

Nature Affinity and the Human Conditions

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Abstract

Human beings have a natural affinity for Nature. Research indicates Nature has positive effects on our physical and psychological well-being, changes our body chemistry and makes humans healthier and happier, but physical and psychological illnesses are increasing with loss of Nature. Nature is an integral part of our physiological, psychological, genetic, and emotional make-up. Human health and the healing of physical and mental ailments improve with contact with animals, plants and the environment and is the reason for animal and horticultural therapy and integrating the environment in architecture. Professionals in all disciplines need to incorporate Nature into the human endeavour.

Keywords: Nature, environment, human health, biophilia, nature-deficit, conservation.

Introduction

For 99% of our existence the human condition has been rooted in the natural world (Wilson 1984, 1993). Our co-evolution with the rest of Nature has been an essential influence on our physiological, emotional, and psychological development and is considered embedded in the human genome (Lumsden and Wilson 1981, 1985). The instinctive bond and deep affiliation humans have with Nature is not just an aesthetic; it is rooted in our biology (Kellert 1993, Wilson 1993, Ulrich 1993, Lumsden and Wilson 1981). It is possible, therefore, that destruction of and disconnecting from the environment can lead to a type of 'nature-deficit disorder' (Louv

2005) and the deprivation of human health and well-being. Yet, the vast and diverse qualities of Nature provide humans and society with the essential means to heal, rejuvenate, and function on higher and healthier levels.

The evolution of nature-affinity

Co-evolution

The significant majority of human history has involved an intimate co-existence and evolution with Nature. Our brains, bodies, emotions, and cultures evolved in a biocentric world (Lumsden and Wilson 1981, Wilson 1984). Although we have a tendency to consider human history only since the end of the most recent Ice Age and advent of agriculture and permanent villages 8,000–10,000 years ago, this latest period constitutes less than 1% of human evolution. The evolution of what is today *Homo sapiens* actually occurred over millions of years and involved critical cognitive and physiological development intricately shaped by Nature (Wilson 1993). Mechanized society comprises less than 0.01% of human development and is likely a negligible influence on our evolution. Indeed, over the course of 99% of human history, the predominant influence on our development and why we are who we are today is Nature (Wilson 1984).

For example, a particular genotype may have made some individuals more prone to a certain positive behavioral response to an environmental cue and that response was more likely to enhance the individual's survival (Wilson 1993). Consequently, that genotype, which was linked to certain environmental characteristics, was passed on to successive generations and spread through the population (Lumsden and Wilson 1981, Wilson 1993). In other words, those individuals who were most able to understand and benefit from the intricacies of certain environmental attributes were most able to adapt and survive. Consequently, selective advantages that co-evolved with these

environmental attributes were passed on to successive generations over millions of years. These traits remain embedded in us today and are the basis for our affinity to certain characteristics in Nature (Wilson 1984).

The evolution of traits and their disappearance in species is a long and extensive process, but humans are a young species. Anatomically similar ancestors appear in the fossil record only 130,000–200,000 years ago (Alemseged et al. 2002) and modern humans appear only about 10,000–14,000 years ago, both of which are too evolutionarily recent for the disappearance of traits that evolved over millions of years (Stringer 2001). In fact, distinctive characteristics in modern humans may have still been evolving as recently as 10,000 years ago (Stringer 2001). Such traits have remained essential for human survival into recent pre-industrial society and certainly in subsistence-based cultures today. Essentially, the fundamental traits shaped by Nature over 99% of our evolutionary development and that ensured our survival remain in our genetic, physical, and emotional composition (Lumsden and Wilson 1981, 1985) and continue to dictate our affinity for Nature today (Wilson 1984, Ulrich 1993, Heerwagen and Orians 1993, Sagan and Margulis 1993, Rolston 1993).

