

## Cognitive, Mental and Social Benefits of Interacting with Nature: A Systematic Review

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### Abstract

Nature experiences have a positive effect on mental health, especially on psychological well-being because nature is perceived as a supportive, peaceful environment, and an emotional sanctuary. This paper aims to review and document a broad range of empirical evidence regarding the benefits of the experience of nature from cognitive, clinical, and social dimensions separately. The findings investigating the social aspects of interacting with nature point out the connective feature of natural entities through revealing hedonic and self-transcendent feelings and modifying the self-other perception (e.g., self-diminishment) in favor of facilitating social value orientation and oneness among human beings. Having contact with nature also extends cognitive abilities by replenishing attention, memory, executive functioning, and learning capacities, and bolstering creative potential. The experience of nature has uplifting benefits on positive mood, empowers psychological well-being, recovery, and relaxation via mitigating stress and anxiety levels. Socially, contact with nature elicits social cohesiveness through facilitating social value orientation, perspective-taking, and helping behavior. Improving well-being via nature connectedness may be effective in decreasing psychological symptoms such as stress, negative mood states, and expectedly mental health disorders such as depression and anxiety. The several ways of how nature contributes to individual and societal well-being are discussed in the light of the literature.

**Keywords:** Nature, cognitive benefits, well-being, social relationships

Nature, as its name suggests, naturally offers a beneficial living space for our sensory, emotional, cognitive, physical, and mental health in many ways. These effects – considering a cognitive perspective – apply to many areas, from attention (i.e., Basu et al., 2019; Berman et al., 2008; Schutte et al., 2017; Van Hedger et al., 2019), memory (i.e., Bratman et al., 2015; Schertz & Berman, 2019; Wells, 2000) and creativity (i.e., Atchley et al., 2012; Kiewra & Veselack, 2010; Williams et al., 2018) to executive functions (i.e., Bourrier et al., 2018; Gamble et al., 2014; Kaplan, 1993) and learning (i.e., Atchley et al., 2012; Holden & Mercer, 2014; Kiewra & Veselack, 2010; Kuo et al., 2019; Williams et al., 2018), and across all age groups (children, young adults, and elderly). It is also possible to find the cognitive foundations of nature in the neural infrastructure of the brain (i.e., Kim et al., 2010; Kross et al., 2007; Pati et al., 2014; Ulrich, 1981). Therefore, it is very valuable to observe these holistic effects both in neural pathways and in individuals' attitudes and behaviors by taking the perspective of nature itself.

Nature's effect on mental health is generally studied under the term "ecopsychology" which brings ecology and psychology together (Conn, 1998; Rozsak, 1992). Feeling connected to nature has a positive effect on psychological well-being (i.e., Brymer et al., 2020; Cervinka et al., 2011; Choe et al., 2020; Dobson et al., 2021; James et al., 2015; Martyn & Brymer, 2014). Stress (i.e., Ameli et al., 2021; Mishels et al., 2021; Olafsdottir et al., 2018) and anxiety (i.e., Martyn & Brymer, 2014; Song et al., 2020; Yin et al., 2020) are widely studied with nature experiences,

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and these studies indicate that exposing to nature has a significant effect on decreased stress and anxiety level. Because nature is related to well-being and decreased levels of stress and anxiety, it can be a mitigative factor to related disorders such as depression or anxiety disorder (Gascon et al., 2018; Pouso et al., 2020; Pun et al., 2018; Townsend, 2006).

The social benefits of exposure to nature are observed in greater prosocial tendencies including social connection, social value orientation (Diessner et al., 2008; Weinstein et al., 2009), perspective taking (Zhang et al., 2014), helping and generous behavior (Gueguen & Stefan, 2014; Zhang et al., 2014). The observed effects were driven by dispositional tendency to perceive natural beauty and positive effect including "awe", a facilitator of spiritual, moral, and aesthetic experience encompassing feelings of diminished sense and balanced view of self, connection to a greater whole and in turn, attention for surrounding others (Joye & Bolderdijk, 2015; Keltner & Haidt, 2003; Stellar et al., 2018; Zhang et al., 2014).

## Method

Research articles, meta-analyses, other reviews, and related books were examined for the scope of the current review. Different studies from different regions were also included, provided they were written in English. Regarding the cognitive benefits of nature, studies between 1981-2020 were reached. The key terms for the cognition-relevant search were learning, executive functions, creativity, (working) memory, neural-correlates, spatial cognition, decision making, self-monitoring, executive functions, attention, cognitive flexibility, and problem-solving.

