Indian Journal of Health and Well-being
2020, 11(1-3), 84-92
http://www.iahrw.com/index.php/home/journal_detail/19#list

ISSN-p-2229-5356,e-2321-3698, NAAS Ratings 4.13
https://doi.org/10.15614/IJHW.v11i01.18

Human nature connection and mental health: What do we know so far?

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The rapid deterioration of both the natural environment and mental health calls attention to investigate the link between their parallel decline. Anticipating the need for an analysis of the same, the present paper attempts to summarise the literature covering human-nature connection and its implications for mental health in terms of research, therapy and intervention. The papers reviewed are organised under three sections. The first section delineates the effects of nature exposure on health and conceptualises the various nature-based therapies and techniques in literature. The second section includes the literature on Nature Deficit Disorder-a term, given by Richard Louv, referring to the collective consequences of disconnect with nature among today's children. Finally, the third section includes evidences that support rebuilding the connection through outdoor education and the importance of turning to indigenous ways of teaching for a better impact.

Keywords: nature connectedness, nature deficit disorder, anthropocentric

Ecopsychology, among the various existing definitions, is conceptualised as “the expansion and revisiting of psychology to take the ecological context of human life into account” (Metzner, 2008).

The growing gap between Man and Nature has not only driven an alarming ecological decline but has also contributed to a multitude of physical, mental, and emotional illnesses in the modern age. Roszak (1995) postulates that the world's ecological crisis is directly linked with humanity's growing state of psychopathology. Traditional societies, who live in closer connection to the earth, define and distinguish “sanity” and “madness” in terms of their relationship to their natural habitat. Further the imbalance in the human-nature relationship, greater the “madness” found amongst human beings, and greater the likelihood of ecological destruction (Naoufal, 2016).

“Original Trauma”, according to Hay (2005), is the separation of nature from everyday human life. Domestication of nature does not make humans feel “more in control … it actually makes us feel more lost and terrified” thereby making it unnatural for humans to live that way (Hay, 2005). However, humans continue to live in denial and this is further eased by the unintentional 'biased language' that perpetuates Speciesism belief that human beings are superior to other living things and therefore their exploitation is justifiable (Gibney, 2016). Human language has reflected this bias for so long that it has now become the accepted truth. Instead of focusing on healing the self and the planet, the focus has shifted on things that allow escaping from reality- materialistic things that are readily available in the modern world. And technology plays a major part in facilitating this escape. Fisher (1996) concluded that urban and individualist societies are the root of much of human suffering embodied in the form of grief, despair, anxiety, depression, and addiction. The irony is that despite living in an era of unlimited access to information and awareness, feelings of hopelessness and helplessness are more than ever. Awareness without action brews distress. Bonding with the earth and other living things through a therapeutic self-exploration prepares direct action. In healing the earth, humanity can heal itself (& vice versa). This is the premise of ecopsychology.

Invariably, *Ecotherapy* aims to create a therapeutic model that attempts to reconnect people to themselves, their environment, and as a result, to life itself; while at the same time, urges for the importance of green spaces to be accessible in every neighbourhood (Burls, 2005). The greater the amount of time spent in nature, the longer the happiness boost persists. The happier and healthier people are as a result of access to natural environments, the greater their tendency to behave in ways that are environmentally friendly (Westlund, 2015).

Some theories addressing the relationship between humankind and the natural environment are as follows

Biophilia hypothesis

Wilson (1984) postulated the existence of an inherent, biologically-based, possibly genetic, human need to affiliate with life and lifelike processes. And this biophilic affiliation to nature largely influenced human identity, personal fulfilment as well as positive emotional, cognitive, aesthetic and spiritual development. A part of this theory is that a healthy fear, called biophobia, of some aspects of the natural world is essential for human survival. Therefore, there is a balance of respect or healthy fear of some aspects of nature and a capacity to experience a sense awe and wonder with nature.

Kaplan's attention restoration theory

Attention Restoration Theory (ART) posits that people have two types of attention: *directed attention and fascination,* the former being effortful while the latter being effortless. Directed attention is described as an intentional mental process used when focusing on a given task or for warding off or inhibiting unnecessary information, such as noise or distracting stimuli. It is a highly limited resource, and can be depleted if one does not have opportunities for recovery. ART argues that depleted directed attention could be recovered

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through a restorative experience of effortless fascination in natural environments (Kaplan & Kaplan, 1989; Kaplan, 1995).

