



# The nature buffer: the missing link in climate change and mental health research

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## Abstract

The connections between climate change and mental health are well known (Berry et al., *Int J Publ Health* 55(2):123–132, 2010; Clayton and Manning 2018; Kim et al., *J Environ Sci Health C* 32(3):299–318, 2014). Research also points to the positive impacts of nature on mental health, well-being, and attention (Capaldi et al., *Int J Wellbeing* 5(4):1–16, 2015; Kaplan and Kaplan 1989; Tillmann et al., *J Epidemiol Community Health* 72(10):958–966, 2018). However, no empirical research has examined how degradation of nature as a result of climate change can impact the mental health benefits that nature provides. This paper first reviews the existing research on the negative mental health consequences of climate change and the benefits of nature exposure for stress, mental health, and well-being. The connection between these two lines of research is examined in order to fully understand the impacts of climate change on mental health. Suggestions for future research are included.

**Keywords** Climate change · Nature · Mental health · Resilience

The climate crisis is perhaps the most existential problem of the 21st century (Butler 2018). The anthropogenic effects of climate change are often neither recognized nor addressed by those who are most at fault, and many consequences are on time scales that are difficult to conceptualize. Indeed, several studies have demonstrated that individuals discount the impact of environmental issues, and this discounting can affect their willingness to participate in action to mitigate climate change (Jacquet et al. 2013; McDonald et al. 2015). However, a lack of salience does not preclude consequences. Climate change impacts livelihoods and economies (IPCC 2018), and also has repercussions for physical and mental health (Berry et al. 2010; Luber and Lemery 2015). The benefits of nature exposure for mental health and well-being are well studied, but they are largely investigated independently from climate change, as illustrated in Fig. 1 (Kaplan and Kaplan 1989; Lackey et al. 2019; Tillmann et al. 2018; Ulrich 1984). The argument presented here is that there is a gap in the empirical research: studies of climate change and mental health do not look at how nature degradation caused by climate change may affect the positive mental health benefits

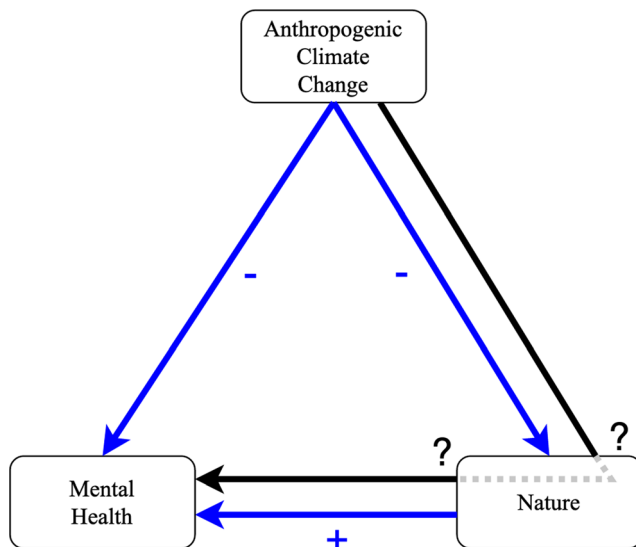
that nature provides. Climate change affects nature, and reduced access to or quality of nature as a result can limit the buffer that nature has for mental health. A better integration of the two separate fields, climate change and mental health, and nature and mental health, will direct us towards possible strategies for how we can be more resilient in the face of climate change.

