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*Book Review*

# Overloaded Ecosystems, Lost Languages, and Emerging Infectious Disease: Three Books on a Path to Ecohealth

*The transdisciplinary science of ecohealth is still a young field of study without a clearly defined literature as its historical foundation. To help build this base of knowledge and theory, the* EcoHealth *editors have agreed to write occasional essays that describe some of the books that have been foundational in our own thinking about and around the field. The essay below by Phil Weinstein is the second in this occasional series.*

With his book *Planetary Overload*, McMichael (1993) introduced ecological concepts and approaches to a whole generation of public health researchers and epidemiologists—including me. The concept of carrying capacity was presented in such a way as to make many researchers rethink their approaches, recontextualising individual diseases of interest in terms of the broader issues of resource over-utilisation and degradation of the Earth's ecosystems. With such degradation comes a loss in 'ecosystem services' (sensu Millennium Ecosystem Assessment 2005), and human health suffers as both a direct and indirect consequence. Perhaps the most obvious of ecosystem services affected by 'overload' are climate regulation and the maintenance of biodiversity. McMichael's book illustrates how both climate change and biodiversity loss can affect health directly, as well as indirectly. He cemented the place of climate change in public health thinking, and did so before the concept of 'emerging infectious diseases' had been fully crystallised as a consequence of major ecological disruptions. Climate change and biodiversity loss can, in fact, interact to drive disease emergence, with particularly good examples from the area of vector borne disease ecology. Mechanisms include changes in water temperatures and nutrient level (O'Reilly et al. 2003), seasonal and phenological disruptions between predators and prey (Saino et al. 2011), and extreme weather events affecting species composition (Willig and Walker 1999). Carver et al. (2010) provide a complex example of such an interaction, with biodiversity loss (predators and competitors) failing to suppress the potential dominance of a disease vector mosquito in Western Australia. Here, reduced rainfall and deforestation have combined to produce saline environments with reduced biodiversity, producing the potential for 'emergence' of mosquito-borne infectious disease.

The concept of 'emerging infectious diseases' was arguably best popularised by Laurie Garrett' s (1994) book *The Coming Plague*, a 750-page masterpiece of infectious disease reportage. With this thoroughly researched book, she led the way in making the issue of emerging infectious diseases accessible to the public, and improved public awareness of the driving roles of ecological and social disruptions in creating these major public health problems. One of her main themes—the HIV/AIDS epidemic—was of course a well-known phenomenon by 1994, just over a decade after the virus was discovered. What was less well known at that time, at least beyond researchers in the field, was that the emergence of this disease was by no means unique. With captivating narrative, she trawls through half a century of discoveries from which only one conclusion can be reached: We were never going to beat microbes, and we never will. Researchers almost come to life as old favourites from Ebola to TB are used to illustrate the inextricable links between pathogen, nature, and human behaviour. So with this book, two things became clearer to me. Firstly, that planetary overload could virtually be measured by the emergence rate of new pathogens; and secondly, that the almost intangible complexities of infectious disease emergence could in fact be conveyed as very

interesting popular science. This latter point is not trivial, because ultimately it will be voters more than researchers that influence what public health responses to emerging infectious diseases will or will not be successful. The cynic in me would observe that, despite the consensus view that prevention is generally preferable to cure, successful *treatments* for malaria, TB, and HIV by far outnumber successful social and environmental interventions to prevent them. With that thought, the question arises as to how closely environmental and social ecologies are linked, and that question was answered for me with a third book: Nettle and Romaine's *Vanishing Voices* (2000).