From an existentialist perspective, humans exist by being-in-the-world, and the world exists because there is a being to disclose it. This idea adds an important perspective to the understanding of mental health and illness and the importance of human connectivity to other living things (Naoufal, 2016). The concept of nature connection views nature as an integral aspect of human life and as that which has a direct effect on health. In a world facing environmental crises of epidemic proportion, the only way for people to begin to take responsibility for their part in the protection of the natural environment is for them to reconnect with that which they are meant to be protecting. By showing how individuals are affected by their connection (or lack there of) with nature and the importance to build this connection, the present study attempts to add a much-needed perspective to the environmental crisis debate.

Aim of the study

The study aims to review the current literature on Human-Nature connection in terms of its implications for mental health.

Purpose of the study

- Develop a conceptual understanding of the directions explored so far in the domain,
- Identify avenues that hold potential for promising results and,
- Gain insights that can help navigate future research.

Method

Search strategy

Potential articles were identified using keyword, abstract and title searches of the search terms, “nature connection”, “nature therapy”, “nature deficit disorder”, and “ecological intelligence”. These searches were further combined with the Boolean operators AND/ORs. The search for relevant papers was conducted in the following electronic databases:

- OmniFile Full Text Mega (H.W. Wilson) accessed through EBSCO
- Google Scholar

Inclusion criteria for selection,

- Publication in English language
- Publication from January 2000 to December 2018
- Articles with full text available.

Exclusion criteria for selection,

- Articles with only abstract available
- Book reviews and commentaries.

After applying the inclusion and exclusion criteria, the total count of articles was at 3,909. Given the sheer volume, a decision was reached to consider articles in the first 10 pages of the google scholar search for each term (800 articles) while all relevant articles within the EBSCO search were considered (20). Articles were screened by examining the titles and abstracts for relevance. The final count of selected articles was 76.

Limitations of the methodology

Since only those articles yielded from the first 10 pages of the Google Scholar search were taken, there is possibility of potential articles being left out that could have contributed further meaning and depth to the review. Another limitation was the restriction of the search to the specific search terms used which may have missed or filtered articles that have used similar other keywords.

Results and discussion

The reviewed literature has been organised into three sections. The first section includes studies investigating the effects of nature exposure on well-being, emphasizing its importance in developing therapeutic mode. In the same section, the various nature-based therapeutic practices in literature have been conceptualised and categorised. The second section presents Nature Deficit Disorder- a term referring to the collective consequence of disconnect with nature among today's children. And the final section highlights evidences that support rebuilding the connection through outdoor education and the importance of turning to indigenous ways of teaching for better impact.

Section 1: Nature exposure and health

The benefits associated to interaction with natural and man-made green environments depend, first, on the duration and timing of the exposure (Shanahan et al., 2016). Short-term exposure to forests, urban parks, gardens and other semi-natural environments has been found to reduce stress and depressive symptoms, increase self-reported positive emotions, improve self-esteem, mood, perceived mental and physical health and produce physiological and psychological relaxation (Park et al., 2017; Song, Igarashi, Ikei, & Miyazaki, 2017; Song et al., 2015, 2018, 2013; Takayama et al., 2014). Long-term exposure to natural environments, such as residing in areas with high greenness or in diverse landscapes, has been associated to reduced mortality and to improved mental health (Fong, Hart, & James, 2018). 'Chronic' exposure to green spaces investigated over varying spatial scales, demonstrate positive effects over distances varying between 150 m and 5 km (Maas et al., 2009).

Outdoor time has been linked with physical activity increase and lower chronic disease risk, including cancer, cardiovascular diseases, diabetes and obesity (Beyer, Szabo, Hoormann, & Stolley, 2018). Rogerson et al. (2016) found that exercising in a natural environment as compared to indoor settings could encourage directed attention and social interactions, which in turn may positively influence future exercise intentions.

Exposure to green or natural environments has been found to be particularly important during prenatal development and early life. Birth weight of infants was seen to be positively influenced by their mother's neighbourhood greenness (James et al., 2015). Local greenery has also been linked to prevalence reductions of obesity in children and shown to have a positive effect on adolescents' blood pressure (Dadvand et al., 2014; Bijnens et al., 2017).