## Climate change and mental health

The research covering the impacts of climate change on mental health is vast and varied. Many studies focus on “direct impacts” (Doherty 2018), or acute responses to events such as natural disasters or heat waves (Cryder et al. 2006; Fernandez et al. 2015; Galante and Foa 1986; McFarlane 1988; Nolen-Hoeksema and Morrow 1991; Parker et al. 2016). Increased frequency and severity of forest fires, flooding, tornadoes, hurricanes, and other natural disasters have all been tied to climate change, and mental health ramifications increase as a result. For example, increases in posttraumatic stress disorder (PTSD) and major depressive disorder (MDD) rates are consequences of severe weather events and other natural disasters (Hussain et al. 2011). After Hurricane Katrina, the prevalence of PTSD among those impacted by the storm was around 20%, and communities closer to the severe flooding had even

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**Fig. 1** Research clearly lays out how anthropogenic climate change negatively affects mental health through events such as natural disasters and heat waves, and how nature positively affects mental health and well-being. However, if climate change affects nature, it may also have a negative effect on mental health through reducing the positive effects offered by nature

higher rates (Galea et al. 2008). After the 2010 earthquake in Haiti, the rate of MDD was close to 30% (Cerdá et al. 2013). The link between heat and increased aggression is well known (Anderson et al. 2000), but heat waves are also tied to increased mental health issues (Palinkas and Wong 2019; Thompson et al. 2018).

Other research focuses on “indirect impacts” (Doherty 2018), which can describe the anxiety associated with thinking about climate change and the future, or effects of lasting climate change and chronic disruption on mental health (Manning and Clayton 2018). For instance, trauma associated with natural disasters is exacerbated by displacement, as people are forced to flee their homes. Although a recent literature review has found that more research is needed to examine exactly how climate change-forced migration affects mental health (Schwerdtle et al. 2020), the rates of depressive and anxiety disorders, along with suicide rates, are much higher than average among people who are forced to move for their jobs, such as migrant workers (Hiott et al. 2008; Hovey 2000; Hovey and Magaña 2003; Sullivan and Rehm 2005), primarily due to the stress of this moving. Similar impacts may be seen on those forced to migrate due to sea-level rise resulting from a changing climate (Shultz et al. 2019).

Global climate change also affects access to resources. Conflict will arise over resources as the growing period for crops shortens, access to freshwater decreases, and drought rates increase (Levy et al. 2017). Research has already found that a crippling drought in the Levant may have contributed to the civil war in Syria (De Châtel 2014). Other conflicts have been linked to oil, food, and fish scarcities (Adano et al.

2012; Klare 2002; Mearns and Norton 2009). The mental health consequences for civilians who are victims of conflict have been well studied. PTSD and MDD are prevalent among those affected (Morina et al. 2018; Thabet and Vostanis 1999), especially when conflict results in displacement (Miller and Rasmussen 2016), and the effects can last from childhood to adulthood (Dyregrov et al. 2000).

Lastly, climate change increases rates of physical ailments, such as lung diseases, heatstroke, cardiovascular disease, and obesity (Luber and Lemery 2015). Physical maladies are often combined with comorbid psychopathologies (McWilliams et al. 2003), and even an increased rate of suicide (Juurlink et al. 2004).

As can be seen from the literature reviewed here, climate change has significant and varied impacts on public mental health (Bourque and Cunsolo Willox 2014; Kim et al. 2014). Modern textbooks that discuss global climate change and mental health tend to focus direct impacts (Luber and Lemery 2015; Pinkerton and Rom 2014), but more and more research is focusing on indirect impacts. However, these indirect impacts have not yet addressed an important causal connection. Climate change has a deleterious effect on nature in a variety of ways. If nature has positive effects on mental health, then its degradation as a result of climate change could in turn have a negative effect on mental health. In order to start to examine this additional indirect pathway, the effects of nature on mental health have to be explored.

### Nature and mental health

The natural environment has many benefits for mental health.<sup>1</sup> The Attention Restoration Theory (Kaplan and Kaplan 1989) posits that interaction with nature reduces attentional fatigue and, through that, rejuvenates cognitive processes and improves mental health (for a detailed explanation of the theory, see Kaplan 1995). A complementary theory, aptly named the Stress Reduction Theory, describes the links between nature and stress. This theory argues that exposure to nature can also reduce stress and improve mental health generally, as a result (Ulrich et al. 1991).

