THEMATIC PAPER

Climate change, biodiversity loss and mental health: a global perspective

Paolo Cianconi,[1] Daniele Hirsch,[2] Stefania Chiappini,[3] Giovanni Martinotti[4] and Luigi Janiri[5]

[1]Professor, Institute of Psychiatry and Psychology, Department of Geriatrics, Neuroscience and Orthopedics, Fondazione Policlinico Universitario A. Gemelli IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy. Email pcianco@gmail.com

[2]Resident, Institute of Psychiatry and Psychology, Department of Geriatrics, Neuroscience and Orthopedics, Fondazione Policlinico Universitario A. Gemelli IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy

[3]PhD student, Department of Neuroscience, Imaging and Clinical Sciences, G. D'Annunzio University, Chieti, Italy

[4]Professor, Department of Neuroscience, Imaging and Clinical Sciences, G. D'Annunzio University, Chieti, Italy

[5]Professor, Institute of Psychiatry and Psychology, Department of Geriatrics, Neuroscience and Orthopedics, Fondazione Policlinico Universitario A. Gemelli IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy

Keywords. Climate change; mental health; biodiversity loss; nature experience; ecopsychology.

First received 5 Nov 2021
Final revision 24 Apr 2022
Accepted 25 May 2022

doi:10.1192/bji.2022.20

Climate change can have various psychopathological manifestations which have been more actively addressed by scientific research only in recent years. Indeed, extreme weather events and environmental changes have been shown to be associated with a range of mental health problems. Following the destruction of ecosystems, biodiversity loss can cause mental distress and emotional responses, including so-called 'psychoterratic' syndromes arising from negatively felt and perceived environmental change. Studies investigating relationships between biodiversity and mental health reveal a complex landscape of scientific evidence, calling for a better understanding of this challenging issue.

The World Health Organization (WHO) has described climate change as one of the greatest health threats of the 21st century.[1] It identifies climate change as one of several factors behind the loss of biodiversity, along with habitat change, environmental overexploitation and pollution.[2]

Biodiversity is a multifaceted concept belonging to ecology and it has been defined as the 'variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part'.[3] An ecosystem is a complex dynamic group of various living organisms acting as a whole functioning unity. The diverse groups of ecosystems, the species living within those ecosystems and the genetic variations within each population, in addition to the processes involving their functioning, constitutes what is called biodiversity.[4] With regard to mental health, the relationship between biodiversity and psychology can be summarised in three types of relationship: biodiversity and well-being, biodiversity and mental health, and biodiversity loss and mental disorders. The objective of this perspective paper is to point out what the evidence shows about those relationships and to highlight further fields of investigation.

Biodiversity and well-being

Holistic and biophilic theories see nature as a source of health due to humans' innate emotional affinity for other living organisms. The conservation of natural resources, including biodiversity, has been identified as necessary for the promotion of good health.[5] From Lovell et al's pioneering study, it is clear how difficult it is to identify benefits of nature on mental health. Indeed, their review suggests some caution in making a definitive correlation between biodiversity richness and health, as not all studies reported this association, which appears to depend on the pattern of interaction and type of exposure to nature.[6] Currently, researchers are attempting to identify cues and clues from natural environments leading to better health and a sense of well-being, but these have not yet been clarified.

The way in which people perceive nature depends on cultural factors (e.g. cultural beliefs, religious beliefs, holism), personal factors (e.g. having lived in rural or urban areas, previous experiences), the type of community considered (e.g. current rural or urban dwellers, tourists), the type of contact (direct/indirect) and the preconceived idea that people have about the concept of intact nature. For example, in Western societies, urbanisation often prevents people from open and permanent contact with natural environments, so the contact with an urban park is identified as a nature experience; however, this type of contact has little to do with the concept of biodiversity, suggesting that it may be the perceived biodiversity, rather than the actual biodiversity of places that gives rise to a person's experience of nature.[7] Regarding the relationship between biodiversity and well-being, the effects of exposure to green areas with greater plant diversity have been grouped in: (a) harm reduction, such as reducing stress; and (b) restoring/building capacities, including improving cognitive function (such as memory and attention), increasing positive social interactions and social cohesion, improving mood, self-esteem, relaxation and subjective well-being, and increasing academic performance, imagination and creativity of children.[8]