Long-term effects have also been implicated in early exposure to natural environments. For example, early life exposure to beneficial microbes is seen to have effects on the development of the immune system and prevalence of chronic inflammatory diseases (Flandroy et al., 2018); early exposure to nature is seen to increase the potential benefits of green spaces in later life (Van den Berg et al., 2016), such as the stress-reducing properties of nature (Hansen et al., 2017). Conversely, the lack of interaction with nature during early life, for instance, due to the limited time spent in nature or green space in urbanized environments, has been associated with a number of

emotional, cognitive and physical difficulties in children, described by Louv (2005) as *'Nature Deficit Disorder'*.

In *'The Nature Principle',* Louv (2012) argues that the negative consequences of a nature deficit are also true for adults of any age and provides examples of positive effects of restorative outdoor experiences such as outdoor gyms and natural terrains, the adoption of healing gardens at hospitals, family and neighbourhood nature clubs engaging in regular outdoor activities, and workplace gardens. Louv states these outdoor activities are sources for "Vitamin N", needed to nourish both the psyche and body. Outdoor learning is also equally effective among adult populations (18-35 years) with the natural settings and wilderness acting as means for cultural, spiritual, transformative as well as leadership learning (Walter, 2013).

The therapeutic and restorative benefits of nature contact has been explored on the basis of three main areas of contact: Viewing nature (Ochiai et al., 2017; Song et al., 2017; Song et al., 2018); being in the presence of nearby nature (Fong et al., 2018); or active participation and involvement with nature (Friesen, 2010; Kobayashi et al., 2018; Machado & Swank, 2018). In the case of depression, immersing oneself in nature not only relieves symptoms but also creates positive effects such as less mental rumination and fewer negative thoughts (Beyer et al., 2014). Studies have investigated restorative benefits for physiological processes (Kobayashi et al., 2017; Song, Ikei, & Miyazaki, 2017; Song et al., 2016) and several have been dedicated to benefits on attention and stress, built on the foundation of Kaplan's Attention Restoration theory (ART) and Ulrich's Stress Reduction theory.

One such project on nature-based rehabilitation (NBR) was the Alnarp Rehabilitation Garden established in 2002. In a longitudinal single case study design, Pálsdottír (2014) investigated NBR effects on stress-related mental disorders. Results revealed that the participants had a strong need to be alone with nature, undisturbed by the presence of others when resting or handling the emotions evoked in the rehabilitation. Solitary engagement with nature was negatively affected when others entered the scene. This quality of the supportive environment was termed as *social quietness.* The Perceived Sensory Dimensions of: *serene, nature, prospect,* refuge and *space* as well as ART qualities of *extent, being away, fascination* and *compatibility* were found to be the most significant qualities of supportive environments in the rehabilitation garden. Significant positive changes in self-rated health, improved function in everyday life and perceived occupational values in daily life, especially the value of *self-reward,* were also found.

Positive physiological and psychological benefits of nature experience have also been found through *olfactory* (Igarashi, Ikei, Song, & Miyazaki, 2014) and *tactile* (Koga & Iwasaki, 2013) stimulation. One review of the benefits of nature delivered through non-visual senses (sound, smell, taste, touch) and three non-sensory pathways (ingestion or inhalation of phytoncides, negative air ions & microbes) concluded that (1) these non-visual modalities of nature experience have potential to deliver benefits; (2) the evidence is relatively weak and often based on correlational studies; and (3) further exploration of these sensory and non-sensory avenues is needed (Franco et al., 2017).

Richardson et al. (2017) in a review, found that at the workplace, those whose 'inner strength' was restored through exposure to nature photos had greater perseverance in logic and reasoning tasks; visual and physical access to workplace greenery was significantly related to decreased stress; garden and nature-based interventions reduced long-term sick leave and stress symptoms; view of nature and the presence of plants in the workplace were associated with a more quick decline in blood pressure after attention demanding tasks, leading to improved worker productivity. Another study found that incorporating biophilic design elements in an office site shed had a strong positive effect in amending stress, enhancing well-being, fostering a cooperative work environment and sustaining productivity (Gray, 2018).