A substantial body of work has found support for and expanded upon both of these theories. Ulrich (1984) discussed the therapeutic benefits nature provides, even with minimal exposure. For example, over a period of 10 years, hospital records showed that those recovering from surgery experienced fewer complications, self-reported lower pain, and were

<sup>1</sup> For the purposes of this paper, I will be using the term “nature” and “natural environment” as a general term for all non-built environments (including green space) so as to not presuppose anyone’s personal experiences with nature or what they consider to be a natural environment. However, some research in art preferences seems to indicate that the types of natural environments that people prefer are consistent across cultures (Komar and Melamid 1999).

discharged faster if their room had a view of a tree as opposed to a brick wall through a window. Other research has shown that spending time outdoors as opposed to indoors while exercising improves attentional control (Rogerson et al. 2016).

Exposure to nature can also lead to lower levels of stress and act as a buffer in distressing situations, even for grade-school children (Wells and Evans 2003). Looking at both maternal reports of psychological distress and a child's self-report of "self-worth," researchers found that after controlling for socioeconomic status, children with more "natural" area in and near their home experienced less psychological distress in response to stressful life events. In fact, the more stressful the life event, the greater effect nature had on safeguarding against psychological distress.

Other researchers have attempted to identify nature's link to mental health by exploring autonomic nervous system activation, concluding that there are positive correlations between proximity to nature and parasympathetic nervous system activation (van den Berg et al. 2015; Yeager et al. 2018). In a study examining stress and nature, van den Berg et al. (2015) found that participants presented with pictures of green spaces as opposed to "built" (or urban) spaces for 5 min prior to a stressful task experienced greater recovery, as marked by an increase in parasympathetic nervous system activation (the "rest and digest" system). Yeager et al. (2018) examined the link between "greenness" and cardiovascular disease risk (which has been positively correlated with sympathetic nervous system activation). Using GIS data, the researchers found that participants who had higher greenness exposure had lower levels of sympathetic activation.

Nature's benefit to human health can be further explored when the links between stress and physical health are examined, tying together the work of van den Berg et al. and Yeager et al. Continuous sympathetic nervous system activation, which causes the release of cortisol, has negative impacts on human physical health, increasing risk of cardiovascular disease, and reducing immune system function (see Yaribeygi et al. 2017 for a review of the impact of stress on body function). Activating the parasympathetic nervous system through exposure to nature would lower the risk for all of these problems and, additionally, decrease mental fatigue. As studies have shown, the parasympathetic nervous system is activated both after controlled exposure to nature (such as in a laboratory setting or after viewing a picture of nature) and with long-term continuous exposure to nature (such as living in a green area).

More recent research has focused on the duration and type of nature exposure needed for individuals to gain mental health and well-being benefits. While longer and more immersive experiences are better (Stevenson et al. 2018), even relatively short exposures of 30–120 min a week can show positive results (Shanahan et al. 2016; White et al. 2019).

Research on the relationship between nature and mental health is not limited to psychology. The topic is also addressed in public health, psychiatry, environmental studies, urban design, and human ecology fields. While this section is not a comprehensive review of all the literature on this topic, the consensus is clear: nature has positive effects on well-being and mental health (see Hartig et al. 2014 and Shanahan et al. 2015 for discussions of public health benefits of nature, especially in urban environments; Annerstedt and Währborg 2011 for a review on nature-assisted therapy; Collado et al. 2017 for a review of restorative environments; and Franco et al. 2017 for a review on other sensory benefits of nature exposure).

