MEMORANDUM TO THE PRESIDENT

From: **Walter V. Reid**

Subject: **Biodiversity, Ecosystem Change, and International Development**

PROBLEM

During the past decade, the Clinton and Bush administrations regularly included the biodiversity crisis on their public shortlist of global environmental priorities. In practice, they virtually ignored the issue. U.S. policy makers defined the biodiversity crisis as the problem of species extinction, and although they agreed that extinction is morally tragic, they believed that biodiversity had little bearing on U.S. interests and only a small domestic and international constituency. This marginalization of the issue is dangerous and politically misguided. There is another dimension to the problem that is at the very core of U.S. interests. This involves the harmful economic and public health consequences of the wholesale changes humans are making to the structure and function of the world's biodiversity, an issue best characterized as the problem of "ecosystem change."

The new administration needs to reframe the biodiversity issue, taking it from a narrow focus on species extinction to a broader focus on ecosystem change and international development. The latter approach addresses a more critical issue, reinforces international alliances rather than divisions, reinforces international economic and social agendas, and builds political support in the United States. If handled correctly, the issues of biodiversity and ecosystem change could be transformed from a U.S. policy backwater into a visible, popular, and influential opportunity for U.S. leadership.

What is the Biodiversity Problem?

Biodiversity first emerged on the agenda of global environmental concerns in the early 1980s when scientists began to document the threat of global species extinction and habitat loss. By 1993, an international convention on biological diversity had been signed by more than 130 countries. Since then, United Nations agencies have spent more than $1 billion on biodiversity projects around the world—far more than the wildest dreams of conservationists in the 1980s. The warp speed at which this issue gained prominence and became the focus of international action led some to believe that a serious response to this global challenge had begun.

Nobody believes that today. International action has helped some species and habitats, but the pace of species loss and biological resource degradation is accelerating, particularly in developing countries.

The lack of action and the lack of a public constituency stems from the narrow definition of the problem. Biodiversity is the variety of life on Earth. It includes the diversity of species, genetic diversity within species, and the habitats and ecosystems distributed around the world. The biodiversity "problem" is in fact a combination of several interrelated issues concerning changes to the world's biodiversity and how those changes affect people. The issue that has dominated public concern and policy response has been species extinction. Human actions over the past century, in particular the conversion of natural habitats to agriculture and the widespread introduction of nonnative invasive species, have set the stage for an episode of species extinction that, if unchecked, will result in the greatest loss of species in the past 65 million years.[1] Recorded extinctions during the past century already greatly exceed background extinction rates. Scientists predict that tens of thousands of species are likely to go extinct in the coming decades unless major efforts are made to restore habitats and reduce the spread of invasive species. In the United States alone, 1,200 species are currently listed by the federal government as threatened and endangered. The Nature Conservancy estimates that one-third of U.S. flora and fauna is at risk.[2]

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Most species that become extinct over the coming decades will have no practical consequences for human livelihoods. This is not to say that extinctions do not sometimes have serious ramifications. For example, before their extinction, New Zealand's moas (elephant birds) were an important source of food. In other cases, such as the extirpation of elephants from parts of Africa, the loss of a species can change the composition, structure, and functioning of entire ecosystems. Moreover, scientists stress that it is difficult to know which species are essential for maintaining various ecosystem processes, and thus the loss of any species is risky. Even so, hundreds of species have gone extinct over the past century, thousands are faced with extinction today, and the economic and social impacts of these extinctions are likely to be minimal. Many of the species that will be lost are rare or restricted to relatively small areas and do not play a unique role in the ecosystem.

