LETTER FROM THE GUEST EDITOR

Introduction to the Special Topic: Environmental and Public Health Risks Associated with Climate Change

This special topic focuses on emerging risks potentially posed to environmental and public health that have materialized, or are likely to materialize, as a result of the influence of climate change, or are likely to be exacerbated or abated under the influence of climate change. Topics addressed in this theme issue of *Environmental Practice* may be speculative or conditional on posited climate change trends. Environmental and public health risks of interest may be associated with the pace, not only with the direction, of climate change.

We have seen, for example, increased mold infestation of indoor spaces, such as schools, residences, and workplaces, due to increased frequency and intensity of storms (Trenberth, 2007) and associated flooding and water damage (Reid and Gamble, 2009). Likewise, increased frequency and intensity of storms have increased the frequency and magnitude of high-flow events in rivers subject to environmental (and navigational) dredging, such as dredging polychlorinated biphenyl (PCB)-contaminated sediments in the Hudson River in Upstate New York (Michaels and Oko, 2010). Climate stresses on populations have resulted in changes in species composition, richness, and diversity of ecological communities (Harley, 2011; Montes-Hugo et al., 2009).

Climate change may exert ecological effects by selecting for adaptive responses of gene frequencies and species morphology, and of ecological ranges, in response to stresses such as drought. Climate change may stress agriculture systems and irrigation, for example, by increasing saltwater intrusion into groundwater and via emergence of salt-tolerant plants. Emergence of diseases also may be triggered by climate-induced changes in the range of species and associated pathogens (Epstein, 1999), as exemplified by Rift Valley Fever (Vilaly et al., 2013) and perhaps also by Legionnaire's disease, acquired immunodeficiency syndrome (AIDS), and malaria.

Climate change is occurring globally at a pace that is accelerated by civilization, to a geographically variable degree that is difficult to quantify reliably. Its effects, however, already have proven significant for public health and economics (Epstein, 1999), as well as ecosystems (Harley, 2011). Indeed, economic damage inflicted by extreme hurricanes has included insured losses to homes, businesses, and entire communities. The insurance industry therefore embraced early (though not uniformly) the consensus conclusion of the United Nations Environment Programme Intergovernmental Panel on Climate Change (UNEP IPCC) that global climate change is upon us and intensifying (Mills, 2005). Flood insurance has become especially difficult to obtain, and increasingly expensive. Mold insurance for homeowners, I am told, generally cannot be obtained because insurers typically are refusing to underwrite such policies.

On the positive side, climate change–induced stresses on freshwater supplies may stimulate novel ways to secure freshwater. Such stresses may motivate cooperation of affected countries, such as countries in the Middle East, for water management (Bohannon et al., 2006; Tal, 2006), as "necessity is the mother of invention." Similarly, one type of effect of climate change is on environmental regulation by governments at all levels.

Regulation of energy industries increasingly has incorporated incentives for renewable forms of energy and for the least polluting sources of nonrenewables. The process of hydraulic fracturing ("fracking") of bedrock to release trapped oil and natural gas in the past decade has become increasingly widespread, accelerating production of natural gas and increasing the fraction of natural gas produced via fracking (Michaels and Simon, 2013). Fracking is the subject of intense technical attention to control methane leakage to within sustainable rates, and of intense regulatory attention to assure that the rules require industry to protect environmental interests without inflicting mortal economic wounds to the industry. We will see whether, and how, this delicate but critical balancing process succeeds.

For now and the foreseeable future, we have just one planet to live on. As its current managers, we must maintain global climate compatibility with natural and agricultural ecosystems, and with human life, sustainably and forever. Yet, UNEP IPCC projections suggest that we will fail in this endeavor unless measures are taken urgently to mitigate climate change (Stocker, 2013). If we fail to take such measures prospectively and in full measure, we will be forced to resort retrospectively to massive global climate geoengineering. We will be using the planet as a laboratory to see what works and what does not, with the added difficulty that no simultaneous control planet will be available by which to gauge our success. The true gauge of our success will be survival of our planet's natural and agricultural ecosystems along with its human societies.

To assure long-term survival, we must recognize emerging risks in time to manage them effectively. Historical risks cannot merely be extrapolated to the future as though they will remain constant. The insurance industry learned this early and painfully with regard to predicting and underwriting policies for storm damage. Likewise, the risk of being killed by mustard gas increased in World War I, by nuclear explosion in World War II, and by terrorism around September 11th, 2001. Emergence of these risks was gradual and their recognition tragically retrospective. We cannot afford to experience the impending effects of global climate change full force. We therefore cannot afford to

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recognize climate change and its emerging risks retrospectively. We must recognize them now and implement pathways to head them off while doing so is, at least arguably, still possible.

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