Habitat selection and natural landscapes

There is increasing evidence indicating that, over the course of our evolution, humans were most attracted to habitat attributes favoring survival, i.e. those features associated with critical necessities of food, water, warmth, and security—particularly visual openness, low even vegetation, escape cover, and a lower probability of close-encounter threats (Ulrich 1993). Savanna habitats with scattered trees and water sources provided these necessities in greater abundance than most other habitats over human evolution. Paleontological evidence supports this premise and indicates that a significant portion of human evolution occurred in savannas. Our co-evolutionary affinity for open park

or savanna-like landscapes suggests that evolution may have selected for certain habitat preferences in our ancestors, which has been passed on to modern humans who may have a genetic predisposition for such settings (Orians 1980, 1986).

Recent psychological research supports this hypothesis. Studies across diverse groups in Asia, North America, Africa, and Europe reveal that people consistently favor park or savanna-like landscapes or natural settings with similar attributes in urban environments, such as city parks (Ulrich 1977, 1993, Yi 1992), particularly with water features (Shafer et al. 1969, Bernáldez et al. 1989, Chokor and Mene 1992, Ulrich 1993). A key result of this research shows a strong tendency for all groups to favor natural scenes over urban settings—especially those urban environments lacking natural features like vegetation or water—despite apparent cultural, ethnic, political, or socio-economic differences among groups.

Flora

Plants have been central in human evolution, providing food, medicine, shelter, security, refuge, tools, vantage points, and weapons. Heerwagen and Orians (1993) note that trees in particular have played a fundamental role in the evolutionary development of humans. Psychological research shows that people of varying ethnic and cultural backgrounds today consistently choose trees with specific characteristics, particularly low trunks with branching beginning at points lower than half the tree height, broad umbrella-like canopies, moderate to high layered canopies, small leaves, high canopy width:tree height ratio, and flowers (Orians 1980, Heerwagen and Orians 1993)—all of which provided humans with critical necessities and security over the course of our evolution. These data are highly consistent with tree character of savanna ecosystems where humans predominantly evolved and many cultures today prune and genetically modify trees to select for these traits.

Flowering trees are especially attractive for people today. It is hypothesized this is likely because flowering trees indicated an important food resource throughout human evolution (Heerwagen and Orians 1993). Brightly coloured leaves are also highly attractive for similar reasons. In tropical and savanna ecosystems, brightly coloured leaves are generally indicative of a) young leaves, which have higher nutrient content, b) flushing of new leaves at the beginning of the rainy or dry seasons, which are times of increasing resources depending on the region and system, c) signaling of forthcoming flowers and fruits because many tree species flower en masse to attract pollinators at times when the flowers are at their peak of resource availability, and d) markers for locating particular species during resource-rich times as opposed to the rest of the year when most tropical plants have uniformly green leaves (Heerwagen and Orians 1993).

Studies show that people today have a deeper need to be among plants in general than just for their aesthetic beauty. An important benefit plants have provided throughout our evolutionary development is refuge, particularly in the forms of escape, security, and restorative healing (Ulrich 1993, Heerwagen and Orians 1993, Shipman 1986, Frumkin 2001). Such attributes appear to transcend the aesthetic value of plants and remain important in human behavior and psychology today. The refugia and restorative healing that plants provide leads to important physiological benefits, including lower levels of circulating stress hormones, reduced heart rates and blood pressure, increased gains in cognitive performance, and a stronger sense of calm (Ulrich 1993). Such physical and cognitive healing was critical for human performance and survival. In addition, a likely attraction to plants is the fresh oxygen they provide.

Frumkin (2001) notes that plants have also played an important role in sustaining and healing mental health. Horticultural therapy was developed over many centuries and has been used throughout different cultures as a form of both physical and mental health

treatment. Today, horticultural therapy is used in hospitals, geriatric programs, disability programs, community-based programs, prisons, and special education.

