

Ecotherapy – a forgotten ecosystem service: a review

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Introduction

Ecosystems provide basic services upon which humans depend.

Unfortunately, people tend to believe that these ecosystem services are provided for free; therefore, the services are of little or no economic value. These services may not have a specific cost in dollars, but ordinary decisions by communities usually have an effect on the quality and magnitude of nature's provided ecosystem services. While humans do not pay directly for them, we bear the significant cost for their loss regarding increased illness, reduced soil fertility, moratoriums on greenhouse gasses, wastewater treatments facilities, and losses in those images of natural ecosystems that enrich our basic happiness.

The entire human economy depends on the goods and services provided by natural ecosystems ([Daily, 1997](#)). The natural processes of restoration (cleaning, recharging, and recycling), along with goods such as forage, timber and seafood, are worth trillions of dollars annually. Nothing could survive without these ecosystem services. Growing human interventions on the environment can significantly alter the functioning of natural ecosystems reducing the delivery of their services. Ecosystems have been changed by humans more extensively and rapidly in the last 75 years than in any previous period of human existence ([Daily, 1997](#)). We have used these resources to meet the world's growing demands for fiber, food, fuel, freshwater and timber. These alterations to ecosystems likely appear to raise the well-being of billions of people. However, these changes may have, unintentionally:

- Caused a major and sometimes largely permanent loss of biodiversity,
- Stressed the ability of natural systems to continue contributing necessary and important services,
- Altered our comfort level with nature and our sense of place and,
- Reduced human well-being significantly.

Ecotherapy is one of ecosystem services that nature provides and is based on the theories of ecopsychology. Broadly speaking it is an area of psychology that embraces ecology and aims to be holistic in theory and practice ([Buzzell and Chalquist, 2009](#)). This means that from an ecotherapy perspective, the health (physical and mental) of a human being is viewed in the context of the health of the Earth and its natural ecosystems ([Swimme and Berry, 1994](#) ; [Clinebell, 1996](#)). Ecotherapy helps people connect with nature to aid in dealing with physical and mental illnesses ([Buzzell and Chalquist, 2009](#)). This idea of reconnection seeks to remind humans that we are part of ecosystems rather than separate from them ([Jones, 2010](#) ; [Totton, 2011](#)). The philosophical approach is similar to philosophies of deep ecology known as ecosophy T ([Naess, 1973](#) , [1990](#) , [2001](#)). Ecotherapy is evidenced by numerous approaches - green exercise ([Pretty et al., 2005](#) , [2007](#)), green views ([Ulrich, 1984](#) ; [de Vries et al., 2003](#)), horticultural therapy ([Linden and Grut, 2002](#)), wilderness therapy ([Russell, 2001](#)), body therapy through movement ([Clinebell, 1996](#)), art therapy ([Degges-White and Davis, 2010](#)) and animal-assisted therapy ([DeMayo, 2009](#)).

Sometimes, ecotherapy can be just taking more traditional talk therapy

outside into a garden, public space, forest or beach. Ecotherapy often incorporates elements of mindfulness practices ([Ambrose-Oji, 2013](#) ; [Jordan and Hinds, 2016](#)). During outdoor therapy, both nature and human beings serve as therapists, assisting the client toward healing.

Since the advent of major technological advancements, Western society has retreated from the “ Great Outdoors” and placed more emphasis on technology; such as, television, computers, and gaming ([Hartig et al., 2014](#) ; [Chawla, 2015](#)). Mounting evidence suggests that people, by pushing away from nature, have distanced themselves from major environmental issues (e. g., acute weather events, water quality, air quality) and, in the end, have begun to lose contact with a necessary tool for their mental health that is available to all at little or no cost. By denying interactions with natural ecosystems, people jeopardize the rejection of a basic part of our being - a principle that is ironically more evident due to advances in medical technology ([van den Berg et al., 2010](#) ; [Thompson et al., 2012](#)).

Healers in many medical systems, from Ayurvedic medicine ([Chopra and Doiphode, 2002](#)) to traditional Chinese medicine ([Kayne and Booker, 2010](#)) to many Western pediatric perspectives ([Little and Wyver, 2008](#) ; [Prince et al., 2013](#)), have long advocated the importance of nature to well-being.

However, the concept that flowers and trees can influence well-being, psychologically, was largely untested until the late 1970s, when R. S. Ulrich examined the psychological influence of scenes of nature on stress experienced by students ([Ulrich, 1979](#) , [1981](#) , [1983](#) , [1986](#)) and medical recovery rates ([Ulrich, 1984](#)). His testing showed changes in mental states

and conditions after students observed “ natural” scenes associated with the environment. These scenes increased positive feelings of friendliness, affection, joy and playfulness. Views of non-nature based phenomena like urban settings, on the other hand, resulted significantly in one primary feeling: sadness. Viewing urban scenes also had a tendency to increase feelings of aggression and anger while viewing nature tended to reduce those feelings. Scenes of nature and natural ecosystems fostered positive thoughts and lowered anger and aggression. Based on these findings, Ulrich measured brain activity in healthy, unstressed adults and demonstrated that seeing landscapes associated with nature resulted in the increased production of serotonin ([Ulrich et al., 1991](#)). Many antidepressant medications used in Western medicine are thought to work by elevating the availability of serotonin to enhance communication among nerve cells. Many subsequent researchers have conducted objective testing to confirm this phenomenon. Ulrich’s pioneering research showing changes in surgery recovery times based on patients’ window views of nature (trees) and urban scenes (walls, concrete) demonstrated this “ natural” capacity extended beyond feelings to detectable medical phenomena.

Nature, whether you’re in the woods far away from it all, in a city park, or simply walking down a tree-lined street, has the power to make people feel new again. Studies have shown that a simple walk in nature can reduce anxiety, keep your spirits high, and even improve memory. Even just looking at photographs of greenery for less than a minute can give you a mood boost. Spending time in nature reduces stress and helps people feel energetic and more alive, according to scientists at the University of

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Rochester ([Brown and Ryan, 2003](#)). A recent study used mobile EEG devices to monitor participants' emotions during a walk in nature. Researchers also found that people were more likely to experience meditative-like brain waves and exhibit less frustration if they were walking in a green space, compared to a bustling shopping street or a busy business area ([Aspinall et al., 2013](#)).

Greencare is recognized as an increasingly important phenomenon. It encompasses or involves activities such as care farming, animal-assisted interventions (AAI), social and therapeutic horticulture (STH), healing gardens and facilitated green exercise. Despite the importance of Greencare therapies, there is a lack of appreciation that all of these care intervention types and related research are the result of a simple ecosystem service. Humans' need for nature is more than a simple requirement for material exploitation. Humans also need interaction with nature and its ecosystems to enhance our cognitive, emotional, spiritual and aesthetic development. This review will examine the role of this important ecosystem service (Nature being there) in therapies for several disorders and for several developmental aspects. These include the following physical and mental health disorders:

- General medical recovery (e. g., heart rate, blood pressure, surgery recovery, cardiopulmonary rehabilitation)
- Pain reduction
- Mood and Stress (e. g., post-traumatic stress, anxiety, self-esteem, addiction, mental well-being)

- Attention Deficit/Hyperactivity Disorder
- Dementia
- Obesity
- Other Disorders (e. g., vitamin D deficiencies, general mental health issues)

Finally, Nature therapy is important for several normal developmental aspects of children and the maintenance of those aspects for adults. Therefore, the following developmental aspects are considered in this review:

- Creativity
- Cognition
- Restoration
- Well-being and Life Satisfaction.

Physical and Mental Health Disorders

Medical Recovery

One of the first observations of the restorative effects of nature in a medical setting showed more rapid recovery rates from gall bladder surgery if patients had a view of nature through their windows versus either no window or no natural view ([Ulrich, 1984](#)). Anxiety was reduced in these patients and the recovery times of patients with a “ view” of nature was half that of those with a view of a wall. Ulrich also measured brain activity in healthy,

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unstressed adults and demonstrated that viewing scenes of nature was associated with the elevated production of serotonin ([Ulrich et al., 1991](#)). Viewing nature scenes stimulated positive thinking and reduced aggression and post-stress anger. Ulrich's pioneering research showing changes in recovery times following operations based on patients' window views of nature (trees) and urban scenes (walls, concrete) demonstrated this "natural" capacity extended beyond feelings to tangible medical phenomena. Many other researchers have used objective testing to confirm this phenomenon.

Flowering plants and foliage in hospital rooms have attributed to enhanced recovery rates of patients undergoing appendectomies ([Park and Mattson, 2008](#) , [2009a](#)). Patients in rooms with flowers and plants required less post-operative medications, demonstrated more positive physiological responses (heart rate, anxiety and fatigue, lower systolic blood pressure, pain ratings) and had more positive emotions and greater satisfaction with their hospital rooms than those in the control group. Indoor ornamental plants were also linked to generalized enhanced health outcomes in patients recovering from surgery ([Park and Mattson, 2009b](#)). Indoor plant exposure in Norway enhanced mental health recovery rates of coronary and pulmonary patients but did not enhance their physical recovery ([Raanaas et al., 2010](#)). A recent review ([Bringslimark et al., 2009](#)) cataloged the numerous psychological benefits of passive indoor plant exposures. Passive exposure results are mixed but plant exposure has been shown to result in a variety of outcomes, including reduced pain perception, enhanced emotional states, reduced autonomic arousal, and enhanced creativity and task-performance.

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Pain Reduction

There has recently been a heightened recognition that environmental factors, including exposure to nature scenes, can influence pain ([Malenbaum et al., 2008](#)). [Wilson \(1984\)](#) suggested that human beings have an inherent bond with nature and the contact with the natural world could be beneficial to human health. Given this connection, it is reasonable that nature, natural settings and plants could be useful in healthcare facility design targeted to reduce pain. Natural views of landscapes are not always accessible for hospitalized patients but, even, using simple images of nature enhance recovery rates and pain reduction of coronary surgical patients ([Ulrich et al., 1993](#)). Patients exposed to images of nature were much more likely to change from stronger to weaker pain medication during recovery. Patients exposed to nature images reported significantly less anxiety as well.

Combining nature sounds and images was shown to reduce pain in a randomized clinical trial of patients undergoing flexible bronchoscopies ([Diette et al., 2003](#)). Patients who were exposed to sounds and scenes of nature reported significantly enhanced levels of perceived pain control. In an experiment where healthy participants had pain induced, exposure to a video of natural scenery increased pain tolerance and threshold ([Tse et al., 2002](#)). Exposure of increased levels of sunlight for patients having undergone spinal surgery resulted in reduced pain, stress, use of painkilling medication and the overall costs of pain medication ([Walch et al., 2005](#)).

Biomonitored experimental sessions showed increases in pain tolerance as a result of exposure to ornamental plants in a simulated hospital room ([Park et al., 2002](#)). Similarly, pain perception appears to be altered by exposure to <https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

nature ([Lohr and Pearson-Mims, 2000](#)). Subjects were more willing to keep a hand submerged in ice water for 5 min if they were in a room with flowers than in a room without plants. However, this “ plant” effect was also observed when subjects in non-plant rooms were provided other “ non-nature” stimuli to distract them (e. g., bright colors).

