URBAN EXPANSION IMPACTS ON THE HEALTH OF ECOSYSTEMS, WILDLIFE AND HUMANS

Panel Contribution to the PERN Cyberseminar on Urban Spatial Expansion by

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On a global basis, it is estimated that the proportion of persons living in urban centers will increase to an unprecedented 65% by the year 2030. The 2000 census shows that 80% of the US population now lives in metropolitan areas, with 30% in cities of 5 million or more. The environmental issues posed by such large population centers have profound impacts on public health beyond the city limits. The United Nations has estimated that by year 2015 there will be 26 "megacities" (urban areas of 10 million inhabitants or more), most of them located in less industrialized nations. The factors causing the migration of masses of people from rural to urban areas are linked to environmental degradation. For example, desertification, deforestation, drought and salination of soils are common causes of human migration to cities in Asia and Africa. Deteriorating conditions are also linked to high human growth rates and the inability of local environmental systems to sustain them. However, the prevalence of pollution, together with inadequate sewer and sanitation infrastructure in urban areas, has led to environmental crises at a global scale.

These changes in turn cause a cascade of factors that exacerbate disease emergence such as forest fragmentation, disease introduction, pollution and poverty. For example, recent research has shown that suburban sprawl, forest fragmentation and biodiversity loss are linked to Lyme disease risk in the Northeastern USA. Expansion and changes to agricultural practices are intimately associated with the emergence of Nipah virus in Malaysia, cryptosporidiosis in Europe and North America, and a range of food-borne illnesses globally. Road-building is linked to the expansion of bushmeat consumption and that may have played a key role in the early emergence of HIV-1 and –2.

Global urbanization linked to human migrations may drive disease emergence. For example, in Yunnan province, China, an increase in livestock populations and human migration has lead to an increase in the incidence of schistosomiasis. Human movement also has significant implications for public health. Travelers are not only at risk for contracting communicable diseases when visiting developing countries, but they also act as vectors for delivering infectious diseases to a region. Refugees account for a significant number of human migrants, carrying diseases such as hepatitis B and tuberculosis, as well as various parasites. Zoonotic pathogens are the most significant cause of emerging infectious diseases (EIDs) affecting humans, both in the proportion of EIDs they cause and in the impact they have. Some 1415 species of infectious organisms are known to be pathogenic to humans, with 61% being zoonotic. Seventy-five percent of "emerging pathogens" are zoonotic.

Stressors (e.g. microclimates, habitat alteration/destruction leading to both physical and psychological stress of humans and animals, air and water quality degradation) contribute to the development and spread of infectious disease agents as well as impact the susceptibility that increases prevalence of infectious disease. Human encroachment on wildlife habitat has broadened the interface between wildlife and humans – resulting in increased opportunities for both the emergence of novel diseases in wildlife, and their transmission to people. Rabies is an example of a zoonotic disease carried by animals that have become habituated to urban environments. Bats colonize buildings, skunks and raccoons scavenge human refuse, and in many countries feral dogs in the streets are as common as squirrels and are a major source of human infection.

It is important to note that despite much anecdotal evidence, we still do not understand many of the potential effects that urbanization and land use change might have on disease emergence. In order to be able to better predict disease emergence in the wake of urbanization, and thus make informed health-relevant policies, we need far more ecology and health analyses.

With such understanding, it will be easier to prevent new disease emergence. Yet since these episodes are often rare events, accurate predictions will remain daunting. It is already evident that inserting humans into complex ecosystems can lead to a variety of emerging diseases. But health outcomes depend on the economic circumstances of the human population. In poor and tropical communities, landscape change can lead to major shifts in disease patterns, such as, for example, dysentery, cholera and other sequelae after forest clearing results in flooding. Habitat fragmentation has been linked also to an increase of dengue, yellow fever and recent work has implicated AIDS, Ebola and Marburg linked to environmental changes. For these situations, many conventional public health interventions can prevent several diseases at relatively low cost. As for rich and temperate communities, the infectious disease shifts tend to be more disease specific, e.g., as in the case of habitat fragmentation and Lyme disease.

For sound health policy, we must shift away from dealing primarily with specific risk factors and look "upstream" to underlying landscape determinants of disease, and ultimately the human behavior and established institutions that are detrimental to sustainable population health. Infectious diseases in the urban environment are affected by a multitude of environmental and anthropogenic factors. Among these are pollution, water management, putrescible waste management, vector ecology, urban microclimates, and human encroachment on wildlife habitats. These fields are understudied and need to be researched in conjunction with how they impact population health. The impact of urbanization on ecosystem health is multi-faceted, and therefore we need to implement an interdisciplinary research program addressing such issues. Such a program will result in a better understanding of the effect of urban stressors on the susceptibility of human populations and sensitive subpopulations to infectious disease.

For the development of policy based on research results, a trans-disciplinary coalition is necessary to identify and address health issues at the local level. This coalition should be composed of local politicians, community representatives, economists, ecologists, public health workers, city planners (engineers and architects), social scientists and educators.

This manuscript was based on a larger paper recently published by Patz et al. 2004

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