A "review of reviews" by Hartig, Mitchell, de Vries, and Frumkin (2014) found that the reviews on nature and its benefits varied considerably in their methodology, aims as well the environment and/or pathways to health discussed. However the reviews, in general, agreed that the field was largely dominated by observational study designs, that there was need for more consistent and vigorous studies to establish causality relationships between contact with nature and health, and that very few studies have explored the differences in effect by population subgroup, by type of natural environment or by type of contact with nature and that many studies were elusive about consistent and objective measurement.

Nature-based therapeutic avenues

The concept of healthy nature settings and therapy treatment programs have been discussed by many authors in the last few decades, making it difficult to understand and interpret it in its entirety.

Stigsdotter, Pálsdóttir, Burls et al. in *Forests, Trees, and Human health* (2011) summarised the common nature-related terms used in therapeutic literature,

> Some of the most common names for different nature settings are: *restorative gardens or landscapes* (Gerlach-Spriggs et al., 1998); *healing gardens* (Cooper-Marcus & Barnes, 1999); *therapeutic gardens or landscapes* (Kamp, 1996; Kavanagh & Musiak, 1993); *sensory gardens* (Haller, 2004); *care farms* (Hassink & van Dijk, 2006); *community gardens* (Hassan & Mattson, 1993); *urban green therapeutic spaces* (Cooper-Marcus & Barnes, 1999; Burls, 2008). Among the most popular names for therapy programs or interventions are: *"Horticultural Therapy* (Relf, 1992, USA); *Social and Therapeutic Horticulture* (Sempik et al., 2003 UK); *Ecotherapy* (Burls, 2007; 2008a UK; Clinebell, 1996 USA); *Onotherapy* (Milonis, 2004 Italy); *Conservation Therapy* (Hall, 2004 UK); *Nature Assisted Therapy or Nature Guided Therapy* (Burns, 1998; USA); *Nature Therapy* (Berger & McLoed, 2006; Israel); *Ecological Psychotherapy* (Wilson, 2004); *Care Farming or Green Care* (Hassink & van Dijk, 2006); *People-Plant Relationship* (Flagler & Pincelot, 1994) and *Human Issues in Horticulture* (Relf & Lohr, 2003).

Because several different professions work with natural settings, urban parks, and open green spaces that are related to human health and well-being, it is important to discuss some basic definitions to avoid misinterpretations. As quoted by (Stigsdotter et al., 2011).

> Concepts like restorative gardens, healing gardens, sensory gardens and urban green therapeutic spaces are often used to explain that the design in itself is intended to have effects on the visitor's health; it's a question of a relationship between user and setting, without any therapeutic program or certain therapeutic activities (Haller, 2004). Gardens attached to hospitals, nursing homes and hospices can be described in that way.

On the other hand, the meaning of concepts like therapeutic gardens, and care farms involves a special designed or special chosen place and a therapeutic intervention: the places are purposely designed to improve the health experienced by a special client group, through the interplay between the therapeutic setting, the therapeutic activities, the therapeutic team and the clients (Stigsdotter & Grahn, 2002, 2003). However, all these concepts are often mixed and used in other, quite opposite ways.

Therefore, it is observed that there are two different cases. One involves designing and/ or planning nature settings for the improvement or maintenance of people's health. This could be for a certain group of patients or for the general public and can be defined as *'health design and planning'*. While the other involves using a certain setting, specially designed or used for a therapeutic intervention. This can be defined as a *'nature-based therapeutic intervention'* (Stigsdotter et al., 2011).

Horticultural Therapy, Social and Therapeutic Horticulture and People-Plant Relationship (Chalquist, 2009; Kamioka et al., 2014; Pálsdóttir, Persson, Persson, & Grahn, 2014) are concepts that can be merged under a common concept "horticultural therapy" and concern therapeutic interventions using horticultural activities in garden settings (Stigsdotter, Palsdottir, Burls, et al., 2011). Horticultural therapy has been extended to help treat other diseases or is being used in the care of people, for example, those with strokes, generalized pain and vascular spasms, Alzheimer disease and autistic disorders. Additionally, gardens are being used and recognized more because of their positive effects on health, in many different contexts (Machado & Swank, 2018; Pálsdóttir et al., 2014; Wolf & Robbins, 2015).