PTSD, Mood Modification and Stress Reduction

Post-Traumatic Stress Disorder (PTSD) is one of the most compelling costs of war. PTSD can be defined as an anxiety that can develop after exposure to a terrifying event in which grave physical harm occurred or was threatened ([NIMH, 2011](#)). The prevalence of PTSD among veterans has been pronounced over the years, ranging from about 30% for men and women during the Vietnam era ([Kulka et al., 1990](#)) to 12% in the Gulf War ([Kang et al., 2003](#)) to about 23% overall in Afghanistan/Iraq conflicts ([Tanielian and Jaycox, 2008](#) ; [Ramchand et al., 2010](#) ; [Fulton et al., 2015](#)). Typical mental health treatments for these veterans include trauma-focused cognitive behavioral therapies (e. g., cognitive-processing therapy, cognitive restructuring, exposure therapy, stress inoculation therapy) ([Taylor et al., 2003](#) ; [Hassija and Gray, 2010](#) ; [Hoge, 2011](#)), eye movement desensitization and reprocessing ([Macklin et al., 2000](#) ; [Shapiro, 2014](#)) and pharmaceuticals such as selective serotonin uptake inhibitors ([Marshall et al., 2001](#) ; [Stein et al., 2002](#) ; [Hoge, 2011](#)).

An alternative strengths-based strategy for PTSD treatment has been various forms of recreation-based ecotherapy ([Hawkins et al., 2016](#)). Strength-based approaches focus on internal strengths (e. g., interests, beliefs, talent abilities, skills, knowledge, aspirations, character strengths, virtues), external
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strengths (e. g., family support and involvement, social support, positive attitudes, community and home resources, ecological factors) and existing skill sets (e. g., character strengths, military skill sets). The individual's hopes, aspirations and values take priority in treatment instead of medically directed care that focuses on reducing symptoms and functional deficits ([Anderson and Heyne, 2012](#) ; [Heyne and Anderson, 2012](#)). Based on Attention-Restoration Theory (ART, [Kaplan and Kaplan, 1989](#)), this type of strengths-based therapy proposes that people are restored in natural environments because they escape from usual settings and become fascinated by stimulation in natural ecosystems that take their mind off their day-to-day problems. Outdoor adventure, wilderness therapy, outdoor experience and green space-based ecotherapy (e. g., whitewater river rafting, fly-fishing, educational decision-making in nature, interactions and participation in nature) have been shown to be effective therapeutic media for veterans coping with PTSD ([Berman and Davis-Berman, 1995](#) ; [Hattie et al., 1997](#) ; [Fredrickson and Anderson, 1999](#) ; [Ewert et al., 2001](#) ; [Burls, 2007](#) ; [Dustin et al., 2011](#) ; [Mowatt and Bennett, 2011](#) ; [Sibthorp and Jostad, 2014](#)). For many veterans, being in nature is emotionally calming and helps them manage negative mental health symptoms through immersion in novel, natural environments. As a result of ecotherapy, many veterans can see beyond their past military experiences and injuries and establish a greater sense of purpose beyond themselves.

Green space and wilderness therapy are two ecotherapy approaches being used to address mood modification and stress reduction. Green space is important for physical and mental well-being. Interaction and engagement

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with green space have been linked with increased length of life and decreased risk of mental illness across a number of countries ([Takano et al., 2002](#)). Wilderness therapy is a treatment which uses a structured approach to work with adolescents with behavioral problems ([Russell et al., 1999](#) ; [Hill, 2007](#)). This type of therapy is most frequently used with adolescents at risk to help them deal with a variety of psychological problems such as adjustment, emotional or addiction ([Annerstedt and Wahrborg, 2011](#)). The mental health conditions that can be addressed by these types of ecotherapy include anxiety, depression, self-esteem, addiction and stress reduction.

Coronary heart disease patients are often offered some form of rehabilitation that generally involves a combination of health education and exercise. Psychosocial mediations aimed at reducing such risks factors as anxiety and stress are less regularly included although a large body of work indicates they can be successful in modifying the progression of coronary heart disease ([Ornish et al., 1990](#) ; [Krantz and McCeney, 2002](#)). Following a myocardial event, cardiac patients report high levels of anxiety and stress during hospitalization and post-discharge. A patient's overall mood can modify rehabilitative efforts. An affirmative emotional state can offer people the freedom to examine plans for the future. Gardening is a popular and often available method of recreational ecotherapy that lends itself to a healthy lifestyle. Horticultural therapy (HT) is a process through which gardening activities, interaction with plants and closeness to nature are used as a rehabilitative strategy ([Simsonand Straus, 1998](#)). Horticultural therapy has been shown to improve mood state reducing stress and its contribution

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to coronary heart disease (based on POMS score) ([Wichrowski et al., 2005](#)), improve self-esteem and reduce depression ([Son et al., 2004](#) ; [Lee et al., 2008](#)), improve sleep and cognitive issues in dementia patients ([Lee and Kim, 2008](#)), improve engagement and mood-related to dementia ([Gigliotti et al., 2004](#) ; [Gigliotti and Jarrott, 2005](#)) and as a general treatment for mental health issues ([Szofran and Myer, 2004](#)). Further, horticultural activities ([Richards and Kafami, 1999](#)) and integrated adventure therapy programs ([Bennett et al., 1998](#)), have been shown to be useful in substance abuse treatment.

Adventure-based treatment programs have shown success in treating self-esteem issues, schizophrenia, mood modification, adolescent behavior, school success, anger management, sociality and family functionality ([Wilson and Lipsey, 2000](#)). Adventure- and recreation-based group interventions have been useful in promoting well-being and weight loss in schizophrenia ([Voruganti et al., 2006](#)). A 2-week wilderness camp enhanced 10 community-level coping skills related to community survival of chronic mentally ill patients ([Banaka and Young, 1985](#)). Participation in a 10-day winter outdoor adventure enhanced the self-concept and locus of control for hearing-impaired individuals ([Luckner, 1989a](#) , [b](#)). Similarly, outdoor experiential approaches have proven useful in promoting adjustment to brain injury ([Thomas, 2004](#)). One of the most useful applications of wilderness and outdoor experiences has been with the improvement of family functionality and well-being ([Davis-Berman and Berman, 1989](#) ; [Harper and Cooley, 2007](#) ; [Harper et al., 2007](#) ; [Harper and Russell, 2008](#)),

adolescent attachment ([Bettman, 2007](#)) and chemical dependency ([Kennedy and Minami, 1993](#)).

Healing gardens and natural ecosystem encounters have been shown to reduce depression ([McCaffrey, 2007](#)), restore attention in cancer patients ([Cimprich and Ronis, 2003](#)), treat dementia ([Detweiler et al., 2008](#)) and reduce stress ([Kohlleppel and Bradley, 2002](#)). [Wells and Evans \(2003\)](#) reported that 8-10 year-old children from rural areas who were exposed to high levels of nearby nature experienced less stress and tended to recover from stress events more rapidly than children living in homes that lacked direct contact with nature. Cause and effect are difficult to disentangle in these interactions - does nature provide an opportunity for stress recovery; or does contact with nature assist in the development of coping mechanisms; or does it enhance possibilities for interaction with other children; or is the improved stress tolerance simply due to a combination of social and environmental factors? Almost twice as many children chose to play in spaces with trees than in spaces lacking natural elements ([Taylor et al., 1998](#)).

ADHD

The lack of contact with nature ([Louv, 2008](#)) has been suggested to be one of the primary reasons underlying the recent surge in childhood maladies like Attention Deficit Hyperactivity Disorder (ADHD) ([van der Berg and van der Berg, 2010](#)). Over 6 million children in the United States are struggling to cope with chronic attentional deficit or attention-deficit/hyperactivity disorder (ADHD) ([CDC, 2017a](#)). ADHD reduces children's attentional capacity and can have detrimental effects on many aspects of their lives (e. <https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

g., interpersonal relationships, school, personal growth). Many current treatments for ADHD have limited success and have numerous weaknesses, including appetite suppression, sleep disruption, depression and flattened affect ([Douglas, 1972](#) ; [Fiore et al., 1993](#) ; [Hinshaw, 1994](#) ; [Smucker and Hedayat, 2001](#) ; [Purdie et al., 2002](#) ; [Collingwood, 2010](#)). Similarly, behavioral therapies, the second form of ADHD treatment (e. g., direct contingency management, self-monitoring), are typically insufficient to bring children into normal ranges of functioning ([Hinshaw, 1994](#)). Unfortunately, some available treatments have costly side effects and many have limited effectiveness. Attention Restoration Theory proposes that contact with nature and natural ecosystems support attention enhancement and many studies have demonstrated that contact with nature can result in increased attention in adults ([Kaplan, 1995](#)) and children ([Taylor et al., 2001](#)).

Factors like children's motor ability, concentration and social play are all positively influenced following interaction or play in nature ([Fjortoft and Sageie, 2000](#) ; [Fjortoft, 2001](#) , [2004](#)). This improvement is particularly apparent involving children with ADHD ([Taylor et al., 2001](#) ; [Kuo and Taylor, 2004](#) ; [Taylor and Kuo, 2009](#)). Exposure to an ordinary natural setting (i. e., Nature) may be widely effective in reducing attention deficit symptoms in children. Increased green outdoors activities result in reduced children's ADHD symptoms and have more positive affect effects on symptoms than activities in other settings ([Kuo and Taylor, 2004](#)). This green advantage was found among children who lived in a variety of community types regardless of community size, geographic region or household income. This positive effect of natural exposure on ADHD symptoms cannot be the result

of the novelty of exposure to green spaces for urban children as rural children show similar positive results ([Kuo and Taylor, 2004](#)).

Attention Restoration Theory (ART) ([James, 1962](#) ; [Kaplan, 1995](#)) was originally developed in environmental psychology to explain why people consistently reported a sense of renewal after wilderness and other natural environment encounters. Adults and children tend to perform systematically better on objective attention measures after viewing or spending time in natural surroundings ([Tennessen and Cimprich, 1995](#) ; [Kuo, 2001](#) ; [Taylor et al., 2002](#) ; [Taylor and Kuo, 2009](#)).

Dementia

Nature-related activities are a normal part of life - pottering in a garden, looking out a window or walking in the countryside. Such basic pleasures are often unattainable for a person with dementia living in a care facility.

Holistic, interdisciplinary approaches to integrating nature into dementia care facilities provide care that supports both natural sensory stimulation and nature-based activities ([Chalfont, 2007](#)). Horticultural therapy for dementia patients seeks to increase human contact while engaging clients with nature ([Abbott et al., 1997](#) ; [van Loon, 2004](#)). The modification of dementia residential design plans in order to incorporate plants, nature and gardens have shown positive effects ([Day et al., 2000](#) ; [Cobley, 2002](#) ; [Chalfont, 2005](#)).

Agitated aggressive behavior often occurs in late stage dementia. This behavior usually results in the use of chemical and physical restraints which can have significant side effects. Environmental psychologists have shown

that exposure to nature and natural settings decreases agitation ([Whall et al., 1997](#)). Walled gardens appear to have a positive effect on the morale of special care dementia patients but do not always result in reductions in disruptive behaviors ([Lovering, 1990](#) ; [Mather et al., 1997](#)).

Obesity

More than 36% of United States adults and 17% of United States children are classified as obese ([CDC, 2017b](#)) and the number is increasing annually. The medical cost of obesity in the United States alone is estimated to be over \$150 billion ([CDC, 2017b](#)). Globally the obesity rate increases to about 50% for adults and is about the same for children ([OECD, 2017](#)). Common health consequences of obesity include cardiovascular diseases (mainly heart disease and stroke), musculoskeletal disorders (especially osteoarthritis), diabetes and some cancers (e. g., endometrial, breast, ovarian, prostate, liver, gall bladder, kidney and colon). Childhood obesity is associated with higher chance of adult obesity, premature death and disability in adulthood. In addition to the higher likelihood of these maladies in adulthood, obese children often experience difficulties in breathing, higher risk of fractures, insulin resistance, hypertension, early markers of cardiovascular disease and mental health issues.