For this reason, economic forces rarely help to maintain species diversity. However, there are exceptions. For example, species-rich national parks sometimes generate substantial foreign exchange from ecotourism. But more often, the economic benefits that result from simplifying biological systems and planting crops, cutting forests, or building houses or factories far exceed the direct and indirect economic benefits of protecting species diversity. Protecting species from extinction is thus not a utilitarian choice but a moral one. The extinction of a species is the one truly irreversible impact that humans have on the environment. Edward O. Wilson, Pellegrino Research professor in entomology at Harvard University, has called this the "folly" that future generations are least likely to forgive.[3]

Although the threat of species extinction may be the best known aspect of the biodiversity problem, another has far greater practical consequences for human livelihoods and U.S. interests: ecosystem change. Significant changes to the structure and function of habitats and ecosystems not only result in species loss but also affect the ability of these systems to meet human needs. Humans have extensively changed the world's ecosystems, and the pace of this change is accelerating. Some 40 to 50 percent of land is now transformed or degraded by human actions.[4] Models based on the median UN population projections suggest that an

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additional one-third of global land cover will be transformed during the next 100 years with the greatest changes occurring in the next three decades.[5] Human actions (the application of fertilizers, cultivation of certain crops, and fossil fuel combustion) now account for the addition of more biologically active nitrogen to ecosystems then all natural pathways combined.[6] These human-caused nitrogen flows will grow rapidly during the next 20 years as fertilizer use rises by an additional 55 percent. Humans have also transformed freshwater ecosystems. People appropriate 54 percent of accessible freshwater runoff, and dams and diversions have slowed rivers to such an extent that the length of time that an average drop of water entering a river takes to reach the sea has tripled.[7] All of these impacts will be compounded by Earth's changing climate.

Ecosystem change is not always harmful. Indeed, most changes to ecosystems have been made intentionally to increase the production of certain goods and services. For example, the growth in the extent of agricultural lands combined with increases in cereal yields have led to net increases in per-capita food availability despite dramatic increases in world population.[8] Similarly, water withdrawals from freshwater ecosystems have been responsible for the growth of agricultural yields and have also met demands of industry and growing urban populations.

Increasingly, however, the costs of these ecosystem changes are mounting. Two processes are at work. First, human actions have often degraded ecosystems so that they are less capable of producing the quantity and quality of products and services demanded.[9] For example, some 40 percent of agricultural land has been strongly or very strongly degraded in the past 50 years by erosion, salinization, compaction, nutrient depletion, biological degradation, or pollution.[10] Similarly, more than 60 percent of the world's major fisheries are in urgent need of actions to restore depleted stocks or to protect stocks from overfishing.[11]

Second, human-made changes to ecosystems to achieve one goal, such as food production or flood control, have resulted in significant and often unforeseen tradeoffs with other important products and services provided by ecosystems. For example, increased use of nitrogen-based fertilizers to increase agricultural production has eutrophied coastal waters, created "dead zones," and destroyed fisheries in rivers and coastal zones in the Mediterranean and Black Seas and the northwestern Gulf of Mexico. These changes in freshwater and

coastal systems have also jeopardized human health by contributing to outbreaks of cholera and other diseases. Wetland conversion has increased the frequency and severity of downstream flooding.

The magnitude of human demands on ecosystems is now so great that these tradeoffs among goods and services have become the rule. A nation can increase food supply by converting a forest to agriculture but in so doing decreases the supply of goods, such as clean water, timber, biodiversity, or flood control, that may be of equal or greater importance. A nation can increase timber harvest but only with decreased revenues from downstream hydrofacilities and increased risk of landslides.

Policy Issues

All nations need to modify their ecosystems to meet the needs of growing populations, but the potential environmental, social, and economic damage that will result from inappropriate management actions during the next century have serious implications for U.S. interests in particular. Human demand for the products and services of ecosystems, such as food and clean water, will grow dramatically in coming years. The regions in which demand is growing most rapidly are also the regions in which the capacity of ecosystems to meet this demand has already been degraded. These impacts of ecosystem change will cause the greatest harm to the poor, who depend most directly on forests, fisheries, and agriculture and who are most vulnerable to the environmental problems that result from ecosystem degradation, such as floods and crop failures.