Care Farming and Green Care (Hine, Peacock, & Pretty, 2008) concern therapeutic interventions in natural settings and, in particular, farms where animals play a crucial role in the therapeutic program. These therapies belong to animal-assisted therapy and there is a fair body of evidence that has investigated the same (Berget & Braastad, 2011; Friesen, 2010).

Outdoor Behavioural health care, Wilderness therapy, Adventure therapy, Nature Immersion Therapy (Combs, Hoag, Javorski, & Roberts, 2016; Dineen, 2018; Harper, Gabrielsen, & Carpenter, 2018; Revell, Duncan, & Cooper, 2014) are another set of related therapy terminologies popularised in the past decade following the idea of Nature Deficit Disorder (NDD)- array of physical, psychological and behavioural issues that are growing every year among the children of today, hypothesized to be resulting from a "disconnect" with nature (Louv, 2005). The postulated solution to this is to bring the children back to nature which has been executed through several ways from implementing outdoor education to increasing the "green space" in school environments and engaging in extension programs such as wilderness or adventure therapy. All of this can be collectively acknowledged under "nature immersion therapy".

Forest Therapy, Forest bathing or Shirin Yoku (Kobayashi et al., 2017; Song, Ikei et al., 2017; Song et al., 2016; Stigsdotter et al., 2011; Takayama et al., 2014) has been widely researched in Japan. Shirin Yoku, a traditional Japanese practice, involves the mindful use of all five senses to immerse oneself in nature. It emerged during the 1980s as a preventive healthcare practice in Japanese medicine. Reported research on this practice have shown therapeutic effects on: (1) the immune system function (increase in natural killer cells/cancer prevention); (2) cardiovascular system (hypertension/ coronary artery disease); (3) the respiratory system (allergies and respiratory disease); (4) depression and anxiety (mood disorders & stress); (5) mental relaxation (Attention Deficit/ Hyperactivity Disorder) and; (6) human feelings of "awe" (increase in gratitude & selflessness) (Hansen et al., 2017).

All the above discussed therapies are also often referred parallelly or briefly as *Ecotherapy, Ecological Psychotherapy, Conservation Therapy, Nature Assisted Therapy, Nature Guided Therapy and Nature Therapy* (Berger & McLoed, 2006; Burls, 2007). For sake of clarity, the term "nature therapy" and "ecotherapy" will be used interchangeably as an umbrella term henceforth. Nature therapy, therefore, integrates elements from various branches such as art and drama therapy, gestalt psychology, eco-psychology, transpersonal psychology, and body-mind practices thus leading to wide avenues of treatment programs (Berger, 2008).

Section 2: Nature deficit disorder

Nature exposure/ contact is clearly seen to have positive effects for well-being. The question then arises as to what would the consequences be when today's children, our future generation, lose their connection to nature? Children today spend less time with nature and an even lesser time outdoors than their parents did when they were children (Stevens, 2010).

Nature-Deficit Disorder (NDD), coined by Louv (2005) describes the alienation and contact deprivation from the natural world, and the subsequent detrimental effects. It is not a verifiable medical condition but rather intends to explain the deteriorating mental and physical health trends (Driessnack, 2009) seen in children as a consequence of their increasing disconnect with nature. However, very few longitudinal studies can provide empirical weight to this assertion and much evidence is rather circumstantial and anecdotal.

This perspective also addresses how technology has impacted shaping the life of children (Louv, 2009). Using electronics was one of the most frequent activities children participated in when they were outdoors; 65.3% of children reported that they often spent time outdoors listening to music, playing video games, or texting (Larson, Green, & Cordell, 2011). Most of their nature experiences happen from the car window, apartment window, classroom window or through the television- indirectly, causing a loss in the ability to experience the world directly; consequences of which include the growing inability to relate to others, and the loss of capacity to think for themselves or learn about the world from a multidimensional perspective. This inability to feel connected to others or to the world is one of the causes of childhood stress, anxiety, depression, and other medical childhood diagnoses (Driessnack, 2009).

Clements (2004) found that majority mothers agreed with the idea that nature was important to children but that fear of safety and the convenient nature of technology made it easier to keep children inside. It seems the dangers of playing outdoors has overridden the benefits once attributed to connection with nature. At the same time, dangers of the digital world that are more deeply rooted in a child's psyche (rather than just a broken arm or scraped knee) have become acceptable (Clements, 2004).