The interaction between the children's physical activity and the environment is very complex. Physical activity is important for children's health at all ages. It is clear that physical activity is strongly related to both the obesity and fitness of children. Both obesity and fitness track into adulthood where they can enhance risk factors for cardiovascular disease, metabolic disorders and early mortality. People with ready access to nature are less likely to be

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obese, inactive or dependent on anti-depressants ([Neslen, 2017](#)).

Greenspace is an important resource for physical activity. It has the potential to contribute to the reduction of obesity and to improve health. In a review of quantitative research examining the association of greenspace and physical activity, weight status and health condition related to elevated weight, the majority of studies found a positive, but weak, association between greenspace and obesity-related health indicators ([Lachowycz and Jones, 2011](#)). Increased vegetation and greenspace were reported to be associated with reduced weight ([Liu et al., 2007](#) ; [Tilt et al., 2007](#) ; [Bell et al., 2008](#)). In eight major European cities, people were 40% less likely to be obese in the greenest areas of those cities ([Ellaway et al., 2005](#)).

Other Disorders (Vitamin D)

Exposure to the sun is a requirement for the synthesis of adequate amounts of vitamin D by humans. Ultraviolet B from sunlight is absorbed by dehydrocholesterol in the skin which is subsequently transformed and converted to vitamin D₃. Then, the liver metabolizes the vitamin into its biologically active form. Lack of vitamin D is recognized as a potential cause of rickets in children and elevating the potential for osteoporosis and even osteomalacia in adults. Similarly, as a result of more recent findings, it has been recognized that deficiency of vitamin D is correlated with increased multiple sclerosis, cardiovascular disease, some cancers, type I diabetes and rheumatoid arthritis, with possible links to schizophrenia and type II diabetes ([Holick, 2004](#)).

Possibly due to overall reduction of sunlight exposure, people living at higher latitudes have reduced incidence of multiple sclerosis (MS) although Norway
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appears to be an exception. This Norwegian anomaly may be the result of the enhanced outdoor activities by children ([Kampman et al., 2007](#)). It is possible that concerns over skin cancers being related to extensive exposure to the sun in combination with people spending less time outdoors is reducing the general population's exposure to sunlight resulting in a reduction the incidence of these chronic diseases.

Development, Interaction With Nature and Restoration

Children, today, grow up with a variety of indoor play facilities to choose from, including videogames, indoor play gardens, television and even indoor playground equipment; ([Karsten, 2005](#)). Increasing urbanization has significantly reduced the opportunity for safe outdoor play in cities and, even, in the suburbs. In order to protect them from harm, many parents actively discourage children from going outdoors ([Veitch et al., 2010](#)). As a result, more children are growing up disconnected from nature and the outdoors. This severing from interactions with nature could have important ramifications for children's well-being and healthy development ([Little and Wyver, 2008](#)).

Self-Esteem, Creativity and Development

Researchers have established significant and strong connections between direct contacts with nature and strengthened development in children ([Bandoroff and Schrer, 1994](#) ; [Kellert and Derr, 1998](#) ; [Kuo and Taylor, 2004](#) ; [Noddings, 2006](#) ; [Louv, 2008](#)). [Kellert \(2002\)](#) concluded that direct contact with nature significantly and positively impacts children's affective, cognitive, and moral development. [Wells and Evans \(2003\)](#) showed that scores for anxiety, behavioral conduct disorders and depression were lower

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for rural children living near nature. Children living near natural ecosystems rated themselves higher on measures of self-worth than their peers in less natural settings ([Wells and Evans, 2003](#)). The greener a child's view from their apartment, the higher he or she scored on several measures of delay of gratification and impulse control ([Taylor et al., 2002](#)).

Children's general access to nature seems to be diminishing ([Kahn, 2002](#) ; [Kellert, 2002](#)). Not only is there less nature for children to access but many parents may be limiting children's freedom to access nature for fear of violence and accident ([Spencer and Wooley, 2000](#) ; [Louv, 2008](#)). Children's lives are increasingly filled with programmed activities, leaving them with minimal time for exploring nature. A diverse literature has explored the potential impacts of green spaces on healthy child development. Some of the most exciting findings of a link between contact with nature and developmental outcomes in children come from the effects of outdoor challenge programs on children's self-esteem and sense of self. These findings suggest that contact with nature is likely to have significant benefits for children's development ([Kaplan, 1977](#) ; [Kaplan and Talbot, 1983](#) ; [Kellert and Derr, 1998](#)). Similarly, many studies suggested a systematic relationship between outdoor curricula in green space and enhanced learning ([Basile, 2000](#) ; [Ratanapojnard, 2001](#)). Studies comparing creative play in natural versus built spaces are consistent with nature supporting cognitive, social and emotional development ([Kirkby, 1989](#) ; [Taylor et al., 1998](#)).

While methodological arguments could be raised with several of the above studies, the patterns of findings point in the same direction and the persistence of findings across cultural groups and numerous childhood settings. The general belief that contact with nature is supportive in several domains of children's development - cognitive, social and emotional. Just as children require good nutrition and sleep patterns for positive development, they also need contact with nature.

Cognition

Research into childhood outdoor experiences has identified increased cognitive functioning to be a key benefit of interaction with ecosystems ([Chipeniuk, 1995](#) ; [Falk and Dierking, 1997](#) ; [Wells, 2000](#) ; [Kisiel, 2005](#) ; [Tzoulas et al., 2007](#)). In a longitudinal study of children in low-income families where the families were relocated to houses with more nearby nature, the children had higher levels of cognitive functioning and an enhanced ability to direct attention which continued several months after returning to their original homes ([Wells, 2000](#)).

Restoration

Evidence pointing to the psychological and restorative benefits of nature has accumulated significantly over the past several decades. [Olmsted \(1865\)](#) was particularly sensitive to the role of nature (i. e., natural scenery) in restoration. The early writings of Thoreau and his perceptiveness and foresight are likely more appreciated today ([Anderson, 1968](#) ; [Stern, 1970](#)). While these writings have great power and provide deep inspiration for some, the more empirical evidence is convincing for others. Several studies ([Kaplan and Kaplan, 1989](#) ; [Relf, 1992](#) ; [Hartig et al., 2003](#) ; [Berman et al.,](#) <https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[2008](#) ; [Bowler et al., 2010](#)) have addressed the potential restorative qualities of the interaction with nature.

Studies in the 1990s demonstrated the restorative influence of interactions with nature with regard to directed attention ([Hartig et al., 1991](#)), information processing effectiveness ([Hartig et al., 1991](#)), cancer patient enhanced effectiveness recovery ([Cimprich, 1992](#) , [1993](#)) and the restorative benefits of a natural view on attentiveness ([Tennessen and Cimprich, 1995](#)). These studies demonstrated there is a link between restorative experience and directed attention.

Well-Being/Life Satisfaction

In recent years, interest has grown in the positive benefits that might be gained from natural ecosystems and time spent outdoors with regard to an individual's well-being ([Pretty et al., 2003](#) , [2005](#) , [2007](#) ; [Bird, 2007](#) ; [Burls, 2007](#) ; [MIND, 2007](#) ; [Peacock et al., 2007](#)). Because many people live in towns and cities, there are a number of efforts, even including exercise, to reconnect people with nature. Participating in physical activity and experiencing nature both play an important role in positively influencing our health and well-being. Short-term walking interventions, particularly in greenspaces, energize and enhance personal well-being and vitality ([Peacock et al., 2007](#) ; [Plante et al., 2007](#) ; [Teas et al., 2007](#) ; [Barton et al., 2009](#) ; [Focht, 2009](#) ; [Ryan et al., 2010](#)) although walking combined with virtual reality settings depicting natural ecosystems also relaxes and enhances well-being ([Plante et al., 2003](#) , [2006](#)). Similarly, running in nature enhances the exercise experience, modifies physiology and mood and increases overall well-being ([McMurray et al., 1988](#) ; [Harte and Eifert, 1995](#) ; <https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[Kerr et al., 2006](#); [Hug et al., 2008](#)). Research has established a strong link between contact with nature and enhanced human well-being ([Greenleaf et al., 2014](#)).

Discussion

The primary interest of this review is to bring attention to an ecosystem service that is often overlooked, particularly by ecosystem services researchers. These researchers primarily address issues associated with the cleansing of air and water, the recycling of nutrients, the decomposition of waste and the support of living natural resources used for food and fiber. Nature's impact of human physical and mental health can be just as important a service to humans as the services listed above. However, in conducting this review, there are natural issues which arise outside of the ecosystem service's identification. For example, how good is the information relating the impact of nature interactions on these human health conditions? Does it indicate a strong causal linkage or a more causal association? Similarly, what are the underlying psychological processes underlying these relationships? While not, the main intent of the review, a discussion following which addresses these two points - (1) potential underlying mechanisms for these phenomena and (2) associational versus causal evidence for these impacts.

The stress of an unpleasant environment can result in feeling anxious, sad, helpless or depressed. These negative emotions, in turn, elevate heart rate, blood pressure and muscle tension which can suppress the immune system ([Numeroff, 1983](#)). Pleasing environments (e. g., nature) seem to have a

reverse effect (e. g., most of the literature cited in this review). Researchers don't yet understand all the details of why changes like these occur, but one possible explanation is that the types of interaction with nature described in this review reduce stress (e. g., [Kohlleppel and Bradley, 2002](#) ; [Hartig et al., 2003](#) ; [Wells and Evans, 2003](#)) and help people develop a more positive outlook ([Folkman, 2008](#)) both of which have been shown to strengthen the body's immune system ([Dillon et al., 1986](#) ; [Reiche et al., 2004](#) ; [Segerstrom and Miller, 2004](#)).

At the most basic level, the purpose of nature-based therapeutic programs is behavior change ([Maller et al., 2006](#)). This therapeutic approach focuses on the utility of positive emotions to combat the symptoms and basis of illness. The examination of positive emotions in this manner is relatively recent ([Fredrickson, 1998](#) , [2001](#)). Positive emotions are any feeling where there is a lack of negativity. [Fredrickson \(2009\)](#) identifies the 10 most common positive emotions as joy, gratitude, serenity, interest, hope, pride, amusement, inspiration, awe and love. [Fredrickson \(2001\)](#) formulated a new theoretical psychological model to better capture the utility of positive emotion called Broaden-and-Build Theory. This theory is in contrast to traditional psychological models which described the function of negative emotions and their relationships to psychological outcomes. Life threatening circumstances often result in quick and decisive actions that are linked to negative emotions.

Although positive emotions can occur in these types of negative situations, they generally occur in non-life-threatening circumstances. Interactions with

nature support several of the key propositions of the broaden-and build theory and can enhance cognition as well as intrinsic motivation to attachment styles and behavior ([Fredrickson, 1998](#)). The creation of these distinct kinds of positive emotions broaden and individual's short-term thought action processes - enhancing their abilities to cope or adjust to mental health and developmental situations. Interaction with nature develops these positive emotions and the use the connection forms the basis for eco-therapy ([Buzzell and Chalquist, 2009](#)).

Evidence (most of the studies cited in this review) suggests that enhancement of these positive emotions results in broadened scopes of cognition, attention and action; thus, addressing disorders like stress, PTSD, ADHD, and dementia. Similarly, increases in positive emotions promote well-being, sense of security, and connection to nature building intellectual, social and physical resources ([Fredrickson and Branigan, 2005](#)).

