

## Biodiversity and Health: Locally and Beyond

By Yi Li

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Dr. Edward O. Wilson, distinguished biologist and researcher at Harvard University, wrote nearly two decades ago that “biological diversity must be treated more seriously as a global resource.” Wilson realized that the depletion of organismal variation was leading to a host of environmental and economic problems. Many scientists today share Wilson’s concerns about biodiversity; and this concern has only grown in the past few decades. Biodiversity, defined as variation in life at all levels of biological organization, is quickly diminishing, and this erosion is being catalyzed by human pollution, consumption, and exploitation of our resources.

In this area, one prominent example of the effects of loss in biodiversity can easily be observed. Every fall in New England, incidences of Lyme disease increase as more people head outdoors to enjoy the weather and fall foliage. Lyme disease is spread by small insects called ticks, and the disease is more prevalent in the northeastern United States because disease-bearing ticks and animals that serve as reservoirs for these ticks have become more prevalent as well. This increase in the tick population and their hosts can be attributed to a recent decrease in their natural predators. In the northeast, ticks are often carried by white-footed mice, and the predators of these mice – wolves and wildcats – have decreased in number over the years. Additionally, the number of other small animals that may serve as targets for tick bites have decreased as well. The synthesis of all of these factors leads to a rise in the number of cases of Lyme disease in the human population, serving as just one example of how the maintenance of biodiversity in our environment is so crucial to everyday health.

Losses in biodiversity cause much environmental instability. My arguments for the importance of biodiversity in health for human populations come mainly from two fields: a scientific argument based on the importance of environmental stability, and an economic argument based on the cost-effectiveness of preventative biodiversity measures.

In scientific terms, throughout evolutionary history, when organisms become extinct or move away from their environments of origin, parasitic agents take over the niche that these organisms had inhabited. These parasites often find new hosts, and when they jump from one host organism to another, new diseases begin to emerge.

Parasitologists postulate that this is the mechanism of emergence for new human diseases like West Nile Virus and the Avian Flu. Currently, researchers still have a poor understanding of the exact roles that various identified parasites play in different diseases. Research is still ongoing and is being aided by advances in fields such as molecular taxonomy.

The importance of biodiversity can best be illustrated through case-studies of diseases that have spread among human populations due to disruptions in biodiversity.

Deforestation in the Amazon and in remote regions of Africa has exposed people to diseases that originally inhabited wildlife; this is the proposed origin of diseases such as AIDS and Ebola. Research by Dr. Peter Daszak, of the Consortium for Conservation Medicine, has also identified a connection between Chinese horseshoe bats and the outbreak of SARS in Asia. Most poignantly, we may look back in history and see that the introduction of smallpox, typhus and measles by Spanish conquistadors to South American natives in the 15th century resulted in the deaths of nearly 50 million. These examples illustrate how the introduction of disease-causing agents into environments where they were previously nonexistent can have profound consequences.

From an economic perspective, vast amounts of money and economic resources can be saved by taking a preventative approach to the loss in biodiversity, instead of a reactive one. When SARS broke out in Asia, the economic losses from trade and travel totaled around \$50 billion – a figure that hugely impacted the developing economies of the countries affected. On top of that, 800 people died from the disease. The costs of Lyme disease treatments in the United States total to nearly \$500 million each year. One can only imagine the magnitude of these figures for diseases such as AIDS where cost of care is staggering and new transmissions remain undiminished.

A vastly better use of these economic resources is to take a preventative approach to these problems. Scientists advocate for tougher regulations on trade, agriculture and travel as methods of reducing the spread of disease-causing agents and preventing the jump of diseases from wildlife to humans. By protecting the environment, we prevent the catastrophic consequences of emerging disease and spend well below the current costs of reactive measures. All of these benefits come in addition to the inherent benefits of preserving our natural resources and preventing organisms from extinction. Many yet-unstudied and undiscovered organisms may hold the secrets to medical cures. At one point, scientists believed that the Australian gastric brooding frog held the secrets to anti-ulcer treatments because these frogs incubate their young in their stomach only after shutting off digestive acids. Tragically, the frogs became extinct before scientists could study them – their secrets and mysteries died along with them.

As citizens of the metropolitan Boston area, with so many educational resources, we have many opportunities to learn more about the issues surrounding biodiversity. The Harvard Center for Health and the Global Environment ([chge.med.harvard.edu](http://chge.med.harvard.edu)) and Wildlife Trust ([www.wildlifetrust.org](http://www.wildlifetrust.org)) are great online resources for more information on research, recommendations, and upcoming events. We must also remain aware of legislation that will affect biodiversity locally and beyond. Our actions begin with becoming aware of what organizations and companies to support, what initiatives to advocate for, and what political agendas to push for. This approach to biodiversity maintenance requires a long-term vision, but the action must begin now. We must take a stance on this issue before further diseases emerge as a consequence of our actions and before many more resources are depleted in the process.

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