COMMENTARY

Why conservation planning needs socioeconomic data

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Over the past century, human population has expanded rapidly, much to the detriment of many other species that coinhabit the earth. There are roughly four times as many people alive now as there were in 1900. Economic activity has increased even more rapidly than population as evidenced by rising standards of living in most parts of the world. The vast expansion of human activity has led to widespread conversion of natural habitat, the spread of exotic invasive species, changes in nutrient flows, pollution, climate change, and overharvesting. The combined effect of these impacts has put many species at risk of extinction. Projections for continued human population growth and further economic expansion will further increase the risks to biodiversity.

Setting Conservation Priorities

In the face of these large-scale anthropogenic threats to biodiversity and the limited resources devoted to conservation, especially in low-income tropical countries that are home to the majority of species, public and private conservation organizations have been forced by necessity to set priorities. What are the most important places and the most important actions needed to conserve biodiversity? What takes precedence and what can wait? In their article in a recent issue of PNAS, "Cost-effective global conservation spending is robust to taxonomic group," Bode *et al.* (1) provide important advice for addressing such questions.

Effectively conserving biodiversity with limited conservation budgets requires allocating resources to actions that give the biggest "bang per buck," that is, that maximize the conservation return on investment (2). Maximizing the conservation return on investment requires assessing both the expected benefits and costs of alternative conservation strategies and choosing strategies with the highest expected benefit-to-cost ratio. Expected benefits of conservation strategies depend on biological factors, such as the number of species in a region, as well as socioeconomic factors, such as the rate of land conversion in the region. Regions with large numbers of endemic species but facing little or no threat do not require conservation interventions. Only those areas that have large numbers of species and face high threats, "biodiversity hotspots," generate a high benefit from conservation interventions. The costs of conservation strategies include expenditure on land purchase or conservation easements as well as management costs. Virtually all current approaches used by conservation organizations for setting conservation priorities focus solely on benefits and ignore costs (3). And within benefits, more significant attention has been paid to how biodiversity is measured and less attention has been paid to accurately assessing threat.

Incorporating Cost and Threat Data

As Bode *et al.* (1) show, however, conservation priorities are much more sensitive to variation in cost and the degree of threat facing a region than they are to changes in how biodiversity is measured. Bode *et al.* use data on the number of endemic species of various taxonomic groups, the cost of establishing new biological reserves, and the projected rate of loss of habitat for 34 global biodiversity hotspots. They solve the conservation allocation problem across these 34 hotspots to minimize the expected loss of species incorporating cost and threat information by using different taxonomic groups as a measure of biodiversity. Their results show that there is high overlap in areas selected to receive funding regardless of the taxonomic group used to measure biodiversity. Areas with low cost and high threat tend to be allocated funding no matter which taxonomic group is used. Similar results are generated when only information on costs and threat are used. However, very different results are generated when using data on taxonomic groups alone without consideration of costs and threat.

High variability makes cost figure prominently in cost-effective conservation.

These results suggest that conservationists should spend more effort accurately assessing threat levels and costs and less effort worrying about which taxonomic group to use as a surrogate measure for biodiversity. Cost and threat data are highly variable across regions, typically much more variable than the number of species across regions. This high variability makes cost figure prominently in cost-effective conservation that maximizes the biological return per dollar. Other studies have also found that cost variability is wider than biological variability and that cost considerations have an important impact on priority setting (e.g., refs. 2, 4, and 5).

That conservation priorities are relatively insensitive to taxonomic group has practical significance. It is impossible to measure all of biodiversity. We have named approximately 1.8 million of the possibly 5 to 30 million species that exist. Even among named species geographic ranges and life-history characteristics are well known for only a small subset. Therefore, surrogate measures for biodiversity are necessary and a cottage industry has sprung up to analyze the question of what relatively well studied taxonomic group might make a good surrogate for all of biodiversity. Recent global scale analyses, however, have shown that there is often little congruence on selecting species-rich areas for different taxonomic groups (e.g., refs. 6 and 7), making the search for a worthy surrogate problematic. With the results shown here, though, having a good surrogate measure may not matter. Getting accurate data on costs and threat surely will.

Socioeconomic Means to Attain Biological Ends

These results help to highlight the fact that, although the *goal* of conservation is biological (e.g., maximize the number of species conserved), the *means* to obtain the goal are primarily socioeconomic. Understanding the human behavior that lies at the root of threats to biodiversity, calculating the costs of various strategies to conserve biodiversity, and designing strategies, policies, and in-stitutions that can shift human

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behavior to be more consistent with conservation is largely the domain of social science. Planning for how best to mitigate threats and foster the recovery of biodiversity requires an understanding of the human social, political, and economic systems in which conservation operates. Not adequately taking account of social, political, and economic realities in conservation planning will cause the implementation of conservation plans to be ineffective or cause the failure of conservation strategies (8). In the end, it is human actions that have caused the biodiversity crisis and changes in human behavior will be required to adequately resolve it. It is appropriate then that Bode *et al*. (1) find that it is socioeconomic data that are needed for assessing conservation strategies.

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