It is very difficult to “ prove” or even effectively demonstrate causality in nature interaction studies involving humans. The human-nature interaction is often a holistic phenomenon not easily reduced to a reductionist hypothesis-testing approach holding only one factor in change versus a control where the factor is not changed and all other factors are held constant. Human interactions are holistic and not reductionist; therefore, several potential “ causes” are always possible in many of the studies reviewed here. This likelihood of numerous “ causes” often leads social scientists to evaluate using a weight of evidence approach (preponderance of associational relationships) rather than the typical hypothesis-testing approach of the

natural scientist. Even many, natural scientists use observational finding (associations) to develop theoretical constructs addressing large holistic phenomena and then support these theories using reductionist experiments. Many, if not most, large-scale theoretical advances have been the result of holistic associational inferences based on associational data and then supplemented by hypothesis-testing experimentation where feasible. Such is often the case in studies of the impacts of interaction with nature on the human condition.

With this phenomenological tenet in mind, the previous discussed studies are assessed based on the nature of the relationships - associational, weight of evidence, holistic or causal. The intent of these comparisons is not to lessen the impact of associational studies but to assuage critics of non-hypothesis-testing results as being less persuasive than direct hypothesis-testing experimentation. Supplementary Table [S1](#) provides an overview of the studies reviewed herein and categorizes their findings as associational, associational weight of evidence, implied causal based on holistic evidence, or causal based on quasi-rigorous or rigorous experimentation. Much of the studies relating the interaction with nature and positive physical and mental health. Of the 123 studies reviewed here, the large majority (85%) includes associational information based on observations and surveys as opposed to rigorous causal hypothesis testing. This use of associational relationships does not negate the potential of a relationship but simply suggests that other co-linear information may be confuse the specific likelihood of a specific mechanism being identified. In many instances, many of these associational relationships (30%) are the result of quasi-experimental

designs that differentiate between dual or multiple groups for a specific factor but let all other factors vary as they simply occur (addressing that all other factors vary similarly). While associational information dominates the type of analyses in all types of studies linking interactions with nature and health impacts, this is the common approach used by social scientists, non-research health practitioners, and public health departments. The utility of these associations is make multiple observations to create a weight-of-evidence for a set of hypotheses relating nature and health outcomes.

While the social sciences tend to prefer the weight-of-evidence and associational approaches, 51% of the reviewed studies represented quasi-rigorously or rigorously designed hypothesis testing experiments to support the linkages between interactions with nature and changes in physical and mental health. This is a common approach for the medical research community (representing about a quarter on the hypothesis testing experiments). The fact that roughly half of the studies reviewed used some type of hypothesis-testing experimental design suggest that the linkages for some relationships - for example, nature views (including plant life) on medical recovery, pain reduction and pain tolerance; some wilderness challenges impacts on behavioral modifications and locus of control issues; some gardening and nature interactions effects on disease treatment and blood chemistry; and, nature exposure and outdoor exercise on stress reduction.

Most hypothesis-testing designs are also associational (by statistical design) so nearly 45% of the results of the reviewed studies were both hypothesis-

testing and associational. The remaining 40% of associational results were largely linking recreation-based ecotherapy to changes in condition for PTSD patients; mood, self-worth and well-being modifications resulting from interactions with nature or greenspace; many behavioral modification in adolescents (including substance abuse) resulting from wilderness encounters; attention deficit improvements from nature encounters; impacts of nature encounters on dementia improvement; and nature interactions improvements to childhood development, coping skills, and cognition. Similarly, the connections between outdoor exercise and greenspaces with reduction in obesity were largely associational.

Conclusion

Clear and abundant evidence demonstrates that interaction with nature affects not only well-being but health throughout life. The evidence suggests that people, who as children strongly interact with ecosystems and environment, live longer with a better quality of life. This “therapy” tends to make them more active, connected to people and society, engaged with natural places and eat healthier foods. These interactions, even as an adult, often result in lower blood C-reactive proteins and cortisol levels. As a result, children and adults who interact with nature and natural settings tend to be members of groups and volunteer more, have higher self-esteem and better mood, keep learning, and continue regularly to engage with nature and be more resilient to stress. Conversely, people, who, particularly as children, tended to stay indoors (and thus not receive this “therapy”), appear to be more inactive or sedentary, disconnected from society, eat energy-dense

and unhealthy foods, and have higher levels of blood c-reactive proteins and cortisol.

This review has highlighted the role of ecosystems and human-ecosystem interaction as a therapeutic device for a variety of physical, mental and developmental health issues to develop:

- Mobility, dexterity, stamina and resilience;
- Relief of depression and anxiety and improved concentration and memory; and
- Self-management, improved social and familial relations and skills, and self-esteem.

The research and literature seem to support the theoretical benefits derived from ecotherapy and human-ecological interactions. Thus, it seems rather obvious that:

- Being in nature affects health (physical and mental) positively. Being able to regularly get away from your built environment (house or office) and perform activities in a natural setting (or just being able to rest in a natural setting) can restore mental state and physical capacities ([Hartig, 2007](#); [Bjork et al., 2008](#); [Grahn et al., 2010](#));
- Nature affects health positively for most people ([Ulrich, 1999](#), [2001](#)) or some people based on the interaction ([Grahn and Stigsdotter, 2010](#));

- Many nature-based activities affect health positively but may depend on the context of the surrounding environment ([Burls, 2007](#) , [2008](#) ; [Ottozon and Grahn, 2008](#) ; [Grahn et al., 2010](#)); and
- Some people will be more affected than others by treatment in nature-based therapeutic settings ([Grahn et al., 2010](#)).

It seems clear that this service that Nature provides (e. g., Nature being there to provide therapeutic or developmental services), without direct cost, is an underappreciated, if not near-forgotten, ecosystem service in the ecological literature regarding intermediate and final ecosystem goods and services. While often overlooked, the Ecotherapy service provided by nature is a very meaningful and important ecosystem service, worthy of conservation and regulatory costs. In reality, these economic costs which would be more than offset by the costs of medication and treatment through more traditional medical therapies. This discussion of the need and costs of preservation of natural ecosystems, if only for their therapeutic advantages, provides a substantive example of the enhancement of well-being through holistic discourse compared to the less than holistic small talk conversations concerning the continuing development of natural ecosystems strictly for economic growth ([Mehl et al., 2010](#)).

Author Contributions

JS was responsible for the bulk of this review manuscript including writing, assessment, and evaluation of materials. DV was responsible for the collection of manuscripts to review and in offering comments and edits for the draft manuscript.

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Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Supplementary Material

The Supplementary Material for this article can be found online at:

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References

Abbott, G., Cochran, V., and Clair, A. A. (1997). Innovations in intergenerational programs for persons who are elderly: the role of horticultural therapy in a multi-disciplinary approach. *Activit. Adapt. Aging* 22, 27-39. doi: 10.1300/J016v22n01_04

[CrossRef Full Text](#)

Ambrose-Oji, B. (2013). Mindfulness Practice in Woods and Forests: an Evidence Review. Research Report for The Mersey Forest, Forest Research. Alice Holt Lodge Farnham, Surrey.

Anderson, C. R. (1968). Thoreau takes a pot shot at “ Carolina sports”. *Georgia Rev.* 22, 289-299.

[Google Scholar](#)

Anderson, L., and Heyne, L. (2012). *Therapeutic Recreation Practice: A Strengths Approach*. State College, PA: Venture Press.

[Google Scholar](#)

Annerstedt, M., Wahrborg., and P. (2011). Nature-assisted therapy: systematic review of controlled and observational studies. *Scand. J. Public Health* 39, 371-388. doi: 10. 1177/1403494810396400

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Aspinall, P., Mavros, P., Coyne, R., and Roe, J. (2013). The urban brain: analysing outdoor physical activity with mobile EEG. *Br. J. Sports Med. Arch* 6: 2013, doi: 10. 1136/bjsports-2012-091877

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Banaka, W. H., and Young, D. W. (1985). Community coping skills enhanced by an adventure camp for adult chronic psychiatric patients. *Psychiatric Ser.* 36, 746-748. doi: 10. 1176/ps. 36. 7. 746

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Bandoroff, S., and Schrer, D. G. (1994). Wilderness family therapy: an innovative treatment approach for problem youth. *J. Child Fam. Stud.* 3, 175-191. doi: 10. 1007/BF02234066

[CrossRef Full Text](#) | [Google Scholar](#)

Barton, J., Hine, R., and Pretty, J. (2009). The health benefits of walking in greenspaces of high natural and heritage value. *J. Integr. Environ. Sci.* 6, 261-278. doi: 10. 1080/19438150903378425

[CrossRef Full Text](#) | [Google Scholar](#)

Basile, C. G. (2000). Environmental education as a catalyst for transfer of learning in young children. *J. Environ. Educ.* 32, 21-27. doi: 10. 1080/00958960009598668

[CrossRef Full Text](#) | [Google Scholar](#)

Bell, J. F. Wilson, J. S., and Liu, G. C. (2008). Neighborhood greenness and 2-year changes in body mass index of children and youths. *Am. J. Prev. Med.* 35, 547-553. doi: 10. 1016/j. amepre. 2008. 07. 006

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Bennett, L. W., Cardone, S., and Jarczyk, J. (1998). Effects of a therapeutic camping program on addiction recovery: the Algonquin Haymarket relapse prevention program. *J. Subst. Abuse Treat.* 15, 469-474. doi: 10. 1016/S0740-5472(97)00222-5

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Berman D. S., and Davis-Berman, J. (1995). *Outdoor Education and Troubled youth*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools, ED 385425.

[Google Scholar](#)

Berman, M. G., Jonides, J., and Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychol. Sci.* 19, 1207–1212. doi: 10.1111/j.1467-9280.2008.02225.x

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Bettman, J. (2007). Changes in adolescent attachment relationships as a response to wilderness treatment. *J. Am. Psychoanal. Assoc.* 55, 259–265. doi: 10.1177/00030651070550010103

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Bird, W. (2007). *Natural Thinking: Investigating the Links between the Natural Environment, Biodiversity and Mental Health*. London: Royal Society for the Protection of Birds.

[Google Scholar](#)

Bjork, J., Albin, M., Grahn, P., Jacobsson, H., Ardoi, J., Wadbro, J., et al. (2008). Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and well-being. *J. Epidemiol. Commu. Health* 64: e2. doi: 10.1136/jech.2007.062414

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., and Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health* 10: 456. doi: 10. 1186/1471-2458-10-456

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Bringslimark, T., Hartig, T., and Patil, G. G. (2009). The psychological; benefits of indoor plants: a critical review of the experimental literature. *J. Environ. Psychol.* 29, 422–433. doi: 10. 1016/j. jenvp. 2009. 05. 001

[CrossRef Full Text](#) | [Google Scholar](#)

Brown, K. W., and Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *J. Pers. Soc. Psychol.* 84, 822–848. doi: 10. 1037/0022-3514. 84. 4. 822

[CrossRef Full Text](#) | [Google Scholar](#)

Burls, A. (2007). People and green spaces: promoting public health and well-being through Ecotherapy. *J. Public Mental Health* 6, 16, 24–39. doi: 10. 1108/17465729200700018

[CrossRef Full Text](#) | [Google Scholar](#)

Burls, A. (2008). Seeking nature: a contemporary therapeutic environment. *Int. J. Ther. Commun.* 29, 228–244.

[Google Scholar](#)

Buzzell, L., and Chalquist, C. (2009). *Ecotherapy: Healing with Nature in Mind*. San Francisco, CA: Sierra Club Books.