The economic costs of ecosystem degradation directly hinder U.S. efforts to strengthen economies around the world. Africa's economic growth rates will not accelerate while the continent faces increasing problems in meeting basic needs for food and water. Asia's economic growth will be slowed by lower production in its fishing and timber industries and by the health costs associated with declining availability of clean water. The United States needs to help countries confront these issues just as it helps them confront weak financial institutions, corruption, and poorly developed markets.

The United States has even greater reason to be concerned about the social costs of ecosystem degradation. Ecosystem degradation may not be the sole cause

of social unrest and political instability, but the overlap between regions of unrest and regions facing serious problems associated with declining agricultural productivity, diminished fisheries production, and water shortages is evident: Peru, Ecuador, Sierra Leone, Ethiopia, Somalia, Haiti. (See Homer-Dixon memo for this forum.)

A scenario of growing economic and social costs of ecosystem degradation is not the only plausible future. An alternative scenario would redirect the pattern of ecosystem change to better meet human needs and strengthen national economies, while simultaneously addressing the species extinction problem. Indeed, this scenario has already played out in parts of the United States. In the 1800s, much of the now-forested East Coast of the United States had been converted to agriculture. But as agricultural productivity grew and the U.S. economy transformed from a resource-based to an industrial economy, rural populations declined and agriculture became increasingly concentrated in the most productive lands of the Midwest. As the human footprint on natural ecosystems is lightened, the capability of those systems to maintain biodiversity increases.

Although a scenario like this could eventually be achieved globally, it is far from inevitable. For example, well-managed forests could allow 20 percent or less of today's forest area to supply world commercial wood demand in the middle of the 21st century.[12] Similarly, if the world farmer reaches the average yield of today's U.S. corn grower during the next century, the expected world population of 10 billion people would need only half of today's cropland area.

The focus of U.S. policy should be to help countries manage the process of ecosystem change to better meet their short-term economic needs and to set the stage for a long-term reduction of the human footprint. Unlike the relatively weak political and economic leverage provided by the issue of species extinction, the issue of ecosystem change is directly tied to important U.S. economic and security concerns.

This approach to the biodiversity issue bears no resemblance to the approach that has been followed thus far. The set of policies and initiatives that have been cobbled together over the past two administrations too often addresses symptoms rather than problems, fails to achieve synergies and often works at cross-purposes, and entirely lacks a coherent strategic focus. The U.S. public cares about

forests, coral reefs, elephants, and pandas so the country rails against forest loss, launches a coral reef initiative, brings pandas to the nation's capital, and funds a handful of protected areas. This "boutique" approach is viewed by most developing countries as post-colonial meddling that undermines their development goals. And it has achieved little.

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RECOMMENDATIONS

Around the world, the scale of change to the world's ecosystems is immense and growing rapidly. Many of these changes, such as the expansion of agriculture and the use of fertilizers, have provided tremendous benefits for growing populations. But increasingly, these changes are degrading the productivity of ecosystems, causing growing numbers of species extinctions, diminishing the short-term contributions of ecosystems to meeting human needs, and raising the risk of catastrophic changes to the structure and function of ecosystems that could exact substantial costs on the people of the United States and other nations.

Historically U.S. domestic and international efforts have aimed to slow the degradation of the world's ecosystems. In keeping with the broad transitions that provide the context for action by the new presidential administration, the aim should be to move beyond a defensive posture and take actions that help restore the ability of the living planet to meet the aspirations of U.S. citizens and the needs of the world's poor, in particular. To achieve this end, the administration should take the following steps:

Commit to the creation of a reliable system of ecosystem monitoring and assessment in the United States and internationally.

Until recently, knowledge of the scale of ecosystem change and how best to address the challenge was limited. Advances in remote sensing, environmental monitoring, valuation of nonmarketed ecosystem services, ecological modeling, and ecological forecasting have set the stage for a forward-looking "anticipatory

approach" to the problem. International scientific assessment processes, like the Intergovernmental Panel on Climate Change (IPCC) and the proposed Millennium Ecosystem Assessment, can greatly assist decision makers in obtaining state-of-the-art technical information directly relevant to policy choices.[13] This administration should strongly support efforts such as these to communicate the findings of scientific research to policy makers in a manner that directly meets their needs.

