

Disease burden links ecology to economic growth

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A new study, published December 27 in the open access journal *PLOS Biology*, finds that vector-borne and parasitic diseases have substantial effects on economic development across the globe, and are major drivers of differences in income between tropical and temperate countries. The burden of these diseases is, in turn, determined by underlying ecological factors: it is predicted to rise as biodiversity falls. This has significant implications for the economics of health care policy in developing countries, and advances our understanding of how ecological conditions can affect economic growth.

According to conventional economic wisdom, the foundation of economic growth is in political and economic institutions. "This is largely Cold War Economics about how to allocate property rights—with the government or with the private sector," says Dr Matthew Bonds, an economist at Harvard Medical School, and the lead author of the new study. However, Dr Bonds and colleagues were interested instead in [biological processes](#) that transcend such institutions, and which might form a more fundamental economic foundation.

The team was intrigued by the fact that [tropical countries](#) are generally comprised of poor agrarian populations while countries in temperate regions are wealthier and more industrialized. This distribution of income is inversely related to the burden of disease, which peaks at the equator and falls along a latitudinal gradient. Although it is common to conclude that economics drives the pattern of disease, the authors point out that most of the diseases that afflict the poor spend much of their

life-cycle outside the [human host](#). Many cannot even survive outside the tropics. Their distribution is largely determined by [ecological factors](#), such as temperature, rainfall, and [soil quality](#).

Because of the high correlations between poverty and disease, determining the effects of one on the other was the central challenge of their statistical analysis. Most previous attempts to address this topic ignored disease ecology, argue Bonds and colleagues. The team assembled a large data set for all of the world's nations on economics, parasitic and infectious vector-borne diseases, biodiversity (mammals, birds and plants) and other factors. Knowing that diseases are partly determined by ecology, they used a powerful set of statistical methods, new to macroecology, that allowed variables that may have underlying relationships with each other to be teased apart.

The results of the analysis suggest that infectious disease has as powerful an effect on a nation's economic health as governance, say the authors. "The main asset of the poor is their own labor," says Dr Bonds. "Infectious diseases, which are regulated by the environment, systematically steal human resources. Economically speaking, the effect is similar to that of crime or government corruption on undermining economic growth."

This result has important significance for international aid organizations, as it suggests that money spent on combating disease would also stimulate [economic growth](#). Moreover, although diversity of human diseases is highly correlated with diversity of surrounding species, the study indicates that the burden of such human disease actually drops when biodiversity rises. The analysis is inconclusive about why this effect is so strong. The authors suggest that competition and predation limit the survival of disease vectors and free-living parasites where biodiversity is high. The research sets the stage for a number of future analyses that need to lay bare the relationship between health care

funding and economic development.

More information: Bonds MH, Dobson AP, Keenan DC (2012) Disease Ecology, Biodiversity, and the Latitudinal Gradient in Income. *PLoS Biol* 10(12): e1001456. [doi:10.1371/journal.pbio.1001456](https://doi.org/10.1371/journal.pbio.1001456)

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