Fauna

Animals have played particularly important roles in human evolution and development. Hunter-gather groups followed and learned about group hunting strategy from social predators like lions, wolves, African wild dogs, coyotes, and others. Some of these same predators and others, such as snakes, spiders, tigers, bears, etc. have also been instrumental in influencing the development of “biophobias” in human evolution—traits that continue to today (Wilson 1984, Ulrich 1993).

The theory that certain fears and phobic responses are evolutionarily linked to the environment was likely first postulated by Darwin (1877). Clinical studies provide considerable evidence that phobic responses found in people today are linked to strongly conditioned fears of particular environmental cues or objects, such as predators (including hostile humans), that have threatened humans throughout evolution (McNally 1987). Such strong fears and aversive responses would certainly provide an adaptive evolutionary advantage for survival and, thus, be passed on to successive generations. Indeed, some are so rooted in our biological and psychological make-up that such original cues (e.g. fear of attack by lions) are not the actual cause of a person’s specific fear today, but continue to influence instinctive emotive reactions to non-threatening situations.

Yet, “biophilic” (Wilson 1984) responses to animals are as strong or stronger than associated phobias. Despite obvious threats, humans co-evolved with, learned and benefitted from, and co-adapted to the environment with species that have exceptional physical powers or skills. Such learning was an adaptive advantage for early humans and our co-evolution likely developed into

reverence for some species highly able to adapt to harsh environmental conditions. Unusually powerful or extraordinary species, such as tigers, bears, jaguars, wolves, whales, and others have been and still are deified and revered. Humans have held a particular kinship and fascination with these and a variety of other species throughout our development; most notably with those that are either closest to us in behavior and co-evolution or those that appear to have mythical powers and skills. The vast majority are typically mammals, with which we have continued strong kinship today.

It is clear that humans developed strong bonds with animals and our connection carried through human evolution and is deeply rooted in our current kinship with particular species. Archeological evidence indicates that pets were present among pre-agricultural people long before domestication (Katcher and Wilkins 1993). Highly social species like wolves, which have cooperative behaviors, complex cognitive skills, and social organization similar to humans, have been the focus of especially strong kinship by humans. Indeed, it is likely that early and even recent human bands followed, learned and scavenged from, and eventually hunted along-side wolves, which likely scavenged animal remains left by humans. This led to a mutually beneficial association, domestication, interdependent security, companionship, and selective breeding for dogs as pets. Our connection with animals is evolutionarily significant and is likely allied with important therapeutic benefits noted below.

Nature's medicine

A significant majority of medicines and/or their derivatives originate from the natural world. A growing body of data also links human health and wellbeing to both direct and indirect contact with Nature. In fact, research shows that even just viewing healthy natural landscapes, aquariums, plants, gardens, trees, or animals in photos or distantly from windows without direct

contact elicits remarkable physiological, psychological, and behavioral health benefits (Frumkin 2001, Ulrich 1993, Heerwagen and Orians 1993, Katcher and Wilkins 1993). Data also demonstrate that the excessive destruction and loss of Nature not only impact its capacity to provide essential medicines and life-supporting services, but also our ability to benefit from it on various physiological and psychological levels.

Physiological

Ulrich et al. (1991) conducted a study examining the stress-reducing effects of subjects' exposure to video recordings of natural landscapes versus urban settings after first watching a stressful film. People viewing the natural scenes had lower blood pressure, higher reductions in muscle tension, and lower levels of skin conductance fluctuations. There were also directionally associated cardiac responses indicating that continuous intake and attention were higher during exposure to the natural scenes (Ulrich 1993). In addition, subjects reported higher levels of positive feelings and lower levels of anger/aggression and fear. Further, recovery rates in all physiological measures occurred within only 4-6 minutes after viewing natural settings, as opposed to the urban settings that required significantly more time. The study concluded that human responses to natural settings may have significant correlations with the parasympathetic nervous system whereas there were no distinct responses when exposed to urban settings.