Louv closely relates his observation to the "Biophilia hypothesis" (Wilson, 1986). By moving away from nature and going against its innate affiliation, mankind is not only harming itself but also the

surrounding nature. Nature provides a child with freedom that allows for self-discovery which in turn contributes to a feeling of inner contentment. A lack of this contentment causes further problems that relate directly to NDD's consequences.

When a child is hooked to technology, they've disconnected from reality, from themselves, from each other, and the world around them. Time spent in such an activity disappears under the veil of instant gratification. Meanwhile, spending time with nature does the complete opposite-children are in connection with their own imagination and sense of freedom, with the other children they are playing with, to the world, and to the other living things they co-exist with. This experience is conducive to learning, growing, understanding, and becoming human. Time gets amplified in all these dimensions. Studies have shown that just viewing nature can lengthen the subjective perception of time and reduce impulsivity (Berry et al., 2015; Repke et al., 2018).

Rudd, Vohs, and Aaker (2012) showed that awe expands time perception, alters decision-making and enhances well-being. Nature inspires wonder, awe, and creativity thereby facilitating the full use of the senses (Louv, 2005). Children use the full extent of their imagination when playing in natural settings, inventing games and worlds from their own minds (Sandry, 2013).

Exposure to nature also enhances the cognitive abilities, especially those related to executive functioning (Kofler et al., 2018). For children with cognitive disabilities, nature exposure has been linked with an increase in the degree of cognitive function. Kahn and Keller (2002) believe that the bond between animals and children have high benefits to children diagnosed with autism.

Unstructured play, as opposed to structured play, may potentially offer some socio-emotional benefits as well (Gray, 2011). In free play, children are given the opportunity to manage the environment around them which helps promote problem solving and decision-making skills, as well as develop emotion regulation since it also provides a social element where children must face conflicts, learn to work through them and develop mutual respect and cooperation. Therefore, there is a need for more unstructured, outdoor play time where children get to learn from their experiences with the nature around them.

Being exposed to natural environments can also help increase children's resilience against adversity (Wells & Evans, 2003). It was found that the impact of stressful life events on levels of psychological distress and self-worth was lower for children who lived near nature than for children who did not live near nature. Nature can, thus, play a crucial role in children's ability to cope with stress and can serve as a protective factor for children.

Studies also show that children exposed to nature show a significant decrease in ADHD (Attention Deficit Hyperactivity Disorder) symptoms (Dineen, 2018; Taylor & Kuo, 2011; Kuo & Taylor, 2004; Taylor & Kuo, 2009; van den Berg & van den Berg, 2011). According to Kuo and Taylor (2004), the greener the natural settings to which the child is exposed to, the greater the relief of hyperactivity symptoms. This is, in part, due to an immediate reduction of stress and the increase in physical and mental relaxation. Burdette and Whitaker (2005) support this assertion, stating that "direct exposure to nature enhances children's attention span and focus, their creative thought process, problem solving abilities, self-discipline, and self-regulation". Researchers looking at the impact of nature on ADD symptoms found significantly improved attentional functioning after leisure activities in green environments compared to other environments (indoors or structured outdoor play) (Taylor et al., 2001). Supporting the Attention Restoration Theory (Kaplan, 1989) such findings indicate the potential for nature-based therapeutic interventions as effective alternatives to medications for the treatment of ADHD and ADD.

Section 3: Increasing ecological engagement through education

Healing the broken bond between the young and nature is the goal of resolving Nature Deficit Disorder. One of the fundamental ways of achieving this is to use the surrounding community including nature, as the preferred classroom. Incorporating outdoor experiences to education has a three-fold benefit (1) it enhances learning (2) it enhances the overall physical, mental, social and spiritual health of children and (3) it makes children care for nature. However, most of today's educations are oriented at making a living rather than a life.

Louv (2009) describes natural teachers as those who "intuitively or experientially understand the role nature can play" in children's education and health. Sandry (2013) believes that the role of today's teachers is to provide hands-on experiences with the natural world. Some say that this should not just be the educator's role but the parent's role as well. Realistically, most households don't have the time, finances, or ability to engage themselves with nature since wilderness is becoming more inaccessible as cities continue to develop and expand.

