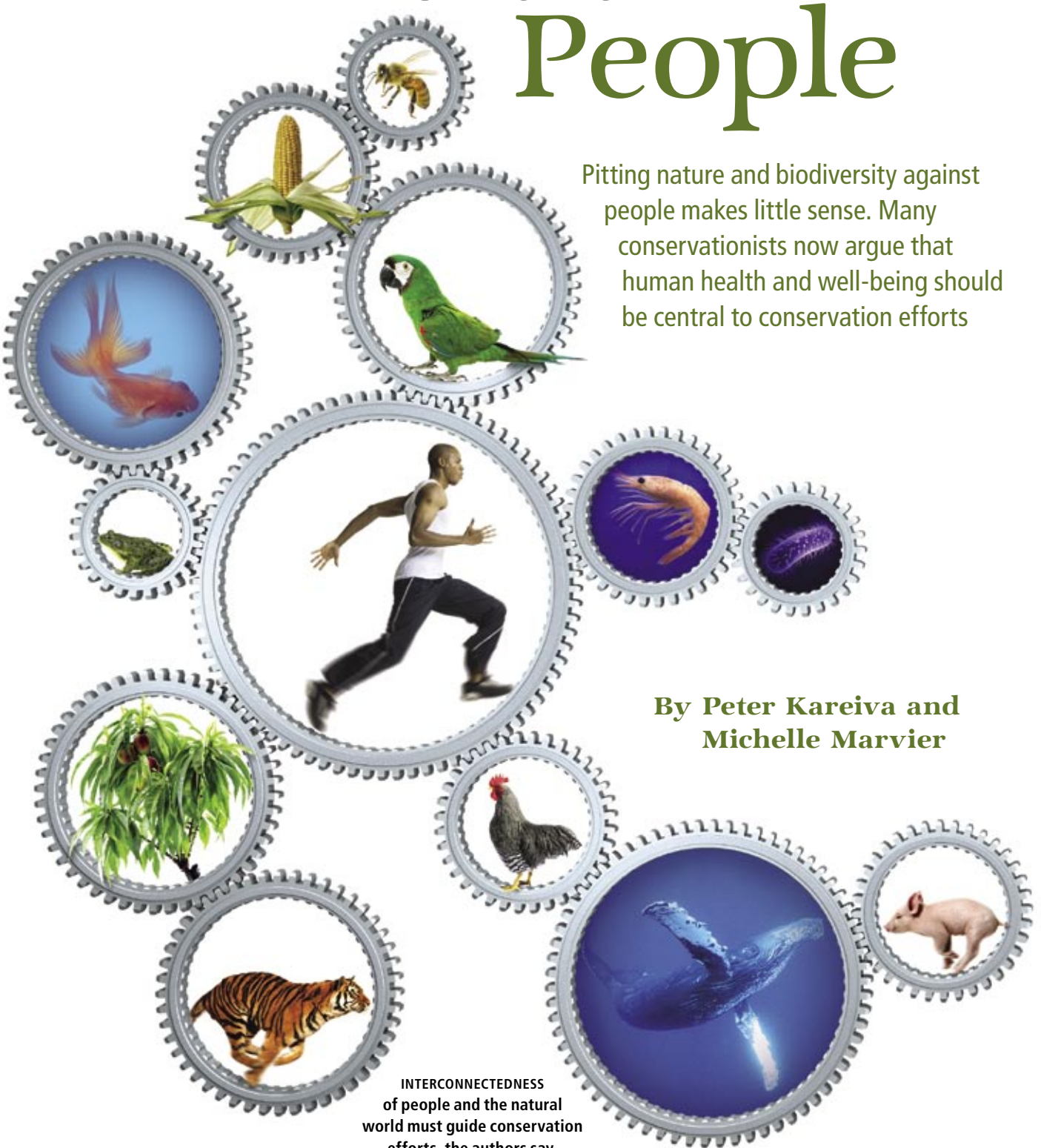


Conservation for the People

Pitting nature and biodiversity against people makes little sense. Many conservationists now argue that human health and well-being should be central to conservation efforts

By Peter Kareiva and
Michelle Marvier



INTERCONNECTEDNESS
of people and the natural
world must guide conservation
efforts, the authors say.



