contentment. Non-parametric statistics were used to compare the rating scores. Six visitors and six caregivers were also interviewed, with qualitative data analyzed for themes. Although the quantitative data did not show any significant difference in affect, the qualitative data indicated that the Snoezelen room and the landscaped garden benefited the well-being of residents and staff but were not readily used due to limited staff available to supervise residents in these settings.

Ogunseitan used participant data from those working and living in a university setting \((n = 379)\) to test the associations between preferences for ecosystem components and restorative environments and quality of life (Ogunseitan, 2005). Structural equation modeling was used to test the fit of a model linking topophilia (bond between people and their environment) and quality of life. Among other correlations from model indices, ecodiversity (e.g. trees, pond, rocks) was significantly correlated with overall quality of life measures \((r = 0.123; p < 0.005)\). Qualitative accounts of participants’ experiences would have strengthened the interpretation of the statistical associations to foster a better understanding of contextual influences.

With implications for schools, day cares and home environments, Taylor et al. (Taylor et al., 2001) and Kuo and Taylor (Kuo and Taylor, 2004) research suggested that children with attention deficit disorder benefited from engagement with nature. When children in these studies played in nature, their symptoms of attention deficit disorder decreased. For instance, Kuo and Taylor (Kuo and Taylor, 2004) used a \(2 \times 2\) repeated measures ANOVA (physical context \(\times\) social context) to analyze data from 452 surveys in a non-probability sample of parents across the USA. They found that symptoms of attention deficit hyperactivity disorder were significantly reduced when
children engaged in activities in outdoor nature-based settings \( (F_{1375} = 32.1, p < 0.0001) \) compared to when they participated in the same activities in non-green indoor built settings \( (F_{1386} = 21.9, p < 0.0001) \).

Findings relevant to the organizational level of health promotion in this review suggest that eco-diverse living and working conditions can influence perceptions of well-being and quality of life and can decrease symptoms of attention deficit disorder.

**Community conditions and context**

Studies examined under the community level of health promotion focus on the processes between organizations that support health and engagement with nature.

Pretty et al.’s findings indicated that exposure to nature during physical activity positively affected blood pressure and self-esteem (Pretty et al., 2005). The researchers exposed five groups of 20 participants to simulated outdoor scenes while exercising on tread mills. The scenes included previously categorized photographs of rural pleasant, rural unpleasant, urban pleasant and urban unpleasant environments. One group acted as a control group and viewed a blank screen. All participants adhered to the same exercise protocol. Blood pressure, self-esteem and mood were measured before and after viewing the scenes and analyzed using a one-way ANOVA test. Rural pleasant scenes (e.g. trees and vegetation) had the greatest effect on systolic blood pressure compared to urban unpleasant \( (p < 0.001) \) and rural unpleasant groups \( (p < 0.05) \). Rural pleasant scenes also had greater influence on self-esteem than exercise alone with 80% of participants in this category showing an increase in self-esteem. Rural unpleasant scenes and degradation of the country side had the least effect. Narrative accounts from participants would have provided a deeper understanding of the relationship of the scenes to self-esteem and mood. For instance, participants’ past experiences in rural and urban settings could have influenced responses to simulated scenes.

Kuo surveyed those living in poverty in an urban center to understand the influence of the natural environment on those whose high-rise housing units have traditionally provided very little access to gardens and other vegetation (Kuo, 2001). Residents \( (n = 145) \) were randomly chosen from architecturally identical residential buildings. Survey instruments were used to measure residents’ attentional capacity and life functioning and photographs were used to assess nearby nature. Statistical analysis (e.g. mean, SD, \( t \)-statistics) revealed that residents who lived in housing complexes with surrounding vegetation reported their needs and problems as less severe and more manageable compared to those living in buildings without nearby nature, even when controlling for age, income, employment and other extraneous variables \( (p = 0.01) \). The findings did not provide insight into how residents engaged with nature or their qualitative accounts of the significance of nearby nature.