Studies in hospitals and prisons, where there are greater opportunities for controlling confounding variables, found notable differences in recovery times for sick and/or postoperative patients exposed to natural scenes. Ulrich (1984) examined recovery data with controls for sex, age, weight, tobacco use, and medical histories. Patient rooms were assigned randomly by the hospital with either window exposure to a small stand of deciduous trees or a brown brick wall. Records of all

cholecystectomy patients over a 10-year period, restricted to the summer months when the trees were in foliage, showed that patients with tree views had statistically significant shorter hospitalizations, lower post-surgical complications, and lower needs for pain medications. Ulrich and Lundén (1990, as cited in Ulrich 1993) also found that open-heart surgery patients exposed to pictures of natural water settings experienced notably lower postoperative anxiety than control groups exposed to abstract pictures or enclosed forest scenes.

Animal therapy has also been demonstrated to induce significant health benefits. Anderson et al. (1992) conducted a study of 6,000 patients who were divided into pet owners and non-pet owners. Pet owners had statistically significant lower systolic blood pressure, triglycerides, and cholesterol than non-pet owners. In a different study of heart attack survivors, patients who owned dogs had a 6-fold higher survival success than non-dog owners (Friedmann and Thomas 1995). Katcher et al. (1983) showed that both hypertensive and normal subjects watching an aquarium had significant decreases in blood pressure below resting levels. Patients with chronic organic brain damage and autistic children with congenital brain dysfunction showed increased speech, social responsiveness, positive emotion, and focused attention when exposed to animals (Katcher and Wilkens 1993).

In a study of patients with mild to moderate depression, patients were required to discontinue antidepressant drugs and psychotherapy at least four weeks prior to being exposed to dolphins in a natural coral reef setting (Antonioli and Reveley 2005). In the experimental group, participants were able to swim, touch, play, and have spontaneous interactions with dolphins, whereas control group participants had the same water activities in the same setting without dolphins. Results showed that the mean severity of depressive symptoms was significantly reduced in the treatment group with physical exposure to dolphins than in the control group without exposure. Katcher and Wilkens (1992, as

cited in Katcher and Wilkins 1993) conducted a study of ADHD children receiving education structured around animal contact versus ADHD children in an outdoor setting without animal contact. Physiologically, results indicated that consistent contact with animals resulted in a highly redundant positive correlation in the central nervous system.

Psychological

There is widespread evidence supporting the positive correlation between physical and mental health. This correlation can include positive physiological responses to Nature, such as lower blood pressure and heart rates, reduced taxing on the sympathetic nervous system, faster and more efficacious recuperative processes, higher survival rates, diminished anxiety, decreased need for medications, etc. Any or all of these effects can lead to both direct and indirect emotional and psychological benefits and feedback to physical health, such as reduced psychological stress, which can facilitate and/or directly correlate with enhanced physical health. Indeed, our emotional attachment to Nature is an integral part of the human endeavor (Wilson 1984, Heerwagen and Orians 1993).

Frumkin (2001), Louv (2005), Nash (1982) and others review how wilderness experiences may be particularly therapeutic, especially for psychiatric patients, including emotionally and behaviorally disturbed children and adolescents; individuals with ADD and ADHD; abuse, rape and incest survivors; the bereaved; cancer patients; suffers of post-traumatic stress (PTSD); and addiction disorders, to mention a few. According to Louv (2005) almost 8 million children in the USA suffer from mental disorders and ADHD is one of the most prevalent. This syndrome is characterized by aggressive or anti-social behavior, attention deficit, restlessness and hyperactivity, and reduced or limited achievement. Evidence indicates that at least some of these symptoms are caused by lack of contact with Nature or high-

sensitivity to urban settings and can be addressed by appropriate exposure to Nature in some form, i.e. contact with animals, natural landscapes, wilderness, etc. Indeed, studies by Faber-Taylor et al. (2001) demonstrated that simple exposure to green outdoor spaces help relieve ADD symptoms. Katcher and Wilkens (1992) showed a consistent positive correlation between exposure to and handling of animals and significant decreases in ADHD symptoms.