[Google Scholar](#)

CDC (2017a). *Attention-Deficit/Hyperactivity Disorder*. Available at:

<https://www.cdc.gov/ncbddd/adhd/data.html>

CDC (2017b). *Overweight and Obesity*. Available at: [https://www.cdc.](https://www.cdc.gov/obesity/data/adult.html)

[gov/obesity/data/adult.html](https://www.cdc.gov/obesity/data/adult.html)

Chalfont, G. E. (2005). Creating enabling outdoor environments for residents. *Nurs. Resid. Care* 7, 454-457.

[Google Scholar](#)

Chalfont, G. E. (2007). Wholistic design in dementia care: connection to nature with PLANET. *J. Hous. Elderly* 21, 153-177. doi: 10.

1300/J081v21n01_08

[CrossRef Full Text](#) | [Google Scholar](#)

Chawla, L. (2015). Benefits of nature contact for children. *J. of Plann. Literat.* 30, 433-452. doi: 10. 1177/0885412215595441

[CrossRef Full Text](#) | [Google Scholar](#)

Chipeniuk, R. (1995). Childhood foraging as a means of acquiring competent human cognition about biodiversity. *Environ. Behav.* 27, 490-512. doi: 10.1177/0013916595274003

[CrossRef Full Text](#) | [Google Scholar](#)

Chopra, A., and Doiphode, V. (2002). Ayurvedic medicine: core concept, therapeutic principles, and current relevance. *Med. Clin. N. Am.* 86, 75-89. doi: 10.1016/S0025-7125(03)00073-7

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Cimprich, B. (1992). Attention fatigue following breast cancer surgery. *Res. Nurs. Health.* 15, 199-207. doi: 10.1002/nur.4770150306

[CrossRef Full Text](#) | [Google Scholar](#)

Cimprich, B., and Ronis, D. L. (2003). An environmental intervention to restore attention in women with newly diagnosed breast cancer. *Cancer Nurs.* 26, 284-292. doi: 10.1097/00002820-200308000-00005

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Cimprich, B. (1993). Development of an intervention to restore attention in cancer patients. *Cancer Nurs.* 16, 83-92. doi: 10.1097/00002820-199304000-00001

[CrossRef Full Text](#) | [Google Scholar](#)

Clinebell, H. J. (1996). *Ecotherapy: Healing Ourselves, Healing the Earth*. New York, NY: Haworth Press.

[Google Scholar](#)

Cobley, M. (2002). Using outdoor spaces for people with dementia – a carer's perspective. *Working Older People* 6, 23–30. doi: 10.

1108/13663666200200019

[CrossRef Full Text](#) | [Google Scholar](#)

Collingwood, J. (2010). *Side Effects of ADHD Medications*. Available at:

<https://psychcentral.com/lib/side-effects-of-adhd-medications>

[Google Scholar](#)

Daily, G. C. (1997). *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, DC: Island Press, 391.

[Google Scholar](#)

Davis-Berman, J., and Berman, D. S. (1989). The wilderness therapy program: an empirical study of its effects on adolescents in an outpatient setting. *J. Contemp. Psychother.* 19, 271–281. doi: 10. 1007/BF00946092

[CrossRef Full Text](#) | [Google Scholar](#)

Day, K., Carreon, D., and C. Stump, C. (2000). The therapeutic design of environments for people with dementia: a review of the empirical research.

Gerontologist 40, 397–416. doi: 10. 1093/geront/40. 4. 397

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[CrossRef Full Text](#) | [Google Scholar](#)

de Vries, S., Verheij, R. A., Groenewegen, P., and Spreeuwenberg, P. (2003). Natural environments: healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environ. Plann. A* 35, 1717-1731. doi: 10. 1068/a35111

[CrossRef Full Text](#) | [Google Scholar](#)

Degges-White, S., Davis, N. eds (2010) *Integrating the Expressive Arts into Counseling Practice: Theory-based Interventions* . New York, NY: Springer.

DeMayo., N. (2009) "Horses, humans, and healing," in *Ecotherapy: Healing with Nature in Mind* , eds C. Chalquist and L. Buzzell (San Francisco, CA: Sierra Club Books).

Detweiler, M. B., Murphy, P. F., Myers, L. C., and Kim, K. Y. (2008). Does a wander garden influence inappropriate behaviors in dementia residents? *Am. J. Alzheimer's Dis. Other Demen.* 23, 31-45. doi: 10. 1177/1533317507309799

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A., and Rubin, H. R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complimentary approach to routine analgesia. *Chest* 123, 941-948. doi: 10. 1378/chest. 123. 3. 941

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

Dillon, K., Minchoff, B., and Baker, K. H. (1986). Positive emotional states and enhancement of the immune system. *Int. J. Psychiatry Med.* 15, 13-18. doi: 10.2190/R7FD-URN9-PQ7F-A6J7

[CrossRef Full Text](#) | [Google Scholar](#)

Douglas, V. I. (1972). Stop, look and listen: the problem of sustained attention and impulse control in hyperactive and normal children. *Can. J. Behav. Sci.* 4, 259-282. doi: 10.1037/h0082313

[CrossRef Full Text](#) | [Google Scholar](#)

Dustin, D., Bricker, N., Arave, J., Wall, W., and Wendt, G. (2011). The promise of river running as a therapeutic medium for veterans coping with Post-Traumatic Stress Disorder. *Ther. Recreat. J.* 45, 326-340.

[Google Scholar](#)

Ellaway, A., Macintyre, S., and Bonnefoy, X. (2005). Graffiti, greenery, and obesity in adults: secondary analysis of European cross sectional survey. *BMJ* 331, 611-612. doi: 10.1136/bmj.38575.664549.F7

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Ewert, A., McCormick, B., and Voight, A. (2001). Outdoor experiential therapies: implications for TR practice. *Ther. Recreat. J.* 35, 107-122.

[Google Scholar](#)

Falk, J. D., and Dierking, L. D. (1997). School field trips: assessing their long-term impact. *Curator* 40, 211-218. doi: 10. 1111/j. 2151-6952. 1997. tb01304. x

[CrossRef Full Text](#) | [Google Scholar](#)

Fiore, T. A., Becker, E. A., and Nero, R. C. (1993). Interventions for students with attention deficits. *Except. Child.* 60, 163-173. doi: 10. 1177/001440299306000210

[CrossRef Full Text](#)

Fjortoft, I. (2001). The natural environment as a playground for children: the impact of outdoor play activities in pre-primary school children. *Early Childhood Educ. J. Environ. Educ.* 29, 111-117. doi: 10. 1023/A: 1012576913074

[CrossRef Full Text](#) | [Google Scholar](#)

Fjortoft, I. (2004). Landscape as playscape: the effects of natural environments on children's play and motor development. *Child. Youth Environ.* 14, 21-44.

[Google Scholar](#)

Fjortoft, I., and Sageie, J. (2000). The natural environment as a playground for children: landscape description and analyses of a natural playscape. *Landsc. Urban Plann.* 20, 83-97. doi: 10. 1016/S0169-2046(00)00045-1

[CrossRef Full Text](#) | [Google Scholar](#)

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

Focht, B. (2009). Brief walks in outdoor and laboratory environments: effects on affective responses, enjoyment and intentions to walk for exercise. *Res. Quart. Exercise Sport* 80, 6111-6620. doi: 10. 1080/02701367. 2009. 10599600

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Folkman, S. (2008). The case for positive emotions in the stress response. *Anxiety Stress Coping* 21, 3-14. doi: 10. 1080/10615800701740457

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Fredrickson, B. L. (1998). What good are positive emotions? *Rev. Gen. Psychol.* 2, 300-319. doi: 10. 1037/1089-2680. 2. 3. 300

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: the broaden-and-build theory of positive emotions. *Am. Psychol.* 56, 218-226. doi: 10. 1037/0003-066X. 56. 3. 218

[CrossRef Full Text](#) | [Google Scholar](#)

Fredrickson, B. L. (2009). *Positivity*. New York, NY: Three Rivers Press.

[Google Scholar](#)

Fredrickson, B., and Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cogn. Emot.* 19, 313-332. doi: 10. 1080/02699930441000238

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Fredrickson, L. M., and Anderson, D. H. (1999). A qualitative exploration of the wilderness experience as a source of spiritual inspiration. *J. Environ. Psychol.* 19, 21–39. doi: 10.1006/jevp.1998.0110

[CrossRef Full Text](#) | [Google Scholar](#)

Fulton, J. J., Calhoun, P. S., Wagner, H. R., Schry, A. R., Hair, L. P., Feeling, N., et al. (2015). The prevalence of posttraumatic stress disorder in operation enduring freedom/operation iraqi freedom (OEF/OIF) veterans: a meta-analysis. *J. Anxiety Disord.* 31, 98–107. doi: 10.1016/j.janxdis.2015.02.003

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Gigliotti, C. M., and Jarrott, S. E. (2005). Effects of horticulture therapy on engagement and affect. *Can. J. Aging* 24, 367–377. doi: 10.1353/cja.2006.0008

[CrossRef Full Text](#) | [Google Scholar](#)

Gigliotti, C. M., Jarrott, S. E., and Yorgason, J. (2004). Harvesting health: effects of three types of horticultural therapy activities for persons with dementia. *Dementia* 3, 161–180. doi: 10.1177/1471301204042335

[CrossRef Full Text](#) | [Google Scholar](#)

Grahn, P., and Stigsdotter, U. K. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. *Landsc. Urban Plann.* 94, 264–275. doi: 10.1016/j.landurbplan.2009.10.012

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[CrossRef Full Text](#) | [Google Scholar](#)

Grahn, P., Tenngart, I. C., Stigsdotter, U. K., and Bengtsson, I. L. (2010) “Using affordances as a health-promoting tool in a therapeutic garden” in: *Innovative Approaches to Researching Landscapes and Health*, eds C. W. Ward, P. Aspinall, and S. Bell (London: Taylor and Francis), 116–154.

[Google Scholar](#)

Greenleaf, A. T., Bryant, R. M., and Pollack, J. B. (2014). Nature-based counseling: integrating the healing benefits of nature into practice. *Int. J. Adv. Counsell.* 36, 162–174. doi: 10. 1007/s10447-013-9198-4

[CrossRef Full Text](#) | [Google Scholar](#)

Harper, N. J., and Cooley, R. (2007). Parental reports of adolescent and family well-being following a wilderness therapy intervention: an exploratory look at systemic change. *J. Exp. Educ.* 29, 393–396.

[Google Scholar](#)

Harper, N. J., and Russell, K. C. (2008). Family involvement and outcome in adolescent wilderness treatment: a mixed-methods evaluation. *Int. J. Child Fam. Welfare* 1, 19–36.

[Google Scholar](#)

Harper, N. J., Russell, K. C., Cooley, R., and Cupples, J. (2007). Catherine freer wilderness therapy expeditions: an exploratory case study of adolescent

wilderness therapy, family functioning, and the maintenance of change.

Child Youth Care Forum 36, 111-129. doi: 10. 1007/s10566-007-9035-1

[CrossRef Full Text](#) | [Google Scholar](#)

Harte, J. L., and Eifert, G. H. (1995). The effects of running, environment, and attentional focus on athletes' catecholamine and cortisol levels and mood.

Psychophysiology 32, 49-54. doi: 10. 1111/j. 1469-8986. 1995. tb03405. x

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Hartig, T. (2007) " Three steps to understanding restorative environments as health resources" in *Open Space: people Space* , eds T. C. Ward and P. Travlou (London: Taylor and Francis), 163-179.