KOMODO NATIONAL PARK in Indonesia has local support because it led to income from cultivating reef fish and selling carvings.



Komodo dragon

KEY CONCEPTS

- Preserving biodiversity for its own sake, particularly in areas called hot spots, is not working as a conservation strategy.
- Focusing on protecting ecosystems vital to people's health and material needs makes more sense.
- Such ecosystems would include not only forests but also wetlands that maintain clean water, mangroves that shield against storms and reefs that sustain fisheries.
- Saving these sites can preserve biodiversity and ensure that people are a priority. —The Editors

In 2004 the World Conservation Union placed three vultures—the long-billed, the slender-billed and the Oriental white-backed—on the critically endangered list. Populations of all three reached nearly 40 million in India and South Asia in the early 1990s but had fallen by more than 97 percent. The reasons for saving these vultures from extinction could be framed in familiar terms: we have an ethical obligation to save the world's biodiversity for its own sake. But the reasons could also be outlined in a less familiar way.

For a long time, observers did not know what was causing the vultures' decline. Some speculated the culprit was habitat loss or pollution. Several years ago researchers discovered that the birds were being killed by an anti-inflammatory drug, diclofenac, commonly administered to cows. In bovines and humans, the medicine reduces pain; in vultures, it causes renal failure. As the vultures have disappeared, hundreds of thousands of cow carcasses customarily left for the birds have festered in the sun, where they incubate anthrax, according to some reports, and are consumed by dogs. Because of the ready food supply, the feral dog population has exploded—and with it the threat of rabies. Thus, the vultures' fate may be linked with that of millions of people; saving the vultures from extinction would protect people from dangerous disease.

Casual observers do not always see links be-

tween human well-being and aiding endangered species, but such connections abound in many situations that engage conservationists. Ecosystems such as wetlands and mangrove stands protect people from lethal storms; forests and coral reefs provide food and income; damage to one ecosystem can harm another half a world away as well as the individuals who rely on it for resources or tourism revenue.

Despite these mutual dependencies, the public and some governments increasingly view efforts to preserve biological diversity as elevating the needs of plants and animals above those of humans. To reverse this trend—and to better serve humanity and threatened organisms—we and a growing number of conservationists argue that old ways of prioritizing conservation activities should be largely scrapped in favor of an approach that emphasizes saving ecosystems that have value to people. Our plan should save many species, while protecting human health and livelihoods.

Out, Out Hot Spot

Conservation's misanthropic reputation has arisen, in part, because millions of people have been forced off their land or have otherwise had their sources of food and income snatched from them so that animals and habitats could be preserved. Kenya's president Mwai Kibaki's con-

A TALE OF TWO STRATEGIES

The well-known conservation strategy of saving hot spots (*left*) does not protect many ecosystems valuable to human health and development. An ecosystem services approach (*right*) would do just that and would establish a different metric for setting priorities.

HOT-SPOTS STRATEGY



THE BASIC IDEA

Identify threatened areas with high plant diversity and protect them, under the assumption that doing so protects an array of animals—which are often harder to catalogue than plants. To date, 25 such hot-spot regions have been named, including Bocaina National Park in Brazil (*above*).

TYPICAL APPROACH

Establish a national park or reserve to protect animal and plant life. Discourage people from living on or using that land. Patrol and enforce boundaries.

DRAWBACKS

Areas rich in plant species are not necessarily rich in animal diversity. Local people are often displaced or lose important resources. Hot spots have not captured the public's imagination or support.

ECOSYSTEM SERVICES STRATEGY



THE BASIC IDEA

Make clear people's dependence on various ecosystems—as is the case with tourism revenues in Punta Tomba, Argentina (*above*)—and identify ecosystems that are gravely threatened and whose impairment will harm local residents.

TYPICAL APPROACH

Where ecosystems are being degraded, establish a conservation plan that protects the ecosystem and benefits the community dependent on it.

WHY IT'S A BETTER IDEA

As people see more clearly their reliance on various ecosystems for their health and economic security, they will support conservation projects. As a result, biodiversity will be preserved, but not at the expense of humans.

WHAT ARE ECOSYSTEM SERVICES?