Evidence from Kuo and Sullivan’s (Kuo and Sullivan, 2001) study suggested that non-green residential settings in urban areas were associated with higher rates of crime compared to more ‘green’ areas with surrounding vegetation. Photographs were used to assess the density of trees and other vegetation around 98 select residential buildings. The relationship between vegetation and police crime indices were then examined. Fisher analyses were used to compare low versus medium vegetation in relation to crime with a significant difference reported \( (p < 0.05) \). Buildings with higher levels of vegetation had 52% fewer crimes than those with low-level vegetation. Multiple regression techniques identified a negative relationship between crime and vegetation even when other confounding variables (such as building height, number of apartments and vacancies) were controlled. Data from this study countered more traditional notions that vegetation contributes to crime in urban centers.

Kuo and Sullivan suggested that carefully managing vegetation (e.g. high canopied trees, low shrubs) can prevent crime while providing recreational and social opportunities important to health and well-being (Kuo and Sullivan, 2001).

Kingsley and Townsend examined the social connections of those involved in an urban community garden project (Kingsley and Townsend, 2006). The researchers used semi-structured interviews to analyze the experiences of 12 participants. Although the sample lacked diversity in terms of socio-economic status, the evidence indicated that involvement in urban community gardening fostered social cohesion, benefiting the health and well-being of community members and their shared environment.
Findings reviewed in this section for relevance at the community level provide valuable insight into the linkages between community-based access to nature and human well-being, life functioning, crime, pro-environmental behavior and social cohesion.

Although research to-date provides ample evidence to support our call for greater attention to the reciprocal health promoting connections between people and surrounding natural ecosystems, there are limitations in this body of literature. It was evident from our review that in many cases, the interpretation and reporting of findings could have been strengthened by narrative accounts from participants themselves, with greater detail on their home, institutional and community contexts. Furthermore, few studies used a participatory research approach that brought together community citizens, practitioners and policy makers from various sectors to examine the socio-ecological features and strategies needed for health promotion.

**IMPLICATIONS FOR RESEARCH, PRACTICE AND POLICY**

Our appraisal of the literature suggests that there are specific knowledge gaps in the literature related to (1) individual and everyday experiences of engaging with nature in local settings, particularly in rural communities; (2) citizens’ perceptions of the barriers and facilitators to engaging with nature in their local settings; (3) socio-political and environmental conditions that contribute to disparity in ability to engage with nature, particularly among disadvantaged groups; (4) perspectives of health practitioners and policy-makers on nature-based health promotion; (5) correlations between human and environmental health in relation to nature-based health promotion; (6) socio-ecological complexities of engaging with nature in the promotion of health; (7) nature-based interventions in community contexts; and (8) nature-based interventions used in conjunction with other health promotion and/or ecological initiatives (e.g. active living programs, creation of green spaces).

Despite these gaps, research findings are helping to map the health-promoting connections between humans and nature and encourage us to begin to tease out ecologically sound ways of enabling health through research, practice and policy. For instance, Cimprich and Ronis’ (Cimprich and Ronis, 2003) study on attention restoration for breast cancer patients has implications for health education in connecting patients with nature for the recovery from breast cancer. Further to this, there are implications that spill over into organizational and community levels where networking with members of the health care team and partnering with representatives from urban planning, recreation, the local botanical garden and department of transportation, for instance, can enable access and equity of resources for engagement with nature in consideration of disparities in patients’ incomes, location of residence and support network among others.