Hartig, T., Evans, G. W., Jammer, L. D., Davis, D. S., and Garling, T. (2003). Tracking restoration in natural and urban field settings. *J. Environ. Psychol.* 23, 109-123. doi: 10. 1016/S0272-4944(02)00109-3

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Hartig, T., Mang, M., and Evans, G. W. (1991). Restorative effects of natural environment experience. *Environ. Behav.* 23, 3-26. doi: 10. 1177/0013916591231001

[CrossRef Full Text](#) | [Google Scholar](#)

Hartig, T., Mitchell, R., de Vries, S., and Frumkin, H. (2014). Natura and health. *Annu. Rev. Public Health* 35, 207-228. doi: 10. 1146/annurev-publhealth-032013-182443

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Hassija, C. M., and Gray, M. J. (2010). Are cognitive techniques and interventions necessary? A case for the utility of cognitive approaches in the treatment of PTSD. *Clin. Psychol. Sci. Pract.* 17, 112-127. doi: 10. 1111/j. 1468-2850. 2010. 01201. x

[CrossRef Full Text](#) | [Google Scholar](#)

Hattie, J., Marsh, H. W., Neill, J. T., and Richards, G. E. (1997). Adventure education and Outward Bound: out of class experiences that make a lasting difference. *Rev. Educ. Res.* 67, 43-87. doi: 10. 3102/00346543067001043

[CrossRef Full Text](#) | [Google Scholar](#)

Hawkins, B. L., Townsend, J. A., and Garst, B. A. (2016). Nature-based recreational therapy for military service members: a strengths approach. *Ther. Recreat. J.* 50, 55-74. doi: 10. 18666/TRJ-2016-V50-I1-6793

[CrossRef Full Text](#) | [Google Scholar](#)

Heyne, L. A., and Anderson, L. S. (2012). Theories that support strength-based practice in therapeutic recreation. *Ther. Recreat. J.* 46, 106-128.

[Google Scholar](#)

Hill, N. R. (2007). Wilderness therapy as a treatment modality for at-risk youth: a primer for mental health counselors. *J. Men. Health Counsel.* 29, 338-349. doi: 10. 17744/mehc. 29. 4. c6121j162j143178

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[CrossRef Full Text](#) | [Google Scholar](#)

Hinshaw, S. P. (1994). *Attention Deficits and Hyperactivity in Children*.

Thousand Oaks, CA: Sage. doi: 10. 4135/9781483326740

[CrossRef Full Text](#) | [Google Scholar](#)

Hoge, C. W. (2011). Interventions for war-related posttraumatic stress disorder. *JAMA* 306, 549-551. doi: 10. 1001/jama. 2011. 1096

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Holick, M. F. (2004). Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers and cardiovascular disease. *Am. J. Clin. Nutr.* 80: 1678S-1688S. doi: 10. 1093/ajcn/80. 6. 1678S

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Hug, S. M., Hansmann, R., Monn, C., Kratli, P., and Seeland, K. (2008).

Restorative effects of physical activity in forests and indoor settings. *Int. J. Fitness*. 4, 25-37.

[Google Scholar](#)

James, W. (1962). *Psychology: The Briefer Course*. New York, NY: Collier Books (Original work published in 1892).

[Google Scholar](#)

Jones, P. (2010). Roosters, hawks and dawgs: toward an inclusive, embodied eco/feminist psychology. *Femin. Psychol.* 20, 365–380. doi: 10.1177/0959353510368120

[CrossRef Full Text](#) | [Google Scholar](#)

Jordan M., Hinds, J. (eds). (2016). *Ecotherapy: Theory, Research and Practice*. London: Macmillan. doi: 10.1057/978-1-137-48688-2

[CrossRef Full Text](#) | [Google Scholar](#)

Kahn, P. H. (2002) “ Children’s affiliations with nature: structure, development and the problem of environmental generational amnesia,” in *Children and Nature: Psychological, Sociocultural and Evolutionary Investigations* , eds P. H. Kahn and S. R. Kellert (Cambridge, MA: The MIT Press), 93–116.

[Google Scholar](#)

Kampman, M. T., Wilsgaard. T., and Mellgren, S. I. (2007). Outdoor activities and diet in childhood and adolescence relate to MS risk above the Arctic Circle. *J. Neurol.* 254, 471–477. doi: 10.1007/s00415-006-0395-5

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Kang, H., Natelson, B., Mahan, C., Lee, K., and Murphy, F. (2003). Post-traumatic stress disorder and chronic fatigue syndrome-like illness among gulf war veterans: a population-based survey of 30, 000 veterans. *Am. J. Epidemiol.* 157, 141–148. doi: 10.1093/aje/kwf187

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[PubMed Abstract](#) | [CrossRef Full Text](#)

Kaplan, R. (1977). *Summer Outdoor Programs: their Participants and Their Effects*. USDA Forest Service Technical Report No. NE-30. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.

[Google Scholar](#)

Kaplan, R., and Kaplan, S. (1989). *The Experience of Nature: a Psychological Perspective*. New York, NY: Cambridge University Press.

[Google Scholar](#)

Kaplan, S. (1995). The restorative benefits of nature: toward an integrative framework. *J. Environ. Psychol.* 15, 169-182. doi: 10.1016/0272-4944(95)90001-2

[CrossRef Full Text](#) | [Google Scholar](#)

Kaplan, S. R., and Talbot, J. F. (1983) " Psychological benefits of nature: toward an integrative framework" in *Behavior and the Natural Environment* , eds I. Altman and J. F. Wohlwill (New York, NY: Plenum Press), 163-204.

[Google Scholar](#)

Karsten, L. (2005). It used to be better? Different generations on continuity and change in urban children's daily use of space. *Children's Geogr.* 3, 275-290. doi: 10.1080/14733280500352912

[CrossRef Full Text](#) | [Google Scholar](#)

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

Kayne, S., Booker, T. (2010) " Traditional chinese medicine" in *Traditional Medicine: A Global Perspective* , ed. S. B. Kayne (London: Pharmaceutical Press).

Kellert, S. R. (2002) " Experiencing Nature: affective, Cognitive and Evaluative Development" in *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations* , eds P. H. Kahn and S. R. Kellert (Cambridge, MA: The MIT Press), 117-152.

[Google Scholar](#)

Kellert, S. R., and Derr, V. (1998). *National Study of Outdoor Wilderness Experience*. Washington, DC: Island Press.

[Google Scholar](#)

Kennedy, B. P., and Minami, M. (1993). The beech hill hospital/outward bound adolescent chemical dependency treatment program. *J. Subst. Abuse Treat.* 10, 395-406. doi: 10. 1016/0740-5472(93)90025-W

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Kerr, J. H., Fujiyama, H., Sugano, A., Okamura, T., Chang, M., and Onouha, F. (2006). Psychological responses to exercising in laboratory and natural environments. *Psychol. Sport Exer.* 7, 345-359. doi: 10. 1016/j. psychsport. 2005. 09. 002

[CrossRef Full Text](#) | [Google Scholar](#)

Kirkby, M. (1989). Nature as refuge in children's environments. *Children's Environ. Quart.* 6, 1-12.

[Google Scholar](#)

Kisiel, J. (2005). Understanding elementary teachers' motivations for science fieldtrips. *Sci. Educ.* 86, 936-955. doi: 10. 1002/sce. 20085

[CrossRef Full Text](#) | [Google Scholar](#)

Kohlleppel, T., and Bradley, J. C. (2002). A walk through the garden: can a visit to a botanic garden reduce stress? *Hort Technol* . 12, 489-491.

[Google Scholar](#)

Krantz, D. S., and McCeney, M. K. (2002). Effects of psychological and social factors on organic disease: a critical assessment of research on coronary heart disease. *Annu. Rev. Psychol.* 53, 341-369. doi: 10. 1146/annurev. psych. 53. 100901. 135208

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Kulka, R. A., Schlenger, W. E., Fairbank, J. A., Hough, R. L., Jordan, B. K., Marmar, C. R., et al. (1990). *Trauma and the Vietnam War Generation: report of Findings from National Vietnam Veterans Readjustment Study* . *Brunner/Mazel Psychosocial Stress Book* , Vol. 18. New York, NY: Routledge (original publication 1990).

[Google Scholar](#)

Kuo, F. E. (2001). Coping with poverty: impacts of environment and attention in the inner city. *Environ. Behav.* 33, 5-34. doi: 10.1177/00139160121972846

[CrossRef Full Text](#) | [Google Scholar](#)

Kuo, F. E., and Taylor, A. F. (2004). A potential natural treatment for attention-deficit/hyperactivity disorder: evidence from a national study. *Am. J. Public Health* 94, 1580-1586. doi: 10.2105/AJPH.94.9.1580

[CrossRef Full Text](#) | [Google Scholar](#)

Lachowycz, K., and Jones, A. P. (2011). Greenspace and obesity: a systematic review of the evidence. *Obes. Rev.* 12: e183-e189. doi: 10.1111/j.1467-789X.2010.00827.x

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Lee, S., Kim, M. S., Suh, J. K. eds (2008) Effects of horticultural therapy on self-esteem and depression of battered women at a shelter in Korea. *Acta Horticult.* 790, 139-142. doi: 10.17660/ActaHortic.2008.790.19

[CrossRef Full Text](#)

Lee, Y., and Kim, S. (2008). Effects of indoor gardening on sleep agitation and cognition in dementia patients - a pilot study. *Int. J. Geriatr. Psychiatry* 23, 485-489. doi: 10.1002/gps.1920

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Linden, S., and J. Grut. J. (2002). *The Healing Fields: Working with Psychotherapy and Nature to Rebuild Shattered Lives*. London: Frances Lincoln Publishing.

[Google Scholar](#)

Little, H., and Wyver, S. (2008). Outdoor play: does avoiding the risks reduce the benefits? *Aust. J. Early Childhood* 33, 33-40.

[Google Scholar](#)

Liu, G. C., Wilson, J. S., Qi, R., and Ying, J. (2007). Green neighborhoods, food retail and childhood overweight: differences by population density. *Am. J. Prev. Med.* 21, 317-325. doi: 10. 4278/0890-1171-21. 4s. 317

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Lohr, V. I., and Pearson-Mims, C. H. (2000). Physical discomfort may be reduced in the presence of interior plants. *HortTechnology* 10, 53-58.

[Google Scholar](#)

Louv, R. (2008). *Last Child in the Woods: saving Our Children from Nature Deficit Disorder*. Chapel Hill, NC: Algonquin press.

[Google Scholar](#)

Lovering, H. J. (1990). Alzheimer's disease and outdoor space: issues in environmental design. *Am. J. Alzheimer's Care Related Disord. Res.* 5, 33-40. doi: 10. 1177/153331759000500307

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[CrossRef Full Text](#) | [Google Scholar](#)

Luckner, J. L. (1989a). Effects of participation in an outdoor adventure education course on the self-concept of hearing-impaired individuals. *Am. Ann. Deaf* 134, 45-49. doi: 10. 1353/aad. 2012. 0646

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Luckner, J. L. (1989b). Altering locus of control of individuals with hearing impairments by outdoor-adventure courses. *J. Rehabil.* 55, 62-67.