In a recent global study, the United Nations identified four kinds of services:

PROVISIONING—supplying food or genetic resources, for example

REGULATING—providing flood control, climate modulation or other similar functions

CULTURAL—offering benefits that are nonmaterial, such as a sense of place and spiritual well-being

SUPPORTING—delivering the most basic elements of an ecosystem, including nutrient cycling, soil formation or pollination

troverial decision to return Amboseli National Park to its original Maasai inhabitants reflects a growing discontent with such preemptory displacements. It is a global discontent. Hunters and farmers in Asia and throughout Africa contend that parks limit their diet and earnings. U.S. farmers and loggers are angry about losing their water privileges or their jobs because of salmon and spotted owls.

Public perception of a nature-versus-people theme also derives from the conservation strategy of focusing on so-called hot spots. In 1988 Norman Myers of the University of Oxford developed the idea of biodiversity hot spots, small areas that harbor a great variety of endemic, or native and geographically restricted, plant species. Myers used diversity of such plants as the measure because plant lists were the most reliable and often the only data available and because it was thought that plant diversity served as a good proxy for animal diversity. Myers and his colleagues at Conservation

International went on to identify 25 hot spots—the Brazilian Cerrado region is one; the Horn of Africa is another—on which to focus conservation projects.

Earlier conservation campaigns had centered on charismatic species such as pandas, whales and seals. In contrast, the concept of hot spots provided a set of rigorous, quantifiable criteria by which to guide conservation investment—a triage system based on counting species was more scientific than one based on compelling photographs of cute or iconic animals. The approach seemed more realistic as well: conservation organizations have limited funds and could now put money in places where the most species might be saved. For the past 15 years, this strategy has been embraced by philanthropic and multinational organizations alike.

Although “hot spot” is a compelling phrase, the idea of biodiversity that underlies it has not succeeded in capturing public imagination or interest. One recent survey showed that only 30

percent of Americans have heard of the term “biodiversity.” And many people working in conservation are careful to avoid the word because it engenders apathy or a negative response. Biodiversity hot spots clearly are not galvanizing the public to fund or participate in conservation.

Some scientists are not so keen on hot spots either. C. David L. Orme of Imperial College London recently pointed out that they might be false advertising: places with a lot of native plant species do not necessarily have many butterfly or vertebrate species as well. Marcel Cardillo, also at Imperial College London, has noted that animals in floral hot spots are not those most vulnerable to extinction: that distinction goes instead to mammals in boreal forests and arctic regions.

Other biologists have shown that many of the world’s least diverse regions provide important seasonal homes, migratory stops or nesting sites. Half a million Magellanic penguins gather each September in Punta Tomba, Argentina, for instance. This dry, shrubby region of Patagonia is home to few endemic plants and could not be called even a biodiversity lukewarm spot. Yet the penguins nesting there are critical to the local economy; 70,000 tourists visit every year to see them. Many similar places exist, sites of low plant biodiversity that are nonetheless crucial to species with far-reaching ecological or economic importance: stretches of tundra that support ducks, swans and geese; temperate rivers where salmon spawn.

A Service Paradigm

Conservation needs additional principles to guide it. Although people may not comprehend the concept of biodiversity, they do value nature as a source of food, fuel, building materials, recreation and inspiration. Ecologists have begun to quantify this natural capital under the umbrella of “ecosystem services,” a term coined by Paul R. Ehrlich and championed by Gretchen C. Daily, both at Stanford University. These services include products for which there are markets, such as medicines and timber, as well as processes whose economic value usually goes unconsidered: water filtration, pollination, climate regulation, flood and disease control, and soil formation. When Robert Costanza of the University of Vermont and other economists attempted to place a dollar value on those processes, they found that the yearly value of such economic services outstripped the gross domestic product of all countries combined.



COUNTRIES highlighted here harbor life raft ecosystems that are conservation priorities for the authors. Such ecosystems are ones whose conservation and restoration would dramatically improve people’s lives. The authors identified the sites using data on poverty, the importance of natural resources to the economy, and the extent of land degradation.