Outdoor education

Friedrich Froebel, known for his work on the importance of play in learning, introduced the term "kindergarten" (Wilson, 2012). "Kindergarten" in German which directly translates to "children's garden" in English, reflects the need to promote children's interaction with nature.

Outdoor education or outdoor-based learning describes learning opportunities and experiences in outdoor settings, deepening learning by actively engaging the senses, through mental and physical stimulation (Louv, 2008). Currently in Western countries, this model has seen implementation in kindergarten and high school levels but it is also being explored to create opportunities for other ages. Much of the literature on outdoor based education, that were reviewed, involved case study approaches or a focus on implementation aspects for a Western population making it slightly less generalizable to other populations. However, the fundamental motivation for all remains the same cross culturally- to bring children back to nature or in some cases, to bring nature back to children.

Place-based education refers to "education in built and human (social, cultural, and economic) environments, as well as in the natural environment" (Paci & Carroll, 2016). Young kindergarteners in Manhattan, USA with Autism Spectrum Disorder are using the Guggenheim Museum as a classroom to learn social skills and foster a sense of self (Di Lello, n.d., as cited in Paci & Caroll, 2016). Children, through guided activities, explore shapes and designs to build their auditory, visual, social, and physical skills. Another place-based education experience, found in India, involves children living in the Himalayan region attending preschool programs based around ecological conservation (Day & Hernandez, n.d.; as cited in Paci & Caroll, 2016). The above programs are examples of place-based education experiences for young children, but there are also

many educational programs designed for high school students. The Semester Schools Network, a group of thirteen schools in the U.S., offers high school students the opportunity to spend a semester participating in a unique educational experience outside the classroom, earning a full semester of academic credits (Semesters Schools Network, n.d., as cited in Paci & Caroll, 2016).

Ferreira, Grueber, and Yarema (2012) conducted a field study on outdoor classrooms and curriculum implemented through a community partnership model. Participants (teachers) in the study reported feeling more confident about their subject knowledge and in their skills to impart that knowledge after the program and the students, reported a sense of "meaningful participation" and a sense of shared purpose.

The pre-primary faculty at Laurel school, Ohio, created a curriculum-*EcoWonder* to increase student engagement with nature. It included turning their courtyard into a "EcoWonder" lab where they would raise gardens in a completely sustainable way, conduct classes on environmental conservation and the importance of recycling all of which were complemented by example, and at the end, a spring festival inviting families. A critical component of the curriculum was to involve both the children and their families to create, again, a sense of community. In their third year, they started a 'Healthy snack initiative' to help children establish lifelong nutritious eating habits (Thornton, 2012).

A study analysing instructor perception narratives found that there were three spatial metaphors central to how instructors story the cultivation of nature connectedness. First was *creating a space for nature connection,* which refers to how instructors establish and uphold a culture of learning that reflects philosophies and values of a broader educational community. Engaging the space which refers to specific strategies or activities used within programs to make nature connection a reality for children. The third metaphor, *broadening the space,* portrays instructors' views on the transformative potential of programs, particularly in terms of how they extend nature connection into wider community and social contexts (Grimwood, Gordon, & Stevens, 2018).

A qualitative study by Stornelli (2017) investigating implementation feasibilities found that nature-based approaches can be integrated in elementary schools regardless of the school environment (i.e.) if accessibility was limited, then natural materials can be used in the class instead. But what really played a significant role was teachers' perception of the outdoors and their willingness to incorporate these experiences (that is, their attitudes & beliefs) in the classroom.

An innovative solution by Lowell school, Tree TALK, combines cell phone technology with nature studies through an interactive audio walking tour of the campus. Visitors are invited to stop at a tree, call it on a cell phone, and engage in a conversation. The trees "answer" calls with student-produced voice messages that are pre-recorded, asks questions and encourage callers to touch, climb, listen, and explore. The project, thus, provides a medium for students to share and apply what they've learnt and also shows that in the right balance, technology and nature do not have to be opposing forces ("Talking to Trees: How Lowell School combats nature deficit disorder," 2012).