## Connecting climate change, nature, and mental health

The connections between climate change and mental health may seem obvious and well documented, as are the connections between nature and mental health. However, little empirical research includes nature as an explicit buffer between climate change and mental health. The research that does connect climate change, nature, and mental health generally looks at the impact of loss of biodiversity on mental health and ecological grief. An American Psychological Association report in 2009 mentions the need for future research on how climate change may affect the positive benefits nature exposure has, specifically in the context of reduction in biodiversity (Swim et al. 2009). While climate change may not cause areas of nature to vanish, they will transform, and one aspect of this transformation is a reduction in biodiversity. These changes may disproportionately affect lower income communities as the cost of maintaining green spaces rises. An early literature review looking at biodiversity and health and well-being found inconclusive results, particularly the studies focused on psychological well-being (Lovell et al. 2014). A more recent review found that the results are still mixed, with some studies finding evidence that biodiversity promotes mental health and well-being while other studies find non-significant results (Marselle et al. 2019, b); additional research focused on perceived species richness and mental health also found inconclusive correlations (Southon et al. 2018). However, biodiversity loss is only one facet of climate change caused nature degradation.

Another recent line of research that has begun to integrate climate change, nature, and mental health specifically examines the responses people have as a result of nature loss due to climate change (Cunsolo and Ellis 2018), building on previous research of emotional connections to nature (Dufrechou 2004) and distress caused by change in nature (Albrecht et al. 2007). This indirect link between climate change and mental health, called ecological grief, describes the reaction that a person can have in response to either physical ecological losses, loss of environmental identity, or anticipated future

ecological loss, tied to the personal experiences that they have had with nature and the loss of a sense of belonging (Cunsolo and Ellis 2018).

Ecological grief, while important to consider in the context of climate change and mental health, does not address the gap in empirical research proposed here. Nature itself acts as a buffer for mental health (Marselle et al. 2019, b; Van den Berg et al. 2010; Wells and Evans 2003), and climate change is degrading this buffer. Climate change will disrupt the way individuals interact with nature, potentially leading to changes in mental health. The research outlined above illustrates just a few of the ways that nature can have an impact on physical and mental health. Limiting access to nature may also restrict the benefits humans can get from nature. No research has yet attempted to empirically examine this aspect of climate change's impact on mental health. In order to fully understand the severity of the climate crisis that we are facing, we should not ignore any aspect of the impacts of climate change on the natural environment or on human health, physical *or* mental. Not including the more complex and indirect pathways can minimize our understanding of the devastating effects of climate change on mental health, which reduces our ability to adequately respond to and protect against these problems.

## Conclusion

Thinking about the consequences of climate change on mental health and positive benefits of nature on mental health and well-being separately makes it harder to understand both problems. Currently, there is no empirical research on an important question: what are the mental health implications of the nature buffer that is degraded due to climate change? Rising sea levels, increased temperatures, and more frequent natural disasters will reduce access to nature and may cause a decline in quality, due to lower biodiversity, decreased biological production, migration of invasive species, or many other factors.

While more comprehensively examining the links between biodiversity and mental health may represent a first step for future research, attention must also be paid to places where climate change has already had an impact on the natural environment, to examine the impact on the mental health of those who reside there. Longitudinal studies should also be employed in regions particularly susceptible to nature degradation due to climate change, such as coastal areas where sea level rise is occurring or forested areas that are becoming more prone to fires. In addition, studies can be done in places where nature was damaged for some reason not due to climate change, such as deforestation for development or the loss of protected lands for drilling or the creation of oil pipelines. These studies would allow us to examine the pathways of how loss of nature affects mental health, specifically examining the buffer that nature provides.

While researching how to minimize the effects of climate change is important, we increasingly need to focus on survival in a world where climate change is a reality (Bullock et al. 2017; Ristino 2019). The interactions between nature, climate change, and mental health are complex and are not easy to study. Not only are the issues difficult to understand, but it is easy to become overwhelmed with despair and anxiety at the state of the world. However, research overwhelmingly points towards how nature can help in stressful situations, and even more research discusses the importance of taking breaks and acknowledging struggles in environmental studies and sciences (Wallace et al. 2020). Understanding exactly how climate change affects nature and will therefore impact mental health is imperative if we are to become more resilient in a world affected by rapid global change.

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## Declarations

**Conflict of interest** The author declares that there is no conflict of interest.

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