The idea of focusing on ecosystem services is not being embraced by academics alone; increasingly, governments and nongovernmental organizations are considering protecting these services a fundamental goal. In 2000 the United Nations called for a study of ecosystem services. A year later an international team of more than 1,300 scientists undertook one of ecology’s most ambitious endeavors: the Millennium Ecosystem Assessment. The project documented the impacts humans have had on ecosystem services in the past 50 years. Services were divided into four categories: provisioning (supplying products such as food or genetic resources), regulating (contributing regulatory functions such as flood control), cultural (supplying nonmaterial benefits such as a sense of spiritual well-being) and supporting (providing basic elements of the ecosystem, such as soil formation). The assessment found that most ecosystem services not only have declined but are being used unsustainably.

For the wider public, the Indian Ocean tsunami in 2004 and Hurricane Katrina in 2005 brought into sharp focus the relation between ecosystems and human living conditions. In both cases, damage was amplified by loss of natural vegetation. The destruction over the past 70 years of some 1,500 square miles of Louisiana’s marshlands and eelgrass beds greatly exacerbated the storm surge generated by Katrina [see “Drowning New Orleans,” by Mark Fischetti; *SCIENTIFIC AMERICAN*, October 2001]. In Southeast Asia the widespread conversion of coastal mangrove forests into shrimp ponds meant there was no



WHEN INDIA’S VULTURES started dying, the ramifications for humans were not immediately clear—until the threat of rabies from increased numbers of feral dogs feasting on animal carcasses made the link explicit. Saving wildlife often saves people, too. Connections such as this between the fate of wildlife and the health of humans abound.

PAGE 50: SAMUEL AND PEDRO VELASCO SW Infographics; DAVIES & STARR Getty Images (corn); DON FARRALL/Getty Images (bee and goldfish); GEORGE DOYLE AND CIARAN GRIFFIN/Getty Images (parrot); RUBBERBALL PRODUCTIONS/GETTY IMAGES (man); PURESTOCK/GETTY IMAGES (shrimp, rooster and frog); MEDICALFOTOMAGNET/GETTY IMAGES (microorganism); FLIP NICKLIN/Minden Pictures/Getty Images (whale); DIGITAL VISION/GETTY IMAGES (pigeon); JOSEPH VAN OS/Getty Images (tiger); CREATIV STUDIO HEINEMANN/Getty Images (plant); THIS PAGE: ANN SANDERSON (top); ASHOK JAIN/Nature Picture Library (vultures)

[CASE STUDY]

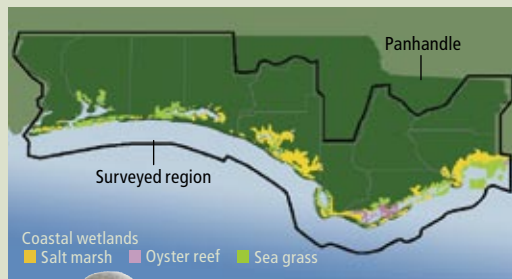
PROTECTING POOR COMMUNITIES AND HABITATS

THE PROBLEM

The salt marshes, sea-grass beds and oyster reefs of Florida's Gulf Coast harbor manatees, sea turtles, piping plovers and many other threatened species, as well as serving as nurseries for economically important shrimp, crab and red snapper. These habitats also provide protection from storm surges that accompany hurricanes, such as Dennis in 2004 (*photograph at right*). Yet strategies to defend and restore coastal ecosystems—which could simultaneously assist people and expand habitats for threatened and economically valuable species—have largely been ignored in favor of engineering projects that accelerate erosion and habitat loss.

THE SOLUTION

Scientists from the Nature Conservancy and the National Oceanic and Atmospheric Administration recently combined maps of critical habitats and threatened species in the Florida Panhandle with maps of anticipated storm surges and of communities most likely to suffer because of storms (*below*). By overlaying these data sets, they were able to identify areas whose restoration should simultaneously protect the most vulnerable human populations as well as many of the areas' most important species.