Biodiversity and mental health

'Nature experience' refers to an individual's perceptions and/or interactions with the natural world (from plants and private gardens to more expansive public green space and wilderness, the weather and movements of the sun) through all sensory modalities, including sight, hearing, taste, touch and smell. These can be real, or occur through representations (e.g. landscape photographs) or simulations (e.g. virtual reality).[9] Mental health benefits from nature experience may occur through multiple psychological causal mechanisms and pathways.[9] The literature

reports an association with a reduction in risk factors for psychiatric disorders, such as improved sleep and reduced chronic stress, and a decreased incidence of certain disorders, such as anxiety, depression, substance use disorders and attention-deficit hyperactivity disorder (ADHD).[9]

One study reported that people in urban areas exposed to more visible and identifiable natural features (plant cover, abundance of afternoon birds) showed a lower prevalence of depression, anxiety and stress; for example, residents of urban areas moving to neighbourhoods with vegetation reported a reduction in depressive symptoms by up to 11%, and the number of anxiety and stress cases fell by up to 25% and 17% respectively.[10] Another study showed that the presence of sufficiently large green spaces close to a community can reduce the risk of schizophrenia.[11] Nonetheless, although a recent review by Marselle and colleagues[12] found some evidence to suggest that biodiversity promotes better mental health and well-being, more studies reported a non-significant association. A possible interpretation of these data could be that if a certain threshold is not exceeded, the loss of biodiversity would not have direct negative effects on mental health or well-being.[13] Moreover, no studies determined the level of biodiversity that is required for an environment to have mental health benefits. Also, a limitation emerging from the cited studies is that most of them focused on urban environments in high-income countries, leaving out low- and middle-income countries.[14] In fact, a further aspect contributing to the complexity of the relationship between biodiversity and mental health is that the effects vary according to socioeconomic factors, preferences, place of residence, occupation, culture, gender and age.[15] It would appear that exposure to biodiversity may be positive for mental health if individuals are in built environments with favourable social conditions (e.g. in northern European and North American countries), whereas greater biodiversity might not show the same benefit for the mental health of those living in poorer social conditions.[16]

Biodiversity loss and mental disorders

The Global Assessment Report describes a biosphere transformed and degraded by human activity: 75% of the Earth's surface has been significantly altered and over 85.5% of the wetland area has been lost.[2] In this regard, ecosystem services refer to the varied benefits to humans provided by the natural environment and healthy ecosystems; they include (a) regulating services, for example carbon sequestration and climate regulation; (b) provisioning services, including food and raw materials; (c) cultural services, including use of natural systems as motifs in books, films and paintings, or for school excursions and scientific discovery; and (d) supporting services such as nutrient cycling, primary production and soil formation.[17] Ecological integrity refers to the ability of environmental life-support systems to sustain themselves in the face of human-induced impacts. Ecological integrity is rapidly declining to the point where adaptation strategies will not be optional but necessary for survival.[13]

Biodiversity loss and its consequences in terms of psychopathology for individuals and communities is becoming an area of great interest for mental health. Psychological symptoms, including anxiety, frustration and depression that cannot be attributed solely to intrapsychological or family issues may arise from a 'disconnection' from the natural world. One study found that people residing in the lowest amount of green space had 24% higher risk of developing schizophrenia.[18] Biodiversity loss can also have an impact on individuals and communities through emotional and affective responses that result not directly from a traumatic event, but rather from the simple observation and ascertainment of climate change effects worldwide, for example territories known to specific populations for generations can be dramatically modified by climate change. In fact, climate change and the speed of the disruption have direct and indirect effects leading to societal vulnerability. We are only beginning to understand the functional adaptation (biological, phenotypical, behavioural and technological) that our species can generate in the face of a radical change such as the massive loss of biodiversity: maladjustments range from the psychopathology of individuals and groups to processes of collapse of complex societies in general.[19]