The mental health part of the current article includes studies about ecopsychology, nature effects on mental health, and relations with mental health disorders and nature conducted between 2006 and 2021. Search terms were ecopsychology, nature connectedness, nature relatedness, nature and well-being, depression, stress, anxiety, mental health disorders, psychopathologies, greenness, nature effect, and interacting with nature. Starting from the newest studies, related studies mentioned in the current studies were reached. Even though the focus was on the most recent studies, some studies conducted before 2014 were included only if they have highly related results to nature and mental health.

Research about the social benefits of contact with nature was limited. Search terms were prosociality, perspective-taking, and social values. This review mostly included the experimental studies which were conducted in the recent decades (i.e., from 2009 to 2016). To understand the relations between the terms, research about the literature of relevant emotions (e.g., awe) was also reported.

## Cognitive Benefits of Experience of Nature

Nature as a whole has enormous effects on the cognitive functioning of human beings. It has numerous and substantial positive effects on many cognitive functions from learning and executive functions to creativity and memory. Still, neurological origins of nature could be found in the brain in relevant studies investigating the underlying mechanisms under how we are affected by nature.

## Neural-Correlates of Experience of Nature

Is it possible to observe the positive effects of nature on the human brain? For instance, in a study, participants who watched natural landscapes showed more relaxation activity in their brains than those who watched urban images (Ulrich, 1981). Still, natural stimuli may lead to reduced attention fatigue and hence renewal of attention through alpha-theta oscillations and synchronization (Chen et al., 2020). As the experience with nature affects individuals in many cognitive aspects, neural reflections of these effects could be observed in the brain, as well (Kim et al., 2010; Pati et al., 2014).

In general, functional magnetic resonance imaging (fMRI) is used in studies investigating the neural traces of experience of nature. In a sampler study (Pati et al., 2014) using fMRI, the participants were given positive, negative, and neutral images along with the natural stimuli. Brain activities of these participants who were exposed to different nature and non-nature images for a short time (i.e., 25 seconds) and also for a long time (i.e., 12 minutes) were measured. In the shorter version of the study, the participants were shown 32-images (equal number of positive, negative, neutral, and nature stimuli). In the longer version, these participants were exposed to a sky composition

and a traditional ceiling image for a total of 12 minutes. In general, sky images are as appreciated as more positive images, as expected (Kaplan et al., 1972; Laumann et al., 2003). In the shorter version of the study, the results indicated that activation patterns were observed in similar areas of the brain for sky compositions and positive images compared to negative and neutral images. What is more interesting, sky compositions produced activation in specific areas of the brain. That is, spatial cognition, perceived motion, and circadian rhythm were some of these areas. In the longer version of the study, sky compositions were found to activate dream-related areas in the brain, while traditional ceiling images tend to activate areas related to facial processing and potentially visual hallucinations. As a result, nature stimuli presented with vegetation and sky could provide beneficial effects different from those provided by positive stimuli in general.

In another study, using fMRI, the brain activity patterns of the participants were examined during the presentation of natural and urban images (Kim et al., 2010). In the study, natural landscape images include contents such as mountains, natural parks, and forests, while urban images include tall buildings and city landscapes. Different areas were activated while the participants were presented with natural or city images. For instance, the basal ganglia, anterior cingulate gyrus, superior and middle frontal gyri, and insula get activated when the participants viewed natural landscapes. However, for the urban images, parahippocampal gyrus, inferior frontal gyrus, amygdala, and hippocampus activations were observed. The superior and middle frontal gyri, one of the brain areas that are activated especially for natural landscapes, plays a role in emotional cognitive processing. Still, these areas are thought to be particularly sensitive to approach-avoidance emotions. On the other hand, the inferior frontal gyrus mostly activated for urban images, is related to decision making. It has been suggested that this activation area is also related to the sensitivity to rejection due to self-monitoring (Kross et al., 2007). The emotional response for selecting the nature stimuli over urban stimuli may have caused the related areas to get activated.