At the same time, the research base itself must be strengthened. The U.S. Global Change Research Program (GCRP) has greatly strengthened the capability of the U.S. public and private sector to anticipate, plan for, and mitigate long-term changes resulting from human impacts on the environment and particularly on climate. To meet the needs identified in this paper, GCRP must be bolstered with a strong focus on the life sciences as well.

Renew the commitment to protecting and restoring species and ecosystems within the United States.

Domestically, the United States has made tremendous strides during the past three decades to reduce pressures on its ecosystems and to protect critical ecosystems and endangered species. These efforts are of enormous value because some of the world's most biologically outstanding places are found within U.S. borders. However, the legacy of past mismanagement of the nation's resources and continuing pressures on many ecosystems can be seen in the growing numbers of endangered species and humans' continuing inability to meet such basic and popularly supported domestic goals as "fishable swimable waters." Specific actions include

- Commit to a 10-year goal of achieving the long-stated U.S. policy objective of making the nations rivers and lakes fishable and swimable. As a first step, call on agencies to formulate a plan that goes beyond the existing regulatory approach to nonpoint source pollution and takes full advantage of incentives and market approaches for increasing the efficiency of fertilizer applications and reducing the risk of catastrophic failure of livestock waste facilities. Meeting this goal is important not only for U.S. rivers but for the coastal zone as well. (See Solow memo.) Moreover, by taking steps to address these problems, the United States will become a leader in technol-

ogy and scientific knowledge that will help the world grapple with the dangerous growth in flows of such nutrients as nitrogen and phosphorus.

- Commit to the goal of reducing the number of threatened species in the United States. The Nature Conservancy regularly publishes statistics on threatened species in the nation. The number has been growing each decade. It is time to reverse this trend by a combination of actions to protect and wisely manage key ecoregions in the nation and by actions to recover species on the federal endangered species list.

- Establish a comprehensive system of marine protection in the coastal waters of the United States. Considerable scientific evidence demonstrates the effectiveness of coastal protected areas in maintaining diversity and helping to maintain and restore harvestable fish populations. Although the United States has one of the world's leading systems of terrestrial protected areas, the country has yet to establish a comparable system for marine and coastal ecosystems. (See Ogden memo.)

Broaden the international approach to the biodiversity crisis to include a strong focus on the need to help countries manage the process of ecosystem change in support of national development.

In the end, the species extinction crisis will be slowed only if we succeed in addressing the broader dimensions of ecosystem change. This does not mean that the United States should not also pursue short-term actions aimed specifically at slowing species extinction. But those short-term actions only make sense if they are part of a long-term strategy addressing nations' prospects and needs for development.

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The public cares about the conservation of species and people believe it is morally wrong to cause species extinctions. But everywhere, these concerns take a back seat to people's immediate needs.

However, the issue of ecosystem change is of tremendous importance for U.S. public and private interests and can better motivate action. The harmful impacts of poorly managed ecosystem changes are already greater than most of the projected impacts of climate change. A priority for the U.S. policy agenda should thus be to help other countries manage the process of ecosystem change in support of national development.

- Ratify the United Nations Convention on Biological Diversity. The Convention on Biological Diversity (CBD) has little direct influence on biodiversity because it is a framework convention with few binding commitments. However, the goals of CBD are very much in keeping with a policy focus on ecosystem change and international development. The primary role of the convention has been to shape the standards and norms by which countries address the biodiversity issue. The United States could assume the position of a world leader on this issue if it worked through CBD to promote the approach of managing ecosystem change to help nations prosper. But it can only do this if it has ratified the convention. Moreover, failure to ratify CBD has substantially weakened U.S. influence in important negotiations, such as the negotiation of the Cartagena Protocol on Biosafety.

