Observing Linkages between Biodiversity and Planetary Health

Vicki Simkovic and David H. Nelson

"Of all the teachings we receive, this one is the most important. Nothing belongs to you. Of what there is, of what you take, you must share."
~ lessons from Kinoomaagewaapkong, "the rocks that teach"

In a small lake in the Kawarthas, an aggressive invasive macroalgae has arrived. It spreads easily by broken fragments caused by boaters passing through the area, and forms dense mats on the bottom of the lake that are so thick (up to two metres) that it becomes impossible for fish to swim through or spawn, or for native plants to grow. Once introduced, it is impossible to eradicate, and will permanently alter the biodiversity and vegetation composition within the lake.[1] A few hundred kilometres away in southwestern Ontario, another wetland is being lost as land is cleared for a development project. And even further away in Latin America, several hundred more acres of tropical rainforest is being cleared for cattle grazing and other crops like soybeans, while ecological 'dead zones' that form in the ocean by mountains of plastic increases.[2] Every day we are slowly losing biodiversity around the world, as relentless progress chips away pieces of the tree of life, leaving in its place an uncertain future, at a time when we are just beginning to understand what this loss will mean for our species, and to human health.

According to the recently published Global Assessment Report on Biodiversity and Ecosystem Services by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, in May 2019, over one million plant and animal species out of a total of eight million species on earth are at imminent risk of extinction, many in the next few decades due to human activities.[2] Population numbers across many taxa (i.e. individual species or entire groups of organisms) have declined globally. Reductions include a 60% decline in 4,000 vertebrate species over 44 years,[3] a 75% decline in flying insect biomass in protected natural areas in Germany over 27 years,[4] a 40-60% decline in shorebirds, grassland birds, aerial insectivores in Canada over five decades,[5] an 83% decline in freshwater fish over 44 years,[3] plant extinction rates that are now 500 times faster than natural extinction rates,[6] and a reduction in diversity of soil microbes.[3]

The Global Assessment has also identified the five main drivers of biodiversity decline: changes in land use (i.e. farming), overfishing, direct exploitation of organisms, climate change, and invasive alien species.[2] Habitats are shrinking to meet the needs of population growth and increased consumption, with agricultural farming and overfishing being the main drivers of the loss.[2] More than 33% of the world's land surface and 75% of freshwater resources are now devoted to crop or livestock production, with the greatest losses occurring in the tropical regions, home to the largest biodiversity on the planet.[2] Over 100 million hectares of tropical forest was lost from 1980-2000, mainly from cattle ranching in Latin American and palm oil plantations in South-East Asia.[2] Wetlands are the most affected type of habitat impacted around the globe, having decreased by 87% (the loss is three times that of forest loss).[3] The introduction of invasive alien species is the second greatest driver of species extinction following habitat loss, and they have risen by 70% since 1970 across 21 countries.[2] Plastic pollution has increased ten times since 1980, with 300-400 million tons of heavy metals, solvents, toxic sludge and other industrial waste being dumped annually into the global waters, creating more than 400 oceanic 'dead zones', forming an area greater than the size of the United Kingdom.[2]

What are the global, long-term implications if natural landscapes, such as those mentioned above, continue to dwindle and play less importance in people's lives?

It is well understood that biodiversity is essential to fostering resilient, healthy natural ecosystems,[7,8] and that these ecosystems in turn supply humanity with a diverse array of ecosystem services, some directly linked to human survival and basic human rights (i.e. food, water, shelter)[9] and others linked in intricate and complex ways to human health (the complete state of physical, mental and social well-being).[2,8,9] An emerging science is examining these intricate linkages, growing out of an urgent need to address the many challenges of the Anthropocene age, the current period of Earth's history where human-influenced activities have dominated global environmental processes.

DEFINITIONS:

- **Biodiversity –** variety and variability among all living organisms (terrestrial, marine, aquatic species) and the ecological complexes of which they are a part – including diversity within species, between species and their ecosystems.[10]
- **Ecosystem Services –** The multitude of benefits that biodiversity provides, including food, medicine, livelihoods, clean air, water and soil.[3]
- **Taxon (plural Taxa) –** A taxonomic group of any rank, such as a species, family, or class, used in the science of biological classification.
- **Anthropocene –** The current geological time period is defined as being human influenced (or anthropogenic), based on global evidence that climate and environmental processes are being influenced by human activity.
- **Symbiocene –** A new term to counter the period of human dominance known as the Anthropocene, supporting a philosophy that seeks to transform the foundations of society from an economical, competition focus to one of symbiosis and interconnectedness, in turn promoting hope and optimism.[25]
- **Living together for mutual benefit,** affirms the interconnectedness of life and all living things. Puts a human worldview back into the community of life.