### **Executive Functions, Learning, and Creativity**

Nature may encourage learning by increasing individuals' attention, stress level, self-discipline, interest, and pleasure in learning, physical activity, and fitness. Nature could also provide a calmer, quieter, warmer, more collaborative, and safer environment for learning (Kuo et al., 2019). On the other hand, during the experience of nature, there could be a smooth transition between intrinsic mind wandering and enchantment towards extrinsic nature. This transition increases ways that strengthen attention control. In addition, the experience of nature provides support for flexibility, mind wandering, and developing relationships between ideas required for creativity (Williams et al., 2018).

Attention Restoration Theory (ART) posits that exposure to natural environments regenerates the executive attention system. For example, the four-day immersion in nature and the associated disconnection from multimedia and technology significantly increases the performance of a group of hikers in creativity and problem-solving. So, spending time in a natural environment brings about cognitive advantages (Atchley et al., 2012).

Nature's ability to keep one's attention at a moderate level allows for the "essential mental housekeeping" (Kaplan, 1993, p. 48) necessary to deal with persistent, unresolved thoughts that would otherwise create a burden on sources of attention while leaving enough room for thinking (Basu et al., 2019). According to ART, directed attention can get fatigued and then refreshed again when individuals spend time in a restorative environment. Accordingly, studies have shown that school-age children's performance in attention tasks gets significantly better after hiking (but not after urban walking) (Schutte et al., 2017).

Still, viewing nature but not the urban has significantly increased executive attention in both young adults and older people (Gamble et al., 2014). Including nature in learning environments may have a beneficial effect on students' knowledge, at least for short periods of time (Holden & Mercer, 2014). It has been suggested that short exposure to nature has a direct positive effect on executive mental functioning (Bourrier et al., 2018).

ART assumes that natural stimuli may restore directed attention functions by reducing demands on the (endogenous) attention system. Brief experiences with natural sounds can improve directed attention function (Van Hedger et al., 2019). Filled with engaging stimuli, nature draws attention in a bottom-up manner and gives a chance to regenerate top-down directed attention abilities. Unlike natural settings, urban environments are full of stimuli

that attract attention dramatically and require additional directed attention making them less uplifting (Berman et al., 2008).

Exposure to various natural stimuli (versus urban stimuli) improves working memory performance (Schertz & Berman, 2019). For instance, children whose homes were nearer to the green areas had higher levels of cognitive abilities (Wells, 2000). On the other hand, natural outdoor classrooms are environments that increase the creativity and imagination of children, due to the factors such as the use of open-ended materials and careful, observant adults that support creative play (Kiewra & Veselack, 2010). Lastly, nature walking (compared to urban walking) also resulted in increased working memory performance (Bratman et al., 2015).

### **Mental Benefits of Interacting with Nature**

Nature has a positive effect on mental health, and it is widely studied that how nature can be beneficial to our well-being. Having a connection with nature may be protective to psychological disorders and also it can help us to regulate our negative mood states, stress, or anxiety level.

### **Ecopsychology: Nature and Psychological Well-being**

Ecopsychology, first described by Roszak (1992), investigates the relationship between psychological well-being and the connection to nature. Ecology is a study of connection with all kinds of life and physical environment. It brings ecology and psychology together (Conn, 1998). Even though ecopsychology is directly related to psychology, it can also strongly be related to different philosophies, spiritualities, and ways of living (Scull, 2008). Because many therapy approaches agree that feeling connected with nature and experiencing nature connectedness positively affect psychological health, it is important to study ecology and psychology together. From an ecopsychological perspective, it is believed that people can be psychologically healthy when they feel deeply connected with a larger system that they are part of (Conn, 1998).

Ecopsychology is directly linked with well-being (Martyn & Brymer, 2014; Roszak, 1992). Even though lack of opportunities and low life qualities in some rural areas can negatively affect mental health (Birch et al., 2020), a significant number of studies found there is a positive relationship between nature and psychological well-being (Brymer et al., 2020; Cervinka et al., 2011; Choe et al., 2020; Dobson et al., 2021; James et al., 2015; Martyn & Brymer, 2014; Pritchard et al., 2020; Rantala & Puhakka, 2019; Sia et al., 2020; Yeo et al., 2019; Zhang et al., 2014). Individuals generally see nature as a mental and emotional sanctuary, because nature is perceived as an accepting, safe, uniquely supportive area, and it enhances psychological well-being (Brymer et al., 2020). Choe, Jorgensen, and Sheffield (2020) created a 3-week mindfulness program with 122 participants either participating in nature or control groups. While nature groups participate in this study in rooms covered with trees, creepers, and nature images; control groups have an empty room with white walls or a room covered with urban setting images. They found that significant changes in well-being and mindfulness programs are more effective in natural environments. Also, participants with natural environments showed improvement even the study was over one week ago.