The restorative influences of Nature often exceed aesthetic values and induce strong positive shifts in emotional states (Ulrich 1993). Ulrich (1981) demonstrated that consistent exposure to natural landscapes fostered greater psychological restoration, higher reductions in negative emotions like fear and aggression, and more positively-toned emotional states compared to individuals consistently exposed to urban environments. Concurrent tests of electrocortical brain activity in the alpha frequency range of these subjects indicated that they were more wakefully relaxed when exposed to natural landscapes. Psychological stress-recovery studies reveal that recuperation was faster and more extensive when subjects were exposed to films of natural settings, particularly park-like grassy settings with a prominent water feature (Ulrich et al. 1991), similar to savanna landscapes (Ulrich 1993). Clinical tests of acutely-stressed dental patients showed statistically significant reductions in anxiety and discomfort as well as higher compliance during surgical procedures after first being exposed to aquariums and pictures of spatially open natural landscapes or serene water scenes versus no exposure or views of outdoor action scenes, e.g. wind surfing (Ulrich 1993).

Natural settings have also been shown to foster higher-order cognitive functioning. Evidence indicates this is evolutionarily based in our need for recuperative healing in natural landscapes. Essentially, reduced stress, anxiety, and mental or physical fatigue help increase higher-order cognition, which provided more resourceful and creative skills and thinking and, thus, adaptive advantages to survive and reproduce.

The healing spirit of wilderness

“The lessons we learn from the wild become the etiquette of freedom” (Snyder 1992). Psychologists led by Sigmund Freud supported the theory that humans are less repressed when exposed to or experiencing an “uncivilized” wilderness condition, leading to greater happiness (Nash 1982) and sense of freedom. As noted above, research shows that exposure to Nature can significantly reduce negative psychological issues and improve an individual’s overall health and emotional well-being. Data support the hypothesis that the restorative influence of Nature on emotional health is manifest in stronger shifts in positive emotional responses, reduction of anxiety and stress, higher cognitive functioning, and greater levels of peace (Ulrich 1993). Ultimately, unaltered wilderness holds the greatest potential to heal and foster a sense of peace and happiness.

Pristine Nature—‘wilderness’—is an essential element of the human condition. The significant role wilderness has played in 99% of human evolution secures Nature’s affect in human development, which has been reliant on sound mental-emotional-cognitive functioning. Technology is incapable of replacing Nature’s services and we remain wholly dependent on a healthy environment for our existence. Nature not only heals our bodies, but it has also been a fundamental element in fostering positive human emotion throughout our evolution. The latter is necessary for our survival. Exposure to secure wilderness conditions has been essential for psychological restoration to reduce anxiety and stress and to foster a sense of security and peace, which have been critical for mental health and higher cognitive functioning to survive.

“Spirit” is a natural part of an individual and the human experience. While it is most often identified with mind and consciousness, it is also a product of the brain and, thus, is affected by both physical and psychological health. In the context of this

discussion, it may also be evolutionarily linked to the environment. Pristine Nature provides a vital function in sustaining and healing positive mental health, which is linked to healthy organic chemical and biological processes. Mental health is also a key element in fostering a strong spirit—a combination of resilience, patience, optimism, and associated qualities that give the individual strength to survive and prosper. Given that restorative properties of Nature have been critical for our survival (Ulrich 1993) and that mental health has been essential, humans likely required and sought specific qualities in Nature to heal and strengthen their spirit. Current research indicates that even integrating natural forms into architecture can generate spiritual inspiration (Joye 2007).

It is suggested that the mythic qualities humans ascribe to Nature were developed to foster a strong mental-emotional condition (Wilson 1996). Such qualities were likely used to give individuals the mental strength and fortitude to not only survive, but ascend to higher ranks in their group and society. Over time, humans have tended to seek strength from the mythical qualities in wilderness as a means to imbue spiritual strength. For many cultures, the religious-type of reverence held for pristine Nature is significant and, aside from subsistence, indigenous cultures today continue to seek wilderness for spiritual strength and reasons more than any others (Snyder 1991).