Biodiversity and Inflammation

One growing concern is the potential link between two global trends: declining biodiversity and increasing incidence of inflammatory disease, particularly in developed nations.[10] The losses in biodiversity since the 1970s are almost in tandem with the rise in inflammatory-mediated, or non-communicable diseases (NCDs), such as allergies, asthma, inflammatory bowel disease, cardiovascular disease, some cancers, and obesity.[10,11] The Biodiversity Hypothesis posits that the altered composition of gut and skin microbiota associated with these NCDs may be connected to reduced contact with the natural environment, which then reduces human exposure to diverse microbes ('Old Friends') that are essential for healthy immunoregulation.[12,13]

Urban environments ('concrete jungles') may prime the inflammatory cascade that promotes "dis-ease".[13-15] For example, Hanski and his colleagues found that adolescents with atopic sensitization (i.e. allergic disposition) had lower environmental biodiversity surrounding their homes as well as lower diversity of gammaproteobacteria on their skin.[16] The rise in non-communicable diseases must therefore be taken into account along with the threat of biodiversity loss, both current and future, if we are truly find a solution to both at the same time.[12,17] It has been recently suggested by Richard Horton, editor-in-chief of *The Lancet's* edition on Planetary Health, and by others before him, that we cannot have healthy people on a sick planet, indicating a fiduciary responsibility in collaboration with the earth instead of the 'conquering motif' that has dominated the main timelines of history – humans as caretakers, rather than users of the earth.[18]

Ecological Grief

The loss of a once treasured nature area, or tuning in to news about species extinctions, climate change, environmental disasters and pollution can invoke many feelings, such as sadness, anger and despair. The pain of ecological grieving is a recognized psychological response to ongoing change in the Anthropocene age, with real implications for mental health.[19] It is clear that we as humans have not paused, as a collective, to determine if the mindset of conquering nature, which began as an attempt to survive the external environment, would come back to haunt us. Those who have spent their lives in an urban 'concrete jungle', for example may be grieving (at least unconsciously) for a world they never knew in the first place. Already, Indigenous groups such as the Inuit in Nunatsiavut, Labrador are directly experiencing the mental anguish of profound environmental change and loss of traditional lifestyles.[19] There is considerable unease in Indigenous communities around the globe who report dramatic changes in their mental health as they see "the land" change into something they have never witnessed before. To Indigenous peoples the land is sacred and part of the global interwoven web of collaboration in the survival and vitality of all species, including humans.[20] This mindset has truly made Indigenous peoples stewards of the earth – globally, nature is declining less rapidly in areas that are traditionally owned, managed or occupied by Indigenous peoples, although Indigenous lands are still facing pressures from resource extraction, deforestation, mining, pollution and water insecurity.[2]

Integrative Strategies

We must approach the problems of sick people and a sick planet simultaneously. It was philosopher and scholar Glenn Albrecht who wrote a manifesto for transitioning our mindset from one of a conquering motif to one of collaboration, where the interconnectedness of living things is emphasized. He proposed this mindset as the foundation for the next era of human history, the Symbiocene (from the Greek *subiosis*, companionship), and like-minded people are beginning to mobilize.[21] Recently, a group of international experts from many disciplines convened at the

7th inVIVO Planetary Health meeting in Canmore, Alberta, and provided the framework for the Canmore Declaration, a Statement of Principles for Planetary Health (see Box 1).[22]

BOX 1:

According to the 2018 Canmore Declaration, Planetary Health is defined as the interdependent sustainable vitality of all natural and anthropogenic ('human-made') ecosystems. Vitality (that is, the highest level of wellness) is connected at scales of person, place and planet; the ecosystems that exist in corporate board rooms, individual households, local communities, national governments can influence ecosystem functioning at the level of the intestinal villus. If any part of this interconnected system of micro, meso and macro ecosystem neglects the sustainability of wellness (of humans and biodiversity at-large), then health at all scales, planetary health will be in peril.[22]

As a result of these mindset shifts, there are new avenues for uniting public and planetary health. This philosophy is positioned as a strategy for reducing the financial burden of global health and at the same time seeks to steady the dizzying rate at which NCDs are growing.[23] Naturopathic doctors should be front and centre of this new mindset shift – though it has almost never been part of the conversation until recently. The philosophy of Planetary Health is directly in line with naturopathic philosophy, and opportunities to incorporate this mindset into the educational curriculum, and/or interdisciplinary collaboration with like-minded professionals should be encouraged.

The loss of biodiversity, the rise in NCDs, the decline in mental health and ecological grieving over an unsettling and uncertain time are a response to a system of earth-interface that is no longer tenable. We must exit the Anthropocene and lay down the foundations for entering the Symbiocene - that is to stop conquering and start collaborating with all life forms on earth. It is going to be easy? No. Can we do it? Yes.[24]

INFO BOX - Strategies and Tips for NDs to include Planetary Health in treatment plans:

- **Discuss ecological grief with your patients –** address environmental issues in practice with your patients, and consider its unique impact to the mental health of each patient. See the work of Dr Ashlee Cunsolo, PhD for more details: https://ashleecunsolo.ca/about/.

- **Become aware of invasive species & plant native species.** If you have a medicinal plant garden, become aware of what species might become problematic or invasive to the natural environment and impact local biodiversity. For example, although Burdock (*Arctium minus* or *A. lappa*) is a useful medicinal plant, it is also a non-native invasive species to North America, and kills many bird species (i.e. warblers, kinglets) yearly, who become stuck in the burs while hunting for insects and die, unable to escape.[26] If you grow burdock, please cut and dispose the seed heads before they develop. Another example, sea buckthorn (labelled a new "opportunity crop"), although useful in treating skin conditions, is escaping into natural areas in Ontario, where is it is outcompeting native flora. Plant non-invasive native species to promote local biodiversity and support pollinators.

- **Become aware of the source of herbal medicines.** Know the source of herbal medicines, to ensure they have been sustainably harvested. In Ontario, American ginseng (*Panax quinquefolius*) is endangered and goldenseal (*Hydrastis canadensis*) is threatened, both face significant pressures from harvesting for medicinal purposes. Nearly all goldenseal populations in North America are wild harvested.[27]

About the Authors

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