Still, exposing some nature-related good experiences over a week in urban settings such as seeing a squirrel in a park, a flower in a wall, or a view of the sky can increase participants' well-being. Moreover, participants reported increased well-being one month after the study was conducted (Dobson et al., 2021). In Sia et al.'s study (2020), elderly individuals participated in a therapeutic nature-based horticulture program. This program included growing pea sprouts, setting up planters, growing vegetables from different modes, and some nature-related art activities such as making sun-catchers and leaf sketching. All sessions were designed to stimulate all senses of the participants (touching, seeing, smelling, etc.). As a result, the participants reported higher psychological health, lower anxiety, and maintained healthier sleep patterns. Additionally, Rantala and Puhakka (2019) found that spending time in nature makes young people calmer and helps them to get away from daily stresses.

Spending longer time in nature (such as staying in a nature area overnight) is related to higher psychological well-being scores (Puhakka et al., 2016). Compared with indoor walks, people who take an outdoor walk in nature reported increased positive affect, relaxation, fascination, and decreased negative affect (Nisbet & Zelenski, 2011). Walking in nature enables a feeling of relatedness to nature and this nature-relatedness can be mediating outdoor walker's positive affect findings.

## Nature Effect on Mental Health

Nature has a significant effect on well-being. It is also strongly related to mental health symptoms such as stress or anxiety (Ameli et al., 2021; Fong et al., 2018; Reese et al., 2021). Exposing greenness has an impact on stress recovery and increased happiness related to the restorative power of nature (Mishels et al., 2021). Participants who experienced virtual reality including nature view reported increased positive affect and decreased negative mood state (Reese et al., 2021).

Japanese Shinrin-yoku (forest bathing, i.e., spending silent time in a woodland environment) among participants' stress levels was one of the interesting studies in this area (Markwell & Gladwin, 2020). Participants were guided to conduct an actual Shinrin-yoku or a digital one (a video about a one-hour forest walk). Positive affect and well-being were higher in participants who did Shinrin-yoku in both ways. However, the digital nature-bath group reported the loss of concentration compared with an actual nature-bath group which reported mental refreshment. Another study was conducted with cancer patients receiving chemotherapy. Participants exposed to nature-based virtual reality views reported a significant increase in their relaxation, feelings of peace, and positive distraction (Scates et al., 2020).

Olafsdottir and colleagues (2018) compared 3 groups participating in actual nature-walk, walking in a gym with nature views on scenes, and only nature view-watch condition without any physical movement. Results indicate that the actual nature walk group has the largest decrease in cortisol level when participants were under more stress. In another study conducted recently in military health care, the participants who take 20 minutes walk in a woodland environment reported lower levels of distress and higher mindfulness from the participants who take a 20-minute walk in a crowded campus road in a military health care facility (Ameli et al., 2021).

Having a connection and touch with nature is a protective factor against environmental stressors. Exposure to nature can help us to restore our emotions and attention (Berto, 2014). Also, nature experiences increase physiological and psychological well-being even if it is virtual (Reese et al., 2021). Participants who have been exposed to a room with greenery walls via virtual reality reported improved blood pressure and reported significantly better post-stress responses on both physical stress levels and psychological anxiety levels (Yin et al., 2020).

Comparing with city view, watching forest view for 15 minutes end up with increased positive mood state (i.e., vigor) and decreased negative mood states (i.e., confusion) in college students. Also, participants with high anxiety levels in the nature-view group reported increased psychological relaxation (Song et al., 2020). Feeling connected to nature is directly linked with decreased anxiety levels, especially with lower trait cognitive anxiety and state cognitive anxiety levels (Martyn & Brymer, 2014). Even though exposing nature views or "feeling connected" with nature is effective on mental health, it is important to be connected with nature, and having touch with the environment (Martyn & Brymer, 2014; Mayer et al., 2008). Being connected with nature has the effect of not only reducing cognitive and trait anxiety but also somatic anxiety. Somatic anxiety levels were found lower in people who engage in outdoor physical activity and have higher levels of nature connectedness (Lawton et al., 2017).

