

Policy Brief on Biodiversity  
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The diversity of life on earth is understood typically at three interacting levels: genetic diversity, species diversity, and ecosystem diversity. Population diversity can also be important to the maintenance of species and genetic diversity. Acknowledging the role of people in nature, we see a fifth interactive level, cultural diversity, or the diversity of ways people potentially reinforce diversity at the different biological levels.

Quantifying biodiversity is difficult because our understanding of genes is undergoing rapid change, our understanding of species is changing through our new understanding of genetics and the use of new genetic technologies, and ecosystems can only be defined in terms of particular combinations of species and degrees of interrelatedness. Scale is also important. The local diversity of species can increase through the introduction of species from other areas, yet since some native species are almost always lost with introductions from other regions, global diversity decreases through introductions.

Nevertheless, even though measures of total diversity are difficult to impossible, all available evidence indicates that the diversity of life is in very rapid decline and will continue to be in decline throughout the 21<sup>st</sup> century. It is generally accepted by the hundreds of natural and social scientists contributing to the Millennium Ecosystem Assessment that the rate of species loss currently is as much as 1000 times the background rates over the planet's history and much higher than the rates that occurred during earlier periods of rapid extinction due to natural processes. The evidence also indicates that across a range of taxonomic groups the size and ranges of populations of many species in the group are decreasing.

The relationship between human well-being and biodiversity is difficult to assess because it is clearly interactive with other factors, especially income and education. Since income can increase through economic activities that reduce biodiversity and its benefits for future peoples, false correlations are easy to find. The relationship is also complicated by the fact that income attached to people in one area may stem from economic activities that affect biological diversity in other areas. How biological diversity contributes to ecosystem services of different types is also very complex. Nevertheless, the hundreds of natural and social scientists contributing to the Millennium Ecosystem Assessment conclude:

*... biodiversity is an important means as well as an end to a number of key constituents and determinants of human well-being. If we keep all other variables constant, we can say with medium certainty that biodiversity loss and deterioration in ecosystem services will contribute—directly and/or indirectly—to worsening health, higher food insecurity, increasing vulnerability, lower material wealth, less freedoms and choices and personal unhappiness. However, there are insufficient data globally to allow rigorous estimations of the full consequences for human well-being of biodiversity loss and deteriorating ecosystem services.*

Clearly, there will never be sufficient data to fully understand the consequences, but the directions we need to go are clear. We need to stem the major drivers of biodiversity loss: 1)

habitat transformations, such as conversion of forests to agricultural lands, that reduce the diversity of ecosystems, 2) habitat fragmentation that limits the ranges of species that require considerable space, 3) the invasion of species from other areas that out-compete native species, 4) the introduction of materials into environmental systems that are toxic to a significant number of species or overload ecosystems with nutrients, 5) overexploitation of particular species through hunting, fishing, and timbering, and 6) changes in local climates and the geographical shift of climates acceptable to particular species and ecosystems through global warming. Here we begin to see how economic activity and the conceptual frameworks by which we understand and modify economic activity are important. Habitat change is slowing down largely because there are fewer and fewer habitats left to fragment. The introduction of species from other regions, however, is increasing dramatically with increased travel of goods and people associated with globalization. The generation and release of toxic materials is heavily associated with industrialization and chemical over ecological approaches to agriculture. Overexploitation of particular species occurs through misinformation about species abundance and dynamics and inadequate management of the commons. Climate change is largely driven by the past and still increasing dependence of our economies on the combustion of fossil hydrocarbons, natural accumulations of past photosynthetic activity, rather than working with current flows of energy from the sun.

Biodiversity loss is occurring through these six drivers and other processes in different combinations in different places. We do not know whether the diversity loss from toxics associated with the greater intensification of agriculture on existing lands is more or less than the diversity loss would have been had the same increase in production occurred through the conversion of new land to agriculture. Efforts to sustain diversity in one region have implications, both through biological and economic processes, for other regions. The complexity means it is not possible to prescribe ideal marginal adjustments to existing environmental policy, the style of most environmental economic policy analyses. Rather, the loss of biodiversity provides strong evidence that substantial change is needed. It is generally held that we can move in the appropriate direction by reducing population levels, reducing material and fossil energy use, especially that related to questionable consumption and over consumption by the rich, and shifting the economy toward more ecological technologies.

Duraiappa, Anantha and Shahid Naeem, *et al.* 2005. Biodiversity Synthesis Report. Millennium Ecosystem Assessment.