[Google Scholar](#)

Macklin, M. L., Metzger, L. J., Lasko, N. B., Berry, N. J., Orr, S. P., and Pitman, R. F. (2000). Five-year follow-up study of eye movement desensitization and reprocessing therapy for combat-related posttraumatic stress disorder. *Compr. Psychiatry* 41, 24-27. doi: 10. 1016/S0010-440X(00)90127-5

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Malenbaum, S., Keefe, F. J., Williams, A., Ulrich, R., and Somers, T. J. (2008). Pain in its environmental context: implications for designing environments to enhance pain control. *Pain* 134, 241-244. doi: 10. 1016/j. pain. 2007. 12. 002

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Maller, C., Townsend, M., Pryor, A., and Brown, P., St. Leger, L. (2006). Healthy nature healthy people: ' contact with nature' as an upstream health promotion intervention for populations. *Health Promot. Int.* 21, 45-54. doi: 10. 1093/heapro/dai032

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Marshall, R. D., Beebe, K. L., Oldham, M., and Zaninelli, R. (2001). Efficacy and safety of paroxetine treatment for chronic PTSD: a fixed-dose, placebo-controlled study. *Am. J. Psychiatry* 158, 1982–1988. doi: 10. 1176/appi. ajp. 158. 12. 1982

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Mather, J. A., Nemecek, D., and Oliver, K. (1997). The effect of a walled garden on behavior of individuals with Alzheimer's. *Am. J. Alzheimer's Dis.* 12, 252–257. doi: 10. 1177/153331759701200603

[CrossRef Full Text](#) | [Google Scholar](#)

McCaffrey, R. (2007). The effect of healing gardens and art therapy on older adults with mild to moderate depression. *Holistic Nursing Pract.* 21, 79–84. doi: 10. 1097/01. HNP. 0000262022. 80044. 06

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

McMurray, R. G., Berry, M. J., Vann, R. T., Hardy, C. J., and Sheps, D. S. (1988). The effect of running in an outdoor environment on plasma beta endorphins. *Ann. Sports Med. Res.* 3, 230–233.

[Google Scholar](#)

Mehl, M. R., Vazire, S., Holleran, S. E., and Clark, C. S. (2010). Eavesdropping on happiness: well-being is related to having less small talk and more

substantive conversations. *Psychol. Sci.* 21, 539–541. doi: 10.1177/0956797610362675

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

MIND (2007). *Ecotherapy: The Green Agenda for Mental Health*. *Mindweek Report*. Available at: <https://www.mind.org.uk/information-support/tips-for-everyday-living/nature-and-mental-health/>

Mowatt, R. A., and Bennett, J. (2011). Veteran stories, PTSD effects and therapeutic fly-fishing. *Ther. Recreat. J.* 45, 286–308.

[Google Scholar](#)

Naess, A. (1990). *Ecology, Community and Lifestyle: Outline of An Ecosophy*. Cambridge: Cambridge Press.

[Google Scholar](#)

Naess, A. (2001) “ Ecosophy: deep versus Shallow Ecology” in *Environmental Ethics: readings in Theory and Application* , ed. L. Pojman (Belmont, WA: Wadsworth), 150–156.

[Google Scholar](#)

Naess. A. (1973). The shallow and the deep, long-range ecology movement. A summary. *Inquiry* 16, 95–100. doi: 10.1080/00201747308601682

[CrossRef Full Text](#) | [Google Scholar](#)

Neslen, A. (2017). *Access to Nature Reduces Depression and Obesity, Finds European Study*. *The Guardian*. Available at: <https://www.theguardian.com/society/2017/mar/21/access-nature-reduces-depression-obesity-european-report>

NIMH (National Institute of Mental Health) (2011). *Post-Traumatic Stress Disorder (PTSD) Risk Prediction*. Available at: <https://www.nimh.nih.gov/news/events/2011/post-traumatic-stress-disorder-ptsd-risk-prediction/index.shtml>

Noddings, N. (2006). *Critical Lessons: What our Schools Should Teach*. New York, NY: Cambridge University Press. doi: 10. 1017/CBO9780511804625

[CrossRef Full Text](#) | [Google Scholar](#)

Numeroff, R. E. (1983). *Managing Stress: A Guide for Health Professionals*. Rockville, MD: Aspen.

[Google Scholar](#)

OECD (Organisation for Economic Co-operation and Development). (2017). *Obesity Update 2017*. Available at: <https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf>

Olmsted, F. L. (1865) " The value and care of parks" reprinted in *The American Environment: Readings in the History of Conservation* , ed. R. Nash (Reading, MA: Addison-Wesley), 18-24.

Ornish, D., Brown, S. E., Billings, J. H., and Scherwitz, L. W. (1990). Can lifestyle changes reverse coronary heart disease?: The Lifestyle Heart Trial. *Lancet* 336, 129-133. doi: 10. 1016/0140-6736(90)91656-U

[CrossRef Full Text](#) | [Google Scholar](#)

Ottoson, J., and Grahn, P. (2008). The role of natural settings in crisis rehabilitation. How does the level of crisis influence the response to experiences of nature with regard to measures of rehabilitation? *Landsc. Res.* 33, 51-70. doi: 10. 1080/01426390701773813

[CrossRef Full Text](#) | [Google Scholar](#)

Park, S.-H., and Mattson, R. H. (2009a). Ornamental indoor plants in hospital rooms enhanced health outcomes of patients recovering from surgery. *J. Alternat. Compliment. Med.* 15, 975-980. doi: 10. 1089/acm. 2009. 0075

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Park, S.-H., and Mattson, R. H. (2009b). Therapeutic influences of plants in hospital rooms on surgical recovery. *HortTechnology* 44, 102-105.

[Google Scholar](#)

Park, S.-H., Mattson, R. H., and Kim, E. (2002). Pain tolerance effects of ornamental plants in a simulated hospital room. *Acta Horticult.* 639, 241-247.

[Google Scholar](#)

Park, S-H., and R. H. Mattson, R. H. (2008). Effects of flowering and foliage plants in hospital rooms on patients recovering from abdominal surgery. *HortTechnology* 18, 563-568.

[Google Scholar](#)

Peacock, J., Hine, R., and Pretty, J. (2007). *Got the Blues, Then Find Some Greenspace. Mental Benefits Green Exercise Activity Green Care Report Mind*. Colchester, University of Essex.

[Google Scholar](#)

Plante, C. G., Gores, C., Brecht, C., Carrow, J., Imbs, A., and Willemsen, E. (2007). Does exercise environment enhance the psychological benefits of exercise for women? *Int. J. Stress Manage* . 14, 88-98. doi: 10. 1037/1072-5245. 14. 1. 88

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Plante, T. G., Aldridge, A., Su, D., Bogdan, R., Belo, M., and Kahn, M. (2003). Does virtual reality enhance the management of stress when paired with exercise? An exploratory study. *Int. J. Stress Manage*. 10, 203-216. doi: 10. 1037/1072-5245. 10. 3. 203

[CrossRef Full Text](#) | [Google Scholar](#)

Plante, T. G., Cage, C., Clements, S., and Stove, A. (2006). Psychological benefits of exercise paired with virtual reality: outdoor exercise energizes

whereas indoor virtual exercise relaxes. *Int. J. Stress Manage.* 13, 108-117.

doi: 10.1037/1072-5245.13.1.108

[CrossRef Full Text](#) | [Google Scholar](#)

Pretty, J., Griffin, M., Sellens, M., and Pretty, C. J. (2003). *Green Exercise: complimentary Roles of Nature, Exercise and Diet in Physical and Emotional Well-Being and Implications for Public Health. CES Occasional Paper 2003-1*, Colchester: University of Essex.

Pretty, J., Peacock, J., Hine, R., Sellens, M., South, N., and Griffin, M. (2007). Green exercise in the UK countryside: effects on health and psychological well-being, and implications for policy and planning. *J. Environ. Plann. Manage.* 50, 211-231. doi: 10.1080/09640560601156466

[CrossRef Full Text](#) | [Google Scholar](#)

Pretty, J., Peacock, J., Sellens, M., and Griffin, M. (2005). The mental and physical health outcomes of green exercise. *Int. J. Environ. Health Res.* 15, 319-337. doi: 10.1080/09603120500155963

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Prince, H., Allin, L., Sandseter, E. B. H., and Arlemalm-Hagser, E. (2013). Outdoor play and learning in early childhood from different cultural perspectives. *J. Adven. Educ. Outdoor Learn.* 13, 183-188. doi: 10.1080/14729679.2013.813745

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

Purdie, N., Hattie, J., and Carroll, A. (2002). A review of the research on interventions for attention deficit hyperactivity disorder: what works best? *Rev. Educ. Res.* 72, 61-99. doi: 10. 3102/00346543072001061

[CrossRef Full Text](#) | [Google Scholar](#)

Raanaas, R. K., Patil, G. G., and Hartig, T. (2010). Effects of an indoor foliage plant intervention on patient well-being during a residential rehabilitation program. *HortScience* 45, 387-392.

[Google Scholar](#)

Ramchand, R., Schell, T. L., Karney, B. R., Osilla, K. C., Burns, R. M., and Caldarone, L. B. (2010). Disparate prevalence estimates of PTSD among service members who served in Iraq and Afghanistan: possible explanations. *J. Trauma Stress* 23, 59-68. doi: 10. 1002/jts. 20486

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Ratanapojnard, S. (2001) *Community-Oriented Biodiversity Environmental Education: its Effect on Knowledge, Values, and Behavior Among Rural Fifth- and Sixth-Grader Students in northeastern Thailand* . Ph. D. Thesis, School of Forestry and Environmental Studies, Yale University, New Heaven, CT.

Reiche, E. M. V., Nunes, S. O. V., and Morimoto, H. K. (2004). Stress, depression, the immune system and cancer. *Lancet* 5, 617-625. doi: 10. 1016/S1470-2045(04)01597-9

[CrossRef Full Text](#) | [Google Scholar](#)

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

Relf, D. Ed. (1992) *The Role of Horticulture in Human Well-being, and Social Development* . Portland, OR: Timber Press.

Richards, H. J., and Kafami, D. M. (1999). Impact of horticultural therapy on vulnerability and resistance to substance abuse among incarcerated offenders. *J. Offender Rehabil.* 29, 183-193. doi: 10. 1300/J076v29n03_11

[CrossRef Full Text](#) | [Google Scholar](#)

Russell, K. (2001). What is wilderness therapy? *J. Exp. Educ* . 23, 170-176. doi: 10. 1177/105382590102400203

[CrossRef Full Text](#) | [Google Scholar](#)

Russell, K. C., Hendee, J. C., Phillips-Miller, D. (1999) “ How wilderness therapy works: an examination of the wilderness therapy process to treat adolescents with behavioral problems and addictions” in *Proceedings: Wilderness Science in a Time of Change, eds D. N. Cole and S. F. McCool (2000. Proc. RMRS-P-000)* . Ogden, UT: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Ryan, R. M., Weinstein, N., Bernstein, J., Warren Brown, K., Mistretta, L., and Gagne, M. (2010). Vitalizing effects of being outdoors and in nature. *J. Environ. Psychol.* 30, 159-168. doi: 10. 1016/j. jenvp. 2009. 10. 009

[CrossRef Full Text](#) | [Google Scholar](#)

Seegerstrom, S. C., and Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychol. Bull.* 130: 601-630. doi: 10. 1037/0033-2909. 130. 4. 601

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Shapiro, F. (2014). The role of eye movement desensitization and reprocessing (EMDR) therapy in medicine: addressing the psychological and physical symptoms stemming from adverse life experiences. *Permanente J.* 18, 71-77. doi: 10. 7812/TPP/13-098

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Sibthorp, J., and Jostad, J. (2014). The social system in outdoor adventure education programs: present and future. *J. Exp. Educ. State Knowl. Issue 37*, 60-74. doi: 10. 1177/1053825913518897

[CrossRef Full Text](#)

Strauss, M. C., and Simpson, S. P. (1998). *Horticulture as Therapy*. New York, NY: Haworth Press.