Although nature studies commonly focused on well-being, stress, and anxiety, there are few studies interested in mental disorders (Gascon et al., 2018; Townsend, 2006; Pun et al., 2018). Nature can be a protective factor among mental health disorders such as depression and anxiety (Gascon et al., 2018). Having contact with greenness has a significant beneficial effect on individuals' health and especially on depression treatment (Townsend, 2006). Another study found that engaging nature is significantly linked with lower anxiety symptoms, depression symptoms, and self-perceived stress (Pun et al., 2018).

During the Covid-19 pandemic, it is found that higher intensity of lockdown is associated with higher levels of mental health disorders symptoms. Lockdown significantly and negatively affected an individual's mental health, on the other hand having a connection with nature helped to cope especially with people under strict lockdown (Pouso et al., 2020). A recent study collected data from 9 different countries and 5,218 participants who are under strict lockdown. People who have limited or lack access to outdoor public places reported significantly higher mental health symptoms than people who have access to outdoor public places. For instance, the participants from

under severe lockdown in Spain reported that nature was helpful to cope with the lockdown effect, also the participants who have outdoor space access or have a view about the blue-green environment mentioned more positive emotions (Pouso et al., 2020).

### **Social Aspects of Interacting with Nature**

Beyond the several beneficial effects of having contact with nature on the restoration of cognitive resources, emotionally uplifting, stress reduction, and recovery; how powerful is nature to establish connectedness between human beings? What are the psychosocial implications of being immersed in a natural environment and how nature shapes the perceptions of each other?

### **Nature and Prosociality**

Broadly speaking, the prevalence of green areas in urban spaces is related to perceptions of improved social connections (Kuo et al., 1998). Connectedness to and embeddedness in nature (e.g., "I often feel a sense of oneness with the natural world around me") is correlated with prosocial traits and increased self-other overlap (Mayer & Frantz, 2004). In one study, a brief nature contact, just sitting in a park for 5 minutes prompted the self-transcendent feelings of connection to a greater whole compared to sitting indoors (Neil et al., 2018). In a two-week nature-based well-being intervention program in which participants were required to take photographs of the emotion-provoking surroundings and report their emotional experiences, the participants assigned to the nature condition reported elevated levels of connectedness to other people and displayed greater prosocial orientation (Passmore & Holder, 2016).

The tendency to perceive natural beauty positively predicted self-report perspective taking, interpersonal empathic concern, and agreeableness even when individual differences in connectedness with nature were controlled (Zhang et al., 2014) and it is negatively associated with materialistic values (Diessner et al., 2008). Participants who were stimulated with subjectively rated more beautiful images tended to engage in more prosocial behavior in tasks measuring generosity with money allocation task for the anonymous partner and a trust game, compared to the ones exposed to less beautiful natural images. This relation is mediated by positive affect and moderated by dispositional proneness to perceive natural beauty. The same relation and the interaction effects were held constant when participants reported their current feelings in the presence of actual more beautiful plants situated in the lab, exposure to more beautiful plants prompted more volunteer helping behavior to the experimenter in a so-called charity task which requires folding paper cranes for tsunami victims in Japan (Zhang et al., 2014). When the features of the stimuli presented to the participants were extraordinary and awe-evoking as opposed to mundane natural environments (e.g., parks and gardens), mood improvements were higher through the mediating role of feelings of "awe", participants felt smaller (as an index for feelings of smallness, humility, and respect), and were more prosocial in a social value orientation task. Moreover, both nature conditions yielded more feelings for connection to others, caring, and spirituality than the neutral group (Joye & Bolderdijk, 2015).

In a series of studies, Weinstein and colleagues (2009) documented that being immersed in natural environments in a lab manipulation yielded higher prosocial and other-focused value orientation (intrinsic aspirations, e.g., "to have deep enduring relationships") and lower self-focused value orientation (extrinsic aspirations, "to be financially successful.") reports than being immersed in an urban environment. In a field experiment, the relation of exposure to a natural environment (less than 1 min) and helping behavior was found. Passersby who were immersed in a park with trees, lawns, and flowers were more readily helpful following the confederate's drop of the glove to the ground than the ones who did not enter the park yet (Gueguen & Stefan, 2014). Again, positive mood fully mediated this relation, and the desire to help others was a partial mediator. Similarly, in one study, participants were required to gaze up either towards a bunch of rising eucalyptus trees or equivalently tall buildings. The ones in the first group reported more feelings of awe and prosociality, less entitlement and they were more likely to help the experimenter to pick up the pens dropped accidentally within the mise en scene of the experiment (Piff et al., 2015).