Besides biodiversity loss, worsening habitat conditions may push people towards migration, which is itself a risk factor for major psychiatric disorders. It can be hypothesised that our slow reactive adaptation to the rapid loss of biodiversity might reduce our resilience to major stressors and traumatic experiences. As early as 2007, Albrecht and colleagues[20] noted the existence of a form of emotional distress arising from the awareness that humankind faces problems due to climate change, suggesting how this awareness contributes to what they termed 'psychoterratic syndromes', which include phenomena such as ecoanxiety, ecoguilt, ecoparalysis, ecological grief and solastalgia. These concerns about the health of the biosphere (for example watching the slow and seemingly irrevocable impact of ecological imbalance, feeling frustration due to an inability to cope with climate change, and anxiety concerning the future of later generations) are now experienced more keenly as people are globally immersed in information and communication about it.[21]

It will certainly take time and further studies to identify these new diseases and disorders. There are no specific references to mental disorders related to climate change in the DSM-5 or ICD-11. However, in response to the growing mental health effects of long-lasting climate-related events, psychotherapists are

https://doi.org/10.1192/bji.2022.20 Published online by Cambridge University Press

pioneering a new field of treatment, termed 'ecopsychology', dedicated to the study of the connection between environmental changes caused by human activity and the psychological difficulties resulting from our increasing experience of these changes. Ecopsychology is comprised of multiple subdisciplines, which include subcategories such as nature, spirituality, transpersonal psychology, environmental activism, experiential environmental education, human ecology, ecotherapy and nature connection.[22] The therapeutic focus of ecopsychology is also a central component of this field, looking for the roots of environmental problems in human psychology and society and the roots of some personal and social problems in our dysfunctional relationship with the natural world. Adaptation to climate change requires from humans a frequent switch between different levels of perspective, ranging from macro- (e.g. resources), to meso- (e.g. collectivity, ethnic realities, mass phenomena and psychosocial phenomena) and micro- (e.g. psychological adaptation, family and individual) levels. Coping strategies are needed to manage the feelings and thoughts that these changes may provoke, so that people can come to terms with them; also, a reduced psychological distance is associated with a higher level of concern and more pro-environmental intentions that lead to better adaptation.[6] Finally, psychiatry and psychology, dealing with biodiversity, are refining their tools of study and proposing further targeted studies, for example aimed at investigating the complex interaction with social determinants, natural disasters (hurricanes, floods, fires and heat waves of short duration) and industrial/technological emergencies (technological disasters triggered by natural hazards, or 'natech' disasters).

Data availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

Acknowledgements

We are grateful to *BJPsych International* for covering in their journal such an important and topical issue as climate change and mental health, and for giving us the opportunity to share our knowledge on the topic, which has been the subject of our research over the past few years.

Author contributions

P.C. conceived the paper and organised it with L.J. and G.M.; P.C. carried out literature searches which D.H. and S.C. used to write the first draft of the paper; D.H. and S.C. edited the drafts of the paper according to corrections provided by P.C., L.J. and G.M.

Funding

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Declaration of interest

None.

References

1 Convention on Biological Diversity, World Health Organization. *Connecting Global Priorities: Biodiversity and Human Health. A State of Knowledge Review*. CBD/WHO, 2015 (https://www.cbd.int/health/SOK-biodiversity-en.pdf).

2 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. *The Global Assessment Report on Biodiversity and Ecosystem Services: Summary for Policymakers*. IPBES, 2019 (https://www.ipbes.net/global-assessment).

3 Millennium Ecosystem Assessment Team. *Ecosystems and Human Well-Being: Synthesis*. Island Press, 2005 (https://www.millenniumassessment.org/documents/document.356.aspx.pdf).