Piping plover

[THE AUTHORS]



Peter Kareiva and Michelle Marvier have worked together for many years, conducting studies of transgenic crops and of salmon in the Pacific Northwest. They are now collaborating on a conservation textbook. Kareiva is chief scientist at the Nature Conservancy, where he conducts research and travels widely to teach and advise on international projects. Marvier is a professor at Santa Clara University, where she directs the Environmental Studies Institute. Both feel strongly that conservation must be more directly connected to people.

wave buffer to protect against the tsunami. Post-tsunami studies led by Sri Lankan researcher Farid Dahdouh-Guebas of Vrije University in Brussels found that shorelines with intact mangrove forests suffered almost no damage. Neither Louisiana's marshes nor Sri Lanka's mangroves rank among the world's biodiversity hot spots; they have virtually no endemic plant species, and we estimate that the number of plant and animal species they contain does not approach one tenth of that found in a rain forest.

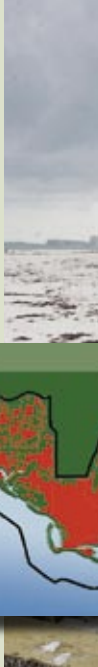
Connections between habitat loss and economic loss that are not always as obvious can also be significant. The winds that whip through Africa's ever expanding Sahara and Sahel carry dust that is blown west over the Atlantic Ocean. Every year several hundred million tons of such sand land in the Americas or the Caribbean. Once there the dust, pollutants, microorganisms and nutrients accompanying the sand play a part in wiping out coral reefs—reducing tourism and fisheries. Overgrazing and unsustainable farming practices in northern and sub-Saharan Africa have fueled poverty, famine and malnutrition regionally and undermined corals and economies half a world away.

The economic benefits afforded by ecosystem services are most needed by developing nations. These countries derive substantial income from timber, fiber and agriculture; forestry and fisheries are typically five to 10 times more impor-

tant as components of national economies for such nations than for the U.S. and Europe. A 2005 U.N. report convincingly explained that maintaining the environment is the key to alleviating poverty for the world's 750 million rural poor.

Human health is also threatened when ecosystems and natural cycles break down. The vultures of India are but one example among hundreds. Almost two million people die every year because of inadequate or unclean water supplies. Conserving wetlands and forests would reduce these deaths: wetlands provide natural filters that improve water quality for drinking and agriculture; healthy forests lock up sediment that would otherwise muddy water. Saving forests and grasslands would reduce plumes of dust originating in Africa and the even larger ones crossing the Pacific Ocean from western China that recently have been linked to a rise in U.S. asthma cases.

A subtler connection between ecosystem degradation and human health can be seen in disease-causing organisms that move from wildlife to humans. Two thirds of the world's emerging diseases, such as the Ebola virus and avian flu, are caused by pathogens that infect nonhuman animal hosts and only make contact with people because of changes in land use and agricultural practices. At issue are not just "exotic" diseases, however. By eliminating wolves and



ANN SANDERSON (maps); JIM BRANDENBURG (Minden Pictures (piping plover)); MARI DARR WELCH (AP Photo (hurricane)); COURTESY OF PETER KAREIVA (Kareiva and Marvier)



THE OUTCOME

By demonstrating how to align conservation and human needs, this team is starting to garner greater public support for conservation and restoration efforts along the Florida Panhandle.



Loggerhead sea turtle



mountain lions, people in the eastern U.S. triggered an explosion in the deer and deer tick populations, which has resulted in more than 20,000 new cases of Lyme disease annually. Attempts to eradicate predators more than a century ago have jeopardized human health today.

Life Raft Conservation

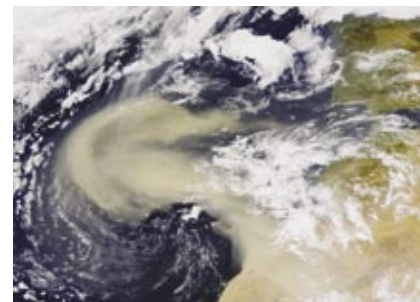
The focus on ecosystem services we are advocating is, in many ways, a repackaging of traditional conservation ideas that emphasize interconnectedness. But our approach differs in several significant ways. First, we believe many conservationists are in denial about the state of the world and must stop clinging to a vision of pristine wilderness. One quarter of a million people join the planet every day. More forests and wetlands will be cleared for agriculture, and more ocean species will be fished to depletion. Biodiversity is going to decline. Wilderness separate from human influence no longer exists.