### **Positive Affect, Awe, and Prosociality**

Natural contexts trigger a bunch of positive emotions including joy, relaxation, and gratitude (e.g., Berman et al., 2012). Positive affect in turn is found to be associated with a broad range of escalated helping behavior including charity and volunteerism (Bizman et al., 1980; Lyubomirsky et al., 2005). These associations are aligned with the

broadening and build the theory of positive emotions (Fredrickson, 1998) which posits that positive emotions broaden the perspective-taking capacity and thought-action repertoire and consequently, builds physical, intellectual, and social resources such as motivating to take actions with long-term benefits including prosocial behaviors.

The other pathway linking exposure to nature to prosociality is supported by the mediating role of feelings of awe and the tendency to perceive natural beauty. Awe is an emotion having moral, spiritual, and aesthetic extensions and is defined with two central themes namely perceived vastness and need for accommodation (Keltner & Haidt, 2003). Vastness points out to a larger entity that may be in physical size or a social size that transcends self's ordinary level of experience or frame of reference. Accommodation refers to a cognitive process of expansion of mental structures in front of the new experience that falls outside one's ordinary understanding of the world and is hard to assimilate into one's current mental state (Keltner and Haidt, 2003). The conceptualization of awe also shows overlap with the notions of "unselfing" (Murdoch, 1967, as cited in Joye & Bolderdijk, 2015) that reflects feelings of smallness, self-forgetfulness, connectedness, or oneness with others which are underlying indicators of prosociality (Shiota et al., 2007; Van Cappellen & Saroglou, 2012). Given that nature is raised as a rich source that provides experiences of initiating beauty with a vast range of and extraordinary sensory stimuli, it has the potential to facilitate feelings of awe (Keltner & Haidt, 2003; Shiota et al., 2007), and participants who were more likely to experience awe were also more likely to appreciate natural beauty, a mediator on the relation of natural exposure and prosociality (Güsewell & Ruch, 2012). Through this pathway, awe is found to be operated on the relation of natural beauty and prosociality as in line with research showing that awe-inspiring natural stimuli linked with humility through self-diminishment, the participants reported more accurate and balanced view of themselves when they were requested to list their strengths and weaknesses. They articulated their attributions for life successes with more contributions of other people (Stellar et al., 2018) as a gate to promote prosociality.

### Conclusions

From the cognitive perspective, interaction with nature affects many areas such as memory, attention, executive functions, creativity, and so on. These effects are states of improvement achieved with the increase in the capacities of the relevant concepts. It is possible that with this increased cognitive capacity, both mental, physical, and emotional recovery coefficients of individuals may increase in parallel. For all these reasons, it's time to take nature seriously as a (consolidated) learning, (healthy and happy) living, and (natural) creating resource.

Nature experiences have a positive effect on mental health, especially on psychological well-being because nature is perceived as a supportive, peaceful environment, and an emotional sanctuary (Brymer et al., 2020). Improving psychological well-being via nature connectedness may be effective in decreasing psychological symptoms such as stress, negative mood states, anxiety types, and expectedly mental health disorders such as depression and anxiety. For these reasons, it seems nature can be a protective factor among psychopathological symptoms, and it can be possible that using nature experiences and building a connection to nature can be effectively used in psychological interventions. Because it is proven that not only having actual touch with nature but also using virtual reality nature experiences are effective (Scates et al., 2020; Reese et al., 2021; Yin et al., 2020), it can be possible to adopt virtual reality greenness exposure to the psychotherapies.

The findings investigating the social aspects of interacting with nature point out the connective feature of natural entities through revealing hedonic and self-transcendent feelings and modifying the self-other perception (e.g., self-diminishment) in favor of facilitating social value orientation and oneness among human beings. This being the case, the experience of nature seems to deliver societal benefits and can be used as a helpful tool by the authorities to build more cohesive neighborhoods with an increased capability of perspective-taking and interpersonal empathic concern.

## Compliance with Ethical Standards

### Author Contributions

All authors developed the concept for this manuscript, carried out the literature search, critically analyzed the relevant literature, wrote the manuscript, and proofread it.

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