Global Change and Public Health

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Introduction and Background

The resurgence of infectious disease in the 1980s and 1990s reflects widespread changes in disease vectors and microbiological agents and in the environment that shapes their growth and distribution. The emergence of plague in India after a 30-year hiatus has brought this resurgence to center stage, but it has occurred in the context of the emergence, resurgence, and redistribution of infectious diseases on a global scale.

In addition to social vulnerabilities and unevenly distributed exposures, changes in biodiversity--particularly the decline in top predators and the selection of "generalist" species over "specialists" (associated with shrinking ecological niches)--provide the background for the emergence of new diseases. Losses in biodiversity reduce the resilience of ecosystems in the face of climatic factors, be they normal or anomalous. Additionally, long-term climatic trends in (a) temperature and precipitation means, (b) minimum to maximum temperature ratios, and in (c) variability are contributing to the redistribution of disease vectors and reservoirs into new latitudes and new altitudes. Against this background, El Niño anomalies generate new breeding sites for disease vectors and generate bursts in their abundance.

Given this interaction among complex systems, deriving simple underlying principles and simple outcomes is essential. Key species (e.g., rodents and insects on land, algae at sea) carry many of the diseases of plants and animals; thus, the trend towards selection and redistribution of these opportunistic species has major implications for agriculture, forestry, fisheries, and human health, as well as commerce, tourism, and allied industries.

Climate variability and extreme events (such as heat waves) directly affect human health (cardiovascular disease and heat stroke), and global changes in UV-B radiation influence the growth of skin cancers and cataracts, as well as depress the immune system (increasing susceptibility to infectious diseases). This review, however, focuses on the indirect effects of global change on health and agriculture, as mediated through the transport of pathogens and the emergence of pests.

Note that person-to-person infectious diseases (diphtheria, measles, TB, HIV) are primarily associated with social dislocation, as well as human population abundance, distribution, and inequities; infectious diseases involving three or more species in their life cycle more readily reflect ecological and meteorological factors. Additionally, unlike evaluating the direct impact of droughts (e.g., on agriculture), interpreting the impacts of climate on ecosystems interactions involves the filtration of climatic factors through the