At the organizational and community level, findings from studies by Taylor et al. (Taylor et al., 2001), and Kuo and Taylor (Kuo and Taylor, 2004) suggest that children’s cognitive functioning can be improved with active play in nature, with critical implications for collaborations among families, public health professionals, urban planning, day care centers, schools and parks and recreation. Local collaborative knowledge building and research on nature-based health promotion is needed to identify ecologically sound strategies for this to happen; playgrounds with ample vegetation and school vegetable gardens are examples of this. Still other findings suggest that trees and vegetation around family residential buildings can negate crime (Kuo and Sullivan, 2001), improve life functioning (Kuo and Sullivan, 2001), and that being in nature can promote recovery from stress (Parsons et al., 1998), encourage development of ecological sensibilities and pro-environmental behavior (Hartig et al., 2001), and provide synergistic effects when combined with physical activity (Pretty et al., 2005). Enabling these types of health outcomes entails what Edwards et al. (Edwards et al., 2007), Marck et al. (Marck et al., 2006) and Dooris (Dooris, 2004, 2006) call whole system change.

Whole system change requires ‘an integrated and effective contribution to economic, environmental and social well-being, not only at a local level but regionally, nationally and globally’ (Dooris, 2004, p. 59). It means bridging traditional silos and bringing people together to develop ecological sensibilities and recreate socio-ecological systems that are responsive to the reciprocal connections between health and nature at the individual, organizational and community level (Hansen-Ketchum et al., 2009).
Capra (Capra, 2005) suggests that this type of ecological thinking requires that we move from thinking of ‘parts to the whole’, from ‘objects to relationships’, from ‘objective knowledge to contextual knowledge’, from ‘quantity to quality’ from ‘structure to process’, and ‘from content to patterns’ (p. 19–20). Initiatives of Fritjof Capra’s Centre for Ecoliteracy (see http://www.ecoliteracy.org/) can further exemplify these shifts. The center’s citizen-based and multi-sectoral work in practice and policy is modeled on the principles of ecology and aimed at education for sustainable living. Exemplar initiatives include project-based learning to improve local environmental quality, develop school gardens and enable food security. These initiatives target students, parents, teachers, researchers, practitioners and decision-makers from multiple sectors within the community and beyond.

Health promotion is a multi-level multi-intervention process (Edwards et al., 2004) that involves on-going participation in knowledge building and action among community citizens, organizations, practitioners and decision-makers across sectors, often outside of traditional health services sectors (Dooris, 2004). It is a process that draws on the notion that health is influenced by the quality of interrelationships between and among humans and the environment (Hansen-Ketchum et al., 2009). In tandem with a multitude of related factors influencing health such as social networks, culture, income and coping strategies (Health Canada/Sante Canada, 2002), our ties to the natural environment are entangled in our everyday decisions and practices, as supported (or not) by our collaborations with others, our community environments and accessible resources.

If we look hard enough, we each have everyday opportunities in research, practice and policy, to use and expand on evidence from studies such as those described previously. We need to draw on and share our ecological knowledge and strengthen our ability to simultaneously nurture health and nature. Ecological knowledge is far too complex to be abandoned to individual pursuit alone; it requires group experiences and memories commensurate with collectively understanding and nurturing the web of life (Goleman, 2009). We need to think long term and understand that sustainable health promotion requires research, practice and policies that connect diverse sectors and work together for systemic change.

CONCLUSIONS

Capra suggests that a sustainable human community ‘must be designed in such a manner that its ways of life, technologies, and social institutions honor, support, and cooperate with nature’s inherent ability to sustain life’ (Capra, 2005, p. xiii). But we do not yet know how health practitioners and decision-makers from diverse sectors use evidence on the health benefits of engaging with nature to inform their work. Do we each, from diverse sectors, consider the need for individuals and families to connect with nature as critical to their health and well-being? Furthermore, how do citizens care for and engage with nature in their rural or urban local contexts? We need to explore these questions and collectively mobilize social, political and physical resources for system level change including policy and funding support for participatory community-based studies. Nature-based health promotion is dependent on the connections among citizens, practitioners, researchers and decision-makers in sharing knowledge and creating ecologically sound policies, infrastructure, resources and community and ecosystem conditions that support healthy living for people and the world.

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