A strong and healthy spirit has also been essential for human advancement beyond the individual. Throughout our evolution individual survival and prosperity have depended on the health and capacity of his/her group and community. In fact, most indigenous cultures today seek spiritual strength in wilderness for the sake of their community more than the individual (Snyder 1991). Indeed, one of the deepest human needs for wilderness is perhaps seeking humility in respect for community (Nash 1982).

The happiness quotient

Nature is critical for human happiness. Connecting with the “essence” of Nature is restorative and humans are more productive and healthy – inspired – when in contact with Nature. The stresses of urbanization are widely acknowledged (Kaplin 1984) and the incidents of physical and psychological illnesses are increasing with our detachment from and destruction of Nature (Louv 2005, Frumkin 2001). While environmental destruction creates significant socio-economic problems, perhaps the most serious deficit in the modern world is not economic; rather, it is environmental. Given that the stresses and extraordinary pace of the modern world are particularly abnormal in an evolutionary context, it is likely that humans have not had sufficient time to evolve and adapt in the absence of Nature. Human development has been critically reliant on Nature and modern humans are too young to have lost this evolutionarily based dependency. Joye (2007) notes that our attraction to natural forms and particular healthy landscape configurations can reduce stress and have positive effects on human function. However, our contact with these elements is reduced in urban life. Our detachment from and destruction of Nature can have notable adverse effects on our psychological and physiological well-being. Thus, it is likely that modern humans are experiencing nature deficit (Louv 2005). Nature not only provides essential medicine for the body and mind, it imbues the individual with emotional and spiritual health. Being in Nature changes our body chemistry and sense of well-being, makes us healthier and, in effect, Nature makes us more whole and our entire being happier.

Nature completes the human condition. It is true that certain harsh aspects of Nature can compromise our health, indeed our lives, particularly if one does not have the proper skills or adaptations. It is equally true that some portions of the environment are difficult, even terrifying, and create fear, anxiety, and stress. Yet, much of this today is the result of removing ourselves from the core foundation that makes us whole as well as from the excessive loss of Nature around us through its destruction. Experiencing the

positive aspects of Nature that correlate with our success as a species nurtures our body and mind. And, a healthy physical and mental condition invariably leads to a more restful, peaceful, and healthy spirit. In effect, a healthy mind and body through positive experiences with Nature can foster greater happiness.

Considering that happiness is a state of mind, it may be true that inner peace and happiness stem from internal emotive processes, such as compassion and contentment. In the context of the current argument, however, it is also true that such emotions are products of a relaxed, healthy, and secure mind and body fostered by positive features found in the natural world. Nature is an important part of our composition. Achieving happiness, therefore, can be facilitated by greater contact with specific aspects of Nature, even in an urban setting. In effect, our *happiness quotient* can be raised—substantially in some cases—by reincorporating various positive features of Nature into our lives.

For example, nature-based architecture provides an opportunity for specific structural elements to correspond with a particular set of innate human affiliations with Nature. Joye (2007) notes “...architectural imitation of natural elements and habitats that promoted fitness (e.g., vegetative structures) can lead to the autonomous and quick onset of positive affective reactions, which can lead to positively toned feelings and stress reduction...such imitations can be realized according to different levels of abstraction, ranging from literal imitations to the application of more abstract geometric features of natural objects (e.g., fractal geometry) and structural features of ancestral habitats. Applying fractal geometry to architecture could be a particularly successful creative strategy, because it is not directly restricted by stylistic conventions and thus does not exclude the expression of cultural or local tastes.”