However, some limitations to outdoor education as a solution are that they are,

Not fully replicative: Most outdoor education experiences ensure exposure to nature but are not necessarily immersive, hence reducing the generalizability of its effects outside the learning set-up.

Don't really teach survival skills: Only extended time far away from any civilized support can provide authentic wild experience but short-term outdoor experiences do not provide the same effects.

Removed from aboriginal practices: The structured nature of outdoor education, removed from indigenous practices and experiences that reflect the biophilous relationship, makes the whole system counter-productive.

Also, several outdoor programmes are constrained by the emphasis on teaching "scientific taxonomies, categorization, and cataloguing"-aspects that can be easily tied to school curriculum (Dickinson, 2013). These methods of *knowing* nature objectify the natural world and therefore distance children from *relating* to nature. To foster deeper appreciation and holistic understanding of nature, such curriculum-focused programs must be balanced with approaches that tap children's affect and encourage emotional expression and connectedness, such as arts-based programming, sensory awareness activities, and play.

One solution, as suggested by Cohn (2011) is to take inspiration from the indigenous ways of teaching that are holistic in their expression, grounded in the philosophy that humans are extensions of nature itself and aim to facilitate the realisation of the *ecological self*- our ecological identity. This realisation will help develop and expand one's *ecological intelligence.*

Goleman (2010) defines "ecological intelligence" as an individual's ability to apply what they learn about their impact on the environment to make more sustainable choices. Just like how social and emotional intelligence are based on taking another's perspective, ecological intelligence extends this to the natural environment around us. By talking not only about the physical environment but also the world of consumerism, Goleman advocates a form of "radical transparency" by companies that goes beyond eco labels and carbon footprint- one that includes three spheres namely the geosphere (including soil, air, water & climate), the biosphere (our bodies, those of other species & plant life) and the sociosphere (conditions of workers). This transparency will help people push through the "green mirage" wherein a company makes improvement in any one aspect of a complex product and calls it "green" but leaves the other ecologically harmful aspects out of the equation. He stresses that "green" is a relative term, and that life cycle assessment (LCA) is needed to learn about all the inputs and outputs, right from the start to the finish of a particular product.

Although nature operates at different levels from micro to global humans tend to perceive only one level at a time, a tendency that underlies many of our current environmental problems. But through collective information gathering and processing, ecological intelligence will help us move beyond this limitation. Ecological intelligence can, therefore, be used as a medium to address 21st century social and environmental issues such as the growing consumer culture, providing effective environmental education, climate change and sustainability. The goal is to essentially shift towards a society that doesn't consume anything that goes against nature.

Summary and conclusion

The symbiotic relationship between Nature and Mankind has

ensured survival of both across time. But modern civilisation has ignored the importance of this relationship and its significance to well-being, resulting in a "disconnect" with nature over the past decade or so, the consequences of which have been devastating for both mankind and nature. Ecopsychology, therefore, attempts to draw parallels between the present suffering of humanity and the suffering of nature, postulating that there is a direct connection between human wellness and environmental sustainability and highlighting the mutual reciprocity of this relationship.

Past literature shows clearly established beneficial effects of nature on physical, psychological, social and emotional well-being. This has led to the emergence of several interventions and therapeutic models aiming to rebuild the deteriorating connection with nature. While some of these are models designed to improve the general well-being and quality of life, others have been developed for rehabilitation purposes-specifically much have researched the restorative effects of nature on physiological imbalance, attention deficit and stress-related disorders.

Adults of today largely spent their childhood outdoors in nature but today's children are deprived of this crucial connection. This trend of growing disconnect and the rise of several physical and psychological dysfunctions among children such as childhood obesity, ADHD, and social-emotional issues, to name a few, has been termed by Richard Louv as 'Nature Deficit Disorder' (NDD). Although not a diagnostic term, NDD expresses the need to look at the problem of a possible "nature-less" childhood. Research has focussed on rebuilding the connection through outdoor or place-based education. However, the current implementations of these "solutions" have been criticised for their lack of authenticity, thereby highlighting a need to learn from the indigenous practices; focusing at the root of human-nature connection and to bring about the realisation of one's ecological self. Education that incorporates these principles will help develop, among students, ecological intelligence.

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Received February 15, 2020
Revision received February 26, 2020
Accepted February 27, 2020