Because our environment will consist mainly of human-influenced systems, biodiversity protection must be pursued in the context of landscapes that include urban centers, intensive agriculture, and managed forests and rivers, not just nature preserves. Ironically, protected areas will most likely need to be intensely supervised to retain their “wildness.” Managers in many parks have come to recognize this reality. Kruger National Park in South Africa is a highly managed

landscape where natural watering holes have been replaced by drilled wells and elephant populations are culled to prevent overcrowding.

The second major shift we urge is that conservationists focus foremost on regions where the degradation of ecosystem services most severely threatens the well-being of people: stands of mangroves in Asia, marshes in the southeastern U.S., drylands in sub-Saharan Africa and coral reefs around the world. This approach would be especially expeditious where government agencies and conservation groups seek to work together for both public protection and for conservation. For example, in the Florida panhandle, a partnership between the National Oceanic and Atmospheric Administration and the Nature Conservancy is working to identify areas of joint concern for public well-being and traditional conservation. By mapping habitats in terms of their ability to protect human communities in addition to their biodiversity, participants are finding important areas to preserve.

Third, conservationists should collaborate more closely with development experts. In the past two decades, many sustainable development projects have sought to bring these groups’ interests together, but only with attention to already marketed items, such as fish or nontimber forest products—and rarely with the spectrum of ecosystem services in mind. By combining and coordinating the energy and capital of



DUST from degraded grassland ecosystems in sub-Saharan Africa travels far afield in wind, harming coral reefs, tourism and fisheries in the Caribbean. Protecting important ecosystems in one part of the world can also help people an ocean away.

J. AND A. KOSTEN/Peter Arnold, Inc. (turtle); NASA (dust)

conservation forces and human welfare projects, the experts could enhance the efficiency and impact of both efforts. For instance, investments in clean, sediment-free water are often the same investments capable of protecting aquatic biodiversity.

Without a close connection between conservation and social issues, policies that protect biodiversity are unlikely to find much public support. Michael Shellenberger and Ted Nordhaus of the consulting company American Environments made the point in a 2004 essay entitled

“The Death of Environmentalism” that environmental groups need to move beyond their tendency to put the environment in an airtight container away from the concerns of others—or be doomed to irrelevance. We believe this stinging indictment of environmentalism applies equally to the conservation movement.

Finally, the conservation efforts we envision will be assessed not just by the number of species protected but by improvements to people’s well-being. Such assessments are already beginning. The Indonesian government and the Nature Conservancy came together to set aside Komodo National Park in 1980, partly to protect the threatened Komodo dragon and partly to preserve forests and coral reefs. Park admission fees were directed to local development projects and to new sources of income: seaweed cultivation, tourism, wood carving and the breeding of prized reef fish. A 2006 survey of local villagers bordering Komodo found that the overwhelming majority was highly supportive of the protected area because of the new income it had generated.

Lurking Unease

Some people will be alarmed by this proposal because the services provided by nature do not always correlate with biodiversity. A second source of anxiety about our approach is the fact that the plants and animals most central to ecosystem services and human economy tend to be fairly abundant. But rare species still have a crucial role: as insurance. With global climate disruption and massive modification of land, the rare species of today may become the abundant species of tomorrow, and so we should save as many as possible. In California, the nonnative European honeybee is the most important pollinator from an economic perspective. If the European honeybee population were to become dramatically reduced (and it has recently been threatened by introduced mites), some of the less abundant native bees might increase and fill the vital economic role of crop pollinators.

Although it would be morally reprehensible for humans to allow the extinction of all species except those few that provide, or might provide, services, it is also unrealistic to think we can return any substantial part of the world to a preindustrial state. Some human-caused extinctions are inevitable, and we must be realistic about what we can and cannot accomplish. We must be sure to first conserve ecosystems in places where biodiversity delivers services to people in need.

[CASE STUDY]

PROTECTING DRINKING WATER

THE PROBLEM

Much of the water that supplies Quito, Ecuador’s largest city, originates in Andean highlands that are home to a tremendous variety of endemic plants and animals, including the spectacular Andean condor. Although a condor reserve has been set up (*photograph*), enforcement is poor. Downstream, many areas around the city do not have enough water to meet their needs, and most of the city’s monitored watersheds have undrinkable water. Poor farming and logging practices in the vicinity of the condor reserve and farm animals grazing too close to stream and river channels are the culprits.