Working in Australia, it is impossible not to draw a parallel between species extinctions and language extinctions. Although the first European contact with Australia came courtesy of the Dutch ship Duyfken in 1606, it was not until the arrival of the 'First Fleet' in 1788 that European language and culture established a foothold in Australia. At that time, some 300 languages were spoken by Aboriginal Australians, of which fewer than half now remain (Dalby 1998)—arguably the highest language extinction rate in the world. Australia also holds the record in extinction rate for mammals, with 18 species being lost in this same time period (Johnson et al. 2007). It would seem then that we have a parallel between extinction rates of animals and languages in Australia, driven by similar and overlapping forces—environmental and social change. Because of my closet interest in historical linguistics, I had long been aware of these parallels, which, incidentally, can be extended to the similarity of process between biological evolution and language change. However, it was not until I read Nettle and Romaine that I realised that extinctions of both species and languages could be seen as outcome indicators for the same process of environmental and social change. Areas of high linguistic diversity show a striking correlation with areas of high species diversity, and Nettle and Romain coin the term 'biolinguistic diversity' to describe the common repository of biodiversity and traditional human culture. This correlation is not spurious; rather, cultural diversity and biological diversity may be causally and inseparably linked through co-evolution in specific habitats. As a result, languages can be viewed as a ''miner's canary: where languages are in danger, it is a sign of environmental distress'' (p. 14). They argue that the extinction of either a language or a species is an indicator of radical anthropogenic ecosystem change, and that most different languages are spoken by indigenous people (more than 50% of the world's languages are spoken, altogether, by less than 5% of the world's population). They describe the link in terms of the survival of a language being dependent on the presence of a community to speak and transmit it, and that community in turn being dependent on a viable environment for them to live in. *Planetary Overload* described how that environment was in fact becoming non-viable, and it should therefore be no surprise that both indigenous languages and native species should be threatened concurrently. In fact, environmental degradation and biodiversity loss are accelerating (Pimm and Raven 2000), as is language extinction: of some 5000 languages alive today, half will be extinct 100 years from now—including most Australian Aboriginal languages, which are dying at the rate of about one language per year. Of those that remain, the vast majority have less than 500 speakers—evolutionarily extinct, in biological terms. If such dramatic data were for biological species, there would almost certainly be a major social upheaval to protect what remained. For some reason, cultural assimilation is perceived as inevitable and acceptable, whereas species extinctions in response to anthropogenic environmental change are not.

It is beyond my capacity to extrapolate the implications of the loss of biolinguistic diversity to all of the likely areas of impact, but I have spent some years teaching the epidemiology and control of communicable disease, and in this field some warnings do leap out at us. If we examine the example of Ross River Virus infection, an Australian mosquito-borne disease, we can see concrete examples of 'miner's canaries'. Biodiversity loss is a risk factor for infectious disease emergence, and the vectors of Ross River Virus proliferate in the absence of their natural competitors and predators. As native bush has been replaced with agroecosystems and urbanised areas, so the mosquito vectors of Ross River Virus have, at least in some areas, proliferated to the point of increasing the risk of human infection. In addition, it is possible that the loss of diversity in warm-blooded hosts has increased the probability of mosquitoes biting and becoming infected by viral reservoir host (a loss of the 'dilution' effect; LoGiudice et al. 2003). At the same time, traditional Aboriginal culture has changed from a hunter–gatherer lifestyle to an agrarian and industrialised lifestyle where children are no longer 'naturally' immunised to the disease by natural exposure early in life (when symptoms are usually imperceptible); and we have already seen the rate of language loss that is associated with this same change in lifestyle. It has been hypothesised that biological and cultural variables have interacted to result in

the 'emergence' of Ross River Virus as a public health problem (Weinstein et al. 2011), but we did not read the warning signs of biolinguistic loss. With the wisdom of hindsight, the loss of biodiversity and loss of languages could both have been interpreted as indicators of socioecologically disrupted systems at risk of producing emerging infectious disease. The 'coming plague' is clearly anthropogenic, and we must heed such warning signs rather than brush the dead 'miner's canaries' under the carpet. I think the authors of all three books would be heartened by the fact that their narratives have led to new research approaches, findings, and recommendations that will, hopefully, benefit human health and ecosystem health concurrently.

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## Three Books

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