[Google Scholar](#)

Smucker, W. D., and Hedayat, M. (2001). Evaluation and treatment of ADHD. *Am. Fam. Physician* 64, 817-829.

[Google Scholar](#)

Son, K. C., Um, S. J., Kim, S. Y., Song, J. E., and Kwack, H. R. (2004). Effect of horticultural therapy on the changes of self-esteem and sociality of individuals with chronic schizophrenia. *Acta Horticult.* 639, 185-191. doi: 10.17660/ActaHortic. 2004. 639. 23

[CrossRef Full Text](#) | [Google Scholar](#)

Spencer, C., and Wooley, H. (2000). Children and the city: a summary of recent environmental psychology research. *Child Care Health Dev.* 26, 395-422. doi: 10.1046/j.1365-2214.2000.00125.x

[CrossRef Full Text](#) | [Google Scholar](#)

Stein, M., Kline, N. A., and Matloff, J. L. (2002). Adjunctive olanzapine for SSRI-resistant combat-related PTSD: a double-blind, placebo-controlled study. *Am. J. Psychiatry* 159, 1777-1779. doi: 10.1176/appi.ajp.159.10.1777

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Stern, P. V. D. (1970). *The Annotated Walden: walden; or, Life in the Woods*. New York, NY : Clarkson N. Potter.

[Google Scholar](#)

Swimme, B., and Berry, T. (1994). *The Universe Story: From the Primordial Flaring Forth to the Ecozoic Era - A Celebration of the Unfolding of the Cosmos*. San Francisco, CA: Harper.

Szofran, J., and Myer, S. (2004). Horticultural therapy in a mental health day program. *J. Ther. Horticult.* 15, 32-35.

[PubMed Abstract](#) | [Google Scholar](#)

Takano, T., Nakamura, K., and Watanabe, M. (2002). Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. *J. Epidemiol. Commun. Health* 56, 913-918. doi: 10. 1136/jech. 56. 12. 913

[CrossRef Full Text](#) | [Google Scholar](#)

Tanielian, T., Jaycox, L. (Eds) (2008) *Invisible Wounds of War: Psychological and Cognitive Injuries, their Consequences, and Services to Assist Recovery* . Santa Monica, CA: RAND Corporation.

Taylor, A. F., and Kuo, F. E. (2009). Children with attention deficits concentrate better after walk in the park. *J. Atten. Disord.* 12, 402-409. doi: 10. 1177/1087054708323000

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Taylor, A. F., Kuo, F. E., and Sullivan, W. C. (2001). Coping with ADD: the surprising connection to green play settings. *Environ. Behav.* 33, 54-77. doi: 10. 1177/00139160121972864

[CrossRef Full Text](#) | [Google Scholar](#)

Taylor, A. F., Kuo, F. E., and Sullivan, W. C. (2002). Views of nature and self-discipline: evidence from inner city children. *J. Environ. Psychol.* 22, 49-64
doi: 10.1006/jevp.2001.0241

[CrossRef Full Text](#) | [Google Scholar](#)

Taylor, A. F., Wiley, A., Kuo, F. E., and Sullivan, W. C. (1998). Growing up in the inner city: green spaces as places to grow. *Environ. Behav.* 30, 3-27. doi: 10.1177/0013916598301001

[CrossRef Full Text](#) | [Google Scholar](#)

Taylor, S., Thordarson, D. S., Maxfield, L., Fedoroff, I. C., Lovell, K., and Ogradniczuk, J. (2003). Comparative efficacy, speed and adverse effects of three PTSD treatments: exposure therapy, EMDR, and relaxation training. *J. Consult. Clinic Psychol.* 71, 330-338. doi: 10.1037/0022-006X.71.2.330

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Taylor, T. K., Schmidt, F., Pepler, D., and Hodgins, C. (1998). A comparison of eclectic treatment with Webster-Stratton's parents and children series in a children's mental health center: a randomized controlled trial. *Behav. Ther.* 29, 221-240. doi: 10.1016/S0005-7894(98)80004-X

[CrossRef Full Text](#) | [Google Scholar](#)

Teas, J., Hurley, T., Ghumare, S., and Ogoussan, K. (2007). Walking outside improves mood for healthy postmenopausal women. *Clin. Med. Oncol.* 1, 35-43. doi: 10.4137/CMO.S343

[CrossRef Full Text](#) | [Google Scholar](#)

Tennessen, C. M., and Cimprich, B. (1995). Views to nature: effects on attention. *J. Environ. Psychol.* 15, 77-85. doi: 10. 1016/0272-4944(95)90016-0

[CrossRef Full Text](#) | [Google Scholar](#)

Thomas, M. (2004). The potential unlimited programme: an outdoor experiential education and group work approach that facilitates adjustment to brain injury. *Brain Injury* 18, 1271-1286. doi: 10. 1080/02699050410001698776

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Thompson, C. W., Roe, J., Aspinall, P., Mitchell, R., Chow, A., and Miller, D. (2012). More green space is linked to less stress in deprived communities: evidence from salivary cortisol patterns. *Landsc. Urban Plann.* 105, 221-229. doi: 10. 1016/j. landurbplan. 2011. 12. 015

[CrossRef Full Text](#) | [Google Scholar](#)

Tilt, J., Unfried, T., and Roca, B. (2007). Using objective and subjective measures of neighborhood greenness and accessible destinations for understanding walking trips and BMI in Seattle, Washington. *Am. J. Prev. Med.* 21, 371-379. doi: 10. 4278/0890-1171-21. 4s. 371

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Totton, N. (2011). *Wild Therapy: Undomesticating Inner and Outer Worlds*.
Ross-on-Wye: PCCS Books.

[Google Scholar](#)

Tse, M. M., Ng, J. K., Chung, J. W., and Wong, T. K. (2002). The effect of visual stimuli on pain threshold and tolerance. *J. Clin. Nurs.* 11, 264-269. doi: 10.1046/j.1365-2702.2002.00608.x

[CrossRef Full Text](#) | [Google Scholar](#)

Tzoulas, K., Korpela, K., Venn, S., Yli-Pelkonen, V., Kazmierczak, A., Niemela, J., et al. (2007). Promoting ecosystem and human health in urban areas using green infrastructure: a literature review. *Landsc. Urban Plann.* 81, 167-178. doi: 10.1016/j.landurbplan.2007.02.001

[CrossRef Full Text](#) | [Google Scholar](#)

Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landsc. Res.* 4, 17-23. doi: 10.1080/01426397908705892

[CrossRef Full Text](#) | [Google Scholar](#)

Ulrich, R. S. (1981). Natural versus urban scenes: some psychophysiological effects. *Environ. Behav.* 13, 523-556. doi: 10.1177/0013916581135001

[CrossRef Full Text](#) | [Google Scholar](#)

Ulrich, R. S. (1983). "Aesthetic and affective response to natural environment," in *Human Behavior and Environment*, eds I. Altman and J. F. Wohlwill (New York, NY: Plenum Press)

[Google Scholar](#)

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science* 224, 420-421. doi: 10.1126/science.6143402

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Ulrich, R. S. (1986). Human responses to vegetation and landscapes. *Landsc. Urban Plann.* 13, 29-44. doi: 10.1016/0169-2046(86)90005-8

[CrossRef Full Text](#) | [Google Scholar](#)

Ulrich, R. S. (1999). "Effects of gardens on health outcomes, theory and research" in *Healing Gardens: Therapeutic Benefits and Design Recommendations*, eds C. Cooper-Marcus and M. Barnes (New York, NY: John Wiley and Sons), 27-86.

[Google Scholar](#)

Ulrich, R. S. (2001) "Effects of healthcare environmental design on medical outcomes" in *Design and Health*, ed. A. Dilani (Stockholm: Svensk Byggtjänst), 49-59.

[Google Scholar](#)

Ulrich, R. S., Dimberg U., and Driver B. L., (1991). " Psychophysiological indicators of leisure benefits," in *Benefits of Leisure* , eds B. L. Driver, P. J. Brown, and G. L. Peterson (State College, PA: Venture).

[Google Scholar](#)

Ulrich, R. S., Lunden, O., and Etinge, J. L. (1993). Effects of exposure to nature and abstract pictures on patients recovery from heart surgery. *Psychophysiology* 5 1: 7.

[Google Scholar](#)

van den Berg, A. E., Maas, J., Verheij, R. A., and Groenewegen, P. P. (2010). Green space as a buffer between stressful life events and health. *Soc. Sci. Med.* 70, 1203–1210. doi: 10. 1016/j. socscimed. 2010. 01. 002

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

van der Berg, A. E., and van der Berg, C. G. (2010). A comparison of children with ADHD in a natural and built setting. *Child Care Health Dev.* 37, 430–439. doi: 10. 1111/j. 1365-2214. 2010. 01172. x

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

van Loon, M. (2004). Grey and green in the Netherlands: research supporting the value of nature-based activities for elderly people. *GrowthPoint* 99, 6–7.

[Google Scholar](#)

Veitch, J., Salmon, J., and Ball, K. (2010). Individual, social and physical environmental correlates of children's active free-play: a cross-sectional study. *Int. J. Behav. Nutr. Phys. Activity* 7: 11. doi: 10.1186/1479-5868-7-11

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Voruganti, L. N. P., Whatham, J., Rec, D., Bard, E., Parker, G., Babbey, C., et al. (2006). Going beyond: an adventure- and recreational-based group intervention promotes well-being and weight loss in schizophrenia. *Can. J. Psychiatry* 51, 575-580. doi: 10.1177/070674370605100905

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Walch, J. M., Rabin, B. S., Day, R., Williams, J. N., Cho, K., and Kang, J. D. (2005). The effect of sunlight on postoperative analgesic medicine use: a prospective study of patients undergoing spinal surgery. *Psychos. Med.* 67, 156-163. doi: 10.1097/01.psy.0000149258.42508.70

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Wells, N. M. (2000). A home with nature: effects of "greenness" on children's cognitive functioning. *Environ. Behav.* 39, 775-795. doi: 10.1177/00139160021972793

[CrossRef Full Text](#) | [Google Scholar](#)

Wells, N. M., and Evans, G. W. (2003). Nearby nature: a buffer of life stress among rural children. *Environ. Behav.* 35, 311-330. doi: 10.1177/0013916503035003001

<https://assignbuster.com/ecotherapy-a-forgotten-ecosystem-service-a-review/>

[CrossRef Full Text](#) | [Google Scholar](#)

Whall, A. L., Black, M. E., Groh, C. J., Yankou, D. J., Kupferschmid, B. J., and Foster, N. L. (1997). The effect of natural environments upon agitation and aggression in late stage dementia patients. *Am. J. Alzheimer's Dis.* 12, 216-220. doi: 10.1177/153331759701200506

[CrossRef Full Text](#) | [Google Scholar](#)

Wichrowski, M., Whiteson, J., Haas, F., Mola, A., and Rey, M. J. (2005). Effects of horticultural therapy on mood and heart rate in patients participating in an inpatient cardiopulmonary rehabilitation program. *J. Cardiopulm. Rehabil.* 25, 270-274. doi: 10.1097/00008483-200509000-00008

[PubMed Abstract](#) | [CrossRef Full Text](#) | [Google Scholar](#)

Wilson, E. O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press.

[Google Scholar](#)

Wilson, S. J., and Lipsey, M. W. (2000). Wilderness challenge programs for delinquent youth: a meta-analysis of outcome evaluations. *Evaluat. Program Plann.* 23: 1. doi: 10.1016/S0149-7189(99)00040-3

[CrossRef Full Text](#) | [Google Scholar](#)