THE SOLUTION

In 2000 the U.S. Agency for International Development (USAID), the Nature Conservancy and local Ecuadorian partners established a water fund. Quito’s hydropower firm, the Andina beer company, Quito’s municipal water supplier and a 2 percent tax on Quito’s residents provide the income. The fund has collected \$4.9 million for supporting conservation, education and water projects upstream from Quito.

THE OUTCOME

As of this year, 11 new park guards have been hired to patrol the protected area, and a massive education program with farmers has been undertaken to teach better land-use practices. More than 3.5 million trees have been planted in an effort to reforest denuded watersheds. It is too early to know whether the more sustainable practices are yielding the desired improvements in water quality, but a network of hydrological monitoring stations is being created. Public enthusiasm for water conservation has grown dramatically.

PROTECTING WILDLIFE

THE PROBLEM

In Namibia the marginalized San people, often referred to as bushmen, suffer extreme poverty and one of the highest rates of stunting among children. They have been displaced from their communal lands and, left with no sustainable way of making a living, have been forced into poaching and excessive hunting. The black rhino, one of the most endangered species in the world, has been one casualty.



THE SOLUTION

In 1996 the government of Namibia passed an act giving the indigenous people ownership of game animals and all revenues from tourism and game products. Local conservancies covering 17 percent of the Namibian land and including 60 communities were set up to manage the wildlife, tracking game movements, for example. USAID provided funds to help the San establish and participate in these local conservancies.

THE OUTCOME

Where the local conservancies are active, wildlife is rebounding, with 600 percent increases in populations of elephants, zebras, oryx and springbok. Namibia also now has the world's largest free-roaming black rhino population. At the same time, more than 500 full-time jobs and more than 3,000 part-time jobs have been created for the local people. In 2004 tourism (left) and hunting generated \$2.5 million in income. This case also illustrates some of the challenges of the ecosystem services approach to conservation: many San remain marginalized, and some observers argue that the indigenous people should be given ownership of the land, not just of the wildlife.

We suggest that instead of mapping the top 10 or 25 locations in need of protection in terms of native plant richness, conservationists should generally seek to identify life raft ecosystems—areas with high rates of poverty, where a large portion of the economy depends on natural systems and where ecosystem services are severely degraded. Conservation efforts aimed at providing clean water, reducing soil erosion and preventing overfishing will help people and protect much, though certainly not all, biological diversity. These types of projects will generate a much broader support base than is typical of most conservation efforts.

Meanwhile some dedicated organizations should continue to support the conservation of species and places without conspicuous utility. Shifting emphasis to ecosystem services does not mean totally changing conservation goals; it means broadening public support for conservation and fostering a shift in emphasis for organizations able to make that shift.

Natural Economy

Whether efforts that conserve ecosystem services are able to support economic development remains to be proved. The future of ecosystem services as a conservation strategy may depend on the unlikely collaboration of ecologists and finance experts. Indeed, much of the enthusiasm for this approach is coming from the business community. In November 2005, for example,

the Goldman Sachs Group announced an ecosystem services framework for its own business operations, which included making \$1 billion available for investing in renewable energy, assessing the impacts of its projects on ecosystem services as standard operating procedure, and establishing a think tank to explore green markets.

The World Bank is also encouraging nations to embrace green accounting methods in which economic assets and national productivity assessments include measures that credit environmental and ecosystem services and subtract degradation that results from pollution or destructive extraction. Economic valuation and the creation of markets for ecosystem services offer the possibility of providing a quantifiable conservation metric to which corporations and people can readily relate, an improvement over policies based on charismatic species or plant endemism.

A few enlightened voices—such as those of 2004 Nobel Peace Prize winner Wangari Muta Maathai and former U.N. secretary-general Kofi A. Annan—have called attention to the connection between the environment, human prosperity and peace. Annan has stated that “our fight against poverty, inequality and disease is directly linked to the health of the earth itself.” Conservationists need to hear and communicate this message. Conservation will only become truly global and widely supported when people are central to its mission. ■

➔ MORE TO EXPLORE

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