- Help countries align the benefits of trade liberalization with improved management of ecosystem change. The United States should not dictate choices about the uses other countries make of their ecosystems. For example, it may make perfect sense to clear forests in a heavily forested country to gain access to new agricultural markets liberalized through freer trade. However, it is in the U.S. interest and in the interest of the countries involved that they make wise choices in responding to liberalized markets. The U.S. administration, and particularly the office of the U.S. Trade Representative, should provide technical assistance to countries that will enable them to better understand the costs and benefits of choices they make under freer trade. The United States can also push international institutions such as the World Trade Organization, the International Monetary Fund, and the World Bank to provide similar assistance.

- Mainstream the issue of ecosystem change in foreign policy. The United States is increasingly drawn into situations of social and political unrest

created in part by ecosystem degradation. When the United States works with countries to strengthen their social and economic institutions, it should also help them enhance their "biological capital." Two issues that can form the core of U.S. efforts to strengthen nations' abilities to manage ecosystem change are the removal of environmentally damaging subsidies and the "greening" of gross domestic product (GDP). It often makes economic, social, and environmental sense to help countries reduce or eliminate subsidies that achieve economic gains largely by consuming biological capital. Harmful subsidies in the fishing industry are a case in point because they encourage overexploitation of fish resources, causing long-term harm to fishing communities when the harvests crash. Similarly, countries would obtain a clearer picture of their resource dependence and the costs of mismanagement of ecosystem change if they accounted for changes in biological capital in their GDP just as they account for other economic changes.[14]

- Increase support to the protection of biodiversity in the most biologically diverse and threatened ecoregions and hot spots around the world. Species extinction cannot be stopped unless we address the problems associated with ecosystem change. That said, no serious reduction in the human footprint in developing nations is likely until the second half of the 21st century at best. In the span of these 50 or more years, tens of thousands of species could become extinct. The extent and effectiveness of the world's network of protected areas will largely determine the number of species that will survive through the next century. Protected areas are pivotal because the extent of the species extinction crisis is highly localized. Within the coterminous United States, more than half of endangered species of plants, birds, fish, and mollusks are found in less than 2.0 percent of the land area.[15] Globally, 35–45 percent of plants and vertebrate animals are found in hot spots that comprise only 1.4 percent of the Earth's land surface.[16]

- Increase support to regions facing serious problems of ecosystem degradation, particularly where it is having a direct effect on the ability of the poor to meet their needs. At the core of the new approach to the biodiversity crisis described here is the argument that the biodiversity problem is intractable politically and operationally if it is defined only as the problem of species extinction. The United States should increase its efforts to slow

species loss in key ecoregions and hot spots, but progress will not be sustained if this is done in isolation without at least as great a commitment to tackling problem areas where ecosystem change is having major impacts on the development prospects of people and nations.

- Commit to the establishment of a fully funded international endowment in support of the maintenance of the world's seedbanks. The world's public-sector seedbanks, maintained by the centers of the Consultative Group on International Agricultural Research (CGIAR) and by national agricultural ministries, house some of the world's most important biodiversity from the standpoint of its importance to human livelihoods. These seedbanks must persist for millennia, yet they struggle to obtain the resources just to last from year to year.

Neither U.S. nor global interests are being well served by the disparate and poorly coordinated U.S. biodiversity policies. By addressing only one aspect of the biodiversity issue, past administrations have made a dangerous and politically shortsighted miscalculation. How countries manage ecosystem change is as close to the center of U.S. interests in many parts of the world as how they manage their economic and human resources. By helping countries manage ecosystem change to support development needs, we would address real concerns of the countries in the context of the mainstream U.S. policy issues of global economic development and national security. And we would steer the course of international development toward a future with a far lighter human footprint on the world's species diversity. This administration could achieve a breakthrough on the biodiversity issue by reframing and mainstreaming the issue of biodiversity, ecosystem change, and international development in U.S. foreign policy.