In the absence of implementing sweeping architectural changes across the modern world, research now shows that increasing our

contact with Nature in various simple and inexpensive forms can facilitate a path toward deeper happiness. This can include incorporating more plants, gardens, or green spaces around and in our homes and offices, increasing physical contact with animals, and spending more time outdoors in fresh air, among trees and plants, and in open green spaces with scattered trees and/or near relatively calm water bodies. City planners could also reclaim and incorporate more green spaces at relatively low cost. In general, the costs of not improving citizen's physical and mental health via such simple steps create significant deficits in human well-being and far exceeds the financial or perceived political expense.

Ultimately, pristine Nature is an essential element of the human condition and it is in the best interests of our health, survival, security, and advancement to protect Nature and incorporate it into our daily lives. In effect, we are healthier, happier and society functions on a higher level when our environment is healthy and we are able to integrate it in our daily lives. Architects, urban planners, educators, psychologists, politicians, economists, and professionals in other disciplines need to recognize both the physical and psychological health benefits of Nature and, subsequently, to society, and incorporate the natural environment into the human endeavor. In so doing, societies would be much further along the path to well-being and happiness.

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Literature Cited

- Alemseged, Z., Y. Coppens, and D. Geraads. 2002. Hominid Cranium from Homo: Description and taxonomy of Homo-323-1976-896. *Am. J. Phys. Anthropol.*, 117(2):103-112.
- Anderson, W, C. Reid, and G. Jennings. 1992. Pet Ownership and Risk Factors for Cardiovascular Disease. *Med. J. Australia*, 57:298 -301.
- Antonioli, C. and M.A. Reveley. 2005. Randomized Control Trial of Animal Facilitated Therapy with Dolphins in the Treatment of Depression. *BMJ*, 331:1-4.
- Bernáldez, F.G., R.P. Abelló, and D. Gallardo. 1989. Environmental Challenge and Environmental Preference: Age and Sex Effects. *J. Env. Mgt.*, 28:53-70.
- Chokor, B.A. and S.A. Mene. 1992. An Assessment of Preference for Landscapes in the Developing World: Case Study of Warri, Nigeria, and Environs. *J. Env. Mgt.*, 34:237-256.
- Darwin, C. 1877. A Biographical Sketch of an Infant. *Mind*, 2:285-294.
- Faber-Taylor, A, F.E. Kuo and W.C. Sullivan. 2001. Coping with ADD: The Surprising Connection to Green Play Settings. *Environment and Behavior*, 33(1):54-77.
- Friedmann, E. and S.A. Thomas. 1995. Pet Ownership, Social Support, and One-Year Survival after Acute Myocardial Infarction in the Cardiac Arrhythmia Suppression trial (CAST). *Am. J. Cardiol.*, 76:1213-17.
- Frumkin, H. 2001. Beyond Toxicity: Human Health and the Environment. *Am. J. Prev. Med.*, 20(3):234-240.
- Heerwagen, J.H. and G.H. Orians. 1993. Humans, Habitats, and Aesthetics. In: *The Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.). Island Press, Washington, DC.

- Joye, Y. 2007. Architectural Lessons From Environmental Psychology: The Case of Biophilic Architecture. *Rev. Gen. Psych.*, 11(4):305-328
- Kaplin, R. 1984. Impact of Urban Nature: A Theoretical Analysis. *Urban Ecology*, 8:189-197.
- Katcher, A., E. Friedmann, A. Beck, and J. Lynch. 1983. Looking, Talking, and Blood Pressure: The Physiological Consequences of Interaction with the Living Environment. In: *New Perspectives on Our Lives with Companion Animals*. Katcher, A. and A. Peck (eds.). University of Pennsylvania Press, Philadelphia.
- Katcher, A. and G. Wilkins. 1992. A Controlled Trial of Animal Assisted Therapy and Education in a Residential Treatment Unit. Paper Presentation, Sixth International Conference on Human Animal Interactions, Montreal.
- Katcher, A. and Wilkins, G. 1993. Dialogue with Animals: Its Nature and Culture. In: *The Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.). Island Press, Washington, DC.
- Kellert, S.R. 1993. The Biological Basis for Human Values of Nature. In: *The Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.). Island Press, Washington, DC.
- Louv, R. 2005. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Algonquin Books of Chapel Hill, Chapel Hill, NC.
- Lumsden, C.J. and E.O. Wilson. 1981. *Genes, Mind, and Culture: The Coevolutionary Process*. Harvard University Press, Cambridge, MA.
- Lumsden, C.J. and E.O. Wilson. 1985. The Relation Between Biological and Cultural Evolution. *J. Soc. and Biol. Structure*, 8(4):343-259.
- McNally, R.J. 1987. Preparedness and Phobias: A Review. *Psych. Bulletin*, 101:283-303.
- Nash, R. 1982. *Wilderness and the American Mind*. Third Edition, Yale University Press, New Haven, CT.
- Orians, G.H. 1980. Habitat Selection: General Theory and Applications to Human Behavior. In: *The Evolution of Human*