4 Magurran AE. Q&A: What is biodiversity? *BMC Biology* 2010; **8**: 145.

5 World Health Organization Regional Office for Europe. *Ottawa Charter for Health Promotion, 1986 (No. WHO/EURO: 1986-4044-43803-61677)*. WHO Regional Office for Europe, 1986 (https://apps.who.int/iris/handle/10665/349652).

6 Lovell R, Wheeler BW, Higgins SL, Irvine KN, Depledge MH. A systematic review of the health and well-being benefits of biodiverse environments. *J Toxicol Environ Health B Crit Rev* 2014; **17**(1): 1–20.

7 Dinerstein E, Vynne C, Sala E, Joshi AR, Fernando S, Lovejoy TE, et al A global deal for nature: guiding principles, milestones, and targets. *Sci Adv* 2019; **5**(4): eaaw2869.

8 Markevych I, Schoierer J, Hartig T, Chudnovsky A, Hystad P, Dzhambov AM, et al Exploring pathways linking greenspace to health: theoretical and methodological guidance. *Environ Res* 2017; **158**: 301–17.

9 Bratman GN, Anderson CB, Berman MG, Cochran B, Vries S, Flanders J, et al Nature and mental health: an ecosystem service perspective. *Sci Adv* 2019; **5**(7): eaax0903.

10 Cox DTC, Shanahan DF, Hudson HL, Plummer KE, Siriwardena GM, Fuller RA, et al Doses of neighborhood nature: the benefits for mental health of living with nature. *BioScience* 2017; **67**: 147–55.

11 Chang H-T, Wu C-D, Wang J-D, Chen P-S, Wang Y-J, Su H-J. Green space structures and schizophrenia incidence in Taiwan: is there an association? *Environ Res Lett* 2020; **15**: 9.

12 Marselle MR, Lindley SJ, Cook PA, Bonn A. Biodiversity and health in the Urban environment. *Curr Envir Health* 2021; **8**: 146–56.

13 Sieswerda LE, Soskolne CL, Newman SC, Schopflocher D, Smoyer KE. Toward measuring the impact of ecological disintegrity on human health. *Epidemiology* 2001; **12**: 28–32.

14 Tagles HD, Idrovo AJ. Biodiversity and mental health. In *Biodiversity Enrichment in a Diverse World* (ed GA Lameed): 211–31. IntechOpen, 2012.

15 Dallimer M, Irvine KN, Skinner AMJ, Davies ZG, Rouquette JR, Maltby LL, et al Biodiversity and the feel-good factor: understanding associations between self-reported human well-being and species richness. *BioScience* 2012; **62**: 47–55.

16 Rosen LN, Targum SD, Terman M, Bryant MJ, Hoffman H, Kasper SF, et al Prevalence of seasonal affective disorder at four latitudes. *Psychiatry Res* 1990; **31**: 131–44.

17 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. *IPBES Workshop on Biodiversity and Pandemics: Workshop Report*. IPBES, 2020 (https://ipbes.net/pandemics).

18 Rotenberg M, Tuck A, Anderson KK, McKenzie K. Green space and the incidence of schizophrenia in Toronto, Canada. *Can J Psychiatry* 2022; **67**: 238–40.

19 Cianconi P, Hanife B, Grillo F, Zhang K, Janiri L. Human responses and adaptation in a changing climate: a framework integrating biological, psychological, and behavioural aspects. *Life* 2021; **11**: 895.

20 Albrecht G, Sartore GM, Connor L, Higginbotham N, Freeman S, Kelly B, et al Solastalgia: the distress caused by environmental change. *Australas Psychiatry* 2007; **15**(suppl 1): S95–8.

https://doi.org/10.1192/bji.2022.20 Published online by Cambridge University Press

21 **Cianconi P, Betrò S, Janiri L.** The impact of climate change on mental health: a systematic descriptive review. *Front Psychiatry* 2020; **11**: 74.

22 **Scull J.** Ecopsychology: where does it fit in psychology in 2009? *Trumpeter* 2008; **24**: 68–85.

https://doi.org/10.1192/bji.2022.20 Published online by Cambridge University Press