- Social Behavior*. J.S. Lockard (ed.). Elsevier North Holland, New York.
- Orians, G.H. 1986. An Ecological and Evolutionary Approach to Landscape Aesthetics. In: *Meanings and Values in Landscape*. E.C. Penning-Roswell and D. Lowenthal (eds.). Allen & Unwin, London.
- Rolston, H. 1993. Biophilia, Selfish Genes, Shared Values. In: *The Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.). Island Press, Washington, DC.
- Sagan, D. and L. Margulis. 1993. God, Gaia, and Biophilia. In: *The Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.). Island Press, Washington, DC.
- Shafer, E.L., J.F. Hamilton, and E.A. Schmidt. 1969. Natural Landscape Preferences: A Predictive Model. *J. Leisure Research*, 1:187-197.
- Shipman, P. 1986. Scavenging or Hunting in Early Hominids: Theoretical Framework and Tests. *American Anthropologist*, 88:27-40.
- Stringer, C. 2001. The evolution of Modern Humans: Where Are We Now? *General Anthropology*, 7(2):1-5.
- Synder, G. 1991. The Etiquette of Freedom. In: *The Wilderness Condition: Essays on Environment and Civilization*. Oelschlaeger, M. (ed). Island Press, Washington, DC.
- Ulrich, R.S. 1977. Visual Landscape Preference: A Model and Application. *Man-Environment Systems*, 7:279-293.
- Ulrich, R.S. 1981. Natural Versus Urban Scenes: Some Psychophysiological Effects. *Environment and Behavior*, 13:523-556.
- Ulrich, R.S. 1984. View Through a Window May Influence Recovery from Surgery. *Science*, 224:420-421.
- Ulrich, R.S. and O. Lundén. 1990. Effects of Nature and Abstract Pictures on Patients Recovering from Open Heart Surgery. Paper presentation, International Congress of Behavioral Medicine, 27-30 June. Uppsala, Sweden.
- Ulrich, R.S., U. Dimberg, and B.L. Driver. 1991. Psychophysiological Indicators of Leisure Benefits. In: *Benefits*

- of Leisure*. Driver, B.L., P.J. Brown, and G.L. Peterson (eds.).
Venture, State College, PA.
- Ulrich, R.S. 1993. Biophilia, Biophobia, and Natural Landscapes.
In: *The Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.).
Island Press, Washington, DC.
- Wilson, E.O. 1984. *Biophilia: The Human Bond with Other Species*.
Harvard University Press, Cambridge, MA.
- Wilson, E.O. 1993. Biophilia and the Conservation Ethic. In: *The
Biophilia Hypothesis*. Kellert, S.R. and E.O. Wilson (eds.). Island
Press, Washington, DC.
- Wilson, E.O. 1996. *In Search of Nature*. Island Press/Shearwater
Books, Washington, D.C.
- Yi, Y.K. 1992. Affect and Cognition in Aesthetic Experiences of
Landscapes. Ph.D. Dissertation. Department of Landscape
Architecture and Urban Planning, Texas A&M University.