Sustainable Development: Promoting Progress or Perpetuating Poverty?
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CHAPTER 11

DO CONSERVATION CONVENTIONS CONSERVE?

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INTRODUCTION

The conservation of biological diversity – or simply "biodiversity"[1] – has emerged as one of the most important international environmental issues. The extent of biodiversity loss is unknown, but the fact that species and habitat are disappearing is quite certain. Human activity has accelerated the rate of species extinction substantially. Even if the world does not face an extinction "crisis" that threatens human survival, the danger to many species, and biological diversity more broadly, is real and worthy of concern.

For decades, governments and international organizations have sought to stem the loss of biodiversity through the adoption of international agreements. The 1973 Convention on International Trade in Endangered Species (CITES) was the first multilateral agreement to address concerns about biological diversity. More recently, over 180 governments entered into the Convention on Biological Diversity (CBD). This was soon followed by an international protocol on "biosafety" which provides for the regulation transgenic crops. This chapter assesses the extent to which these conservation conventions can be expected to stem the loss of species and the decline in biological diversity.

THE THREAT TO BIODIVERSITY

The loss of biological diversity is a serious environmental concern. "We—the human species—have been dependent on other species since the beginning of our time."[2] Non-human species provide sources of food, clothing, and shelter, not to mention satisfaction and pleasure. Estimates of species loss vary greatly but there is broad agreement that the current rate of loss is substantially higher today than at any time in human history and that human activities contribute directly and indirectly both to the decline in biodiversity and to the extinction of individual species.

Species extinction and the decline in biological diversity, while interrelated, should not be confused with one another. Biological diversity consists in not only the multitude of different species but also the genetic differences within given species and populations. The extinction of individual species reduces global biodiversity. So does the extirpation of distinct populations of species, the elimination of species from a given area, or the reduction of genetic diversity within

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[1] In this paper, the terms "biological diversity" and "biodiversity" are used interchangeably.
[2] Edwards (1995), p. 213.

a given population of a species. Thus, widespread species extinction is not a necessary precondition for the substantial biodiversity loss.

Estimates of the total number of species on the planet vary from 3 to 111 million,[3] though most conventional estimates place the number between 5 and 15 million.[4] As many as 15,000 new species are identified and described each year,[5] yet fewer than 2 million plant and animal species have been recorded to date.[6] It is generally accepted that a substantial percentage of birds, mammals, and plants have been identified. This is not the case with other orders of species, however, such as insects, nematodes, and bacteria.[7] To date, efforts to determine the precise number of plant and animal species on the earth have been "surprisingly fruitless."[8] Several new initiatives are underway, however, which could greatly expand human knowledge about the species with which we share the earth.

Although there is little hard data to indicate *which* species are threatened, conservationists estimate that approximately 11 percent of mammals and birds are threatened with extinction around the world and presume that a similar percentage of other types of species may be threatened as well.[9]

Current extinction rates are no more certain. Recent studies have estimated extinction rates as being anywhere between 10 percent and less than 1 percent of species per decade.[10] Activist groups trumpet the high-end estimates. The Worldwatch Institute, for example, cites loss estimates of approximately 50,000 species *per year*.[11] The ecologist Norman Myers presented a similarly catastrophic assessment – 40,000 species per year – in his 1979 book, *The Sinking Ark*.[12] While the precise rate of species extinction is uncertain, these more extreme estimates are highly speculative – and highly unlikely. In the early 1980s, ecologists Thomas Lovejoy and Paul Ehrlich estimated that at least 15 to 20 percent of all species would be gone by the year 2000 – predictions that almost certainly did not come to pass.[13]

Because of the difficulties in estimating the number of species that might go extinct, many choose to quantify estimates of species loss in relation to the background rate of extinction. A commonly cited estimate is that "terrestrial species are vanishing one hundred times faster than before the arrival of humans."[14] The *Global Biodiversity Outlook*, published by the CBD Secretariat, similarly estimates that the current rate of extinction is at least 100 to 200 times the natural background rate.[15] If these estimates are accurate, less than one percent of all species

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[3] *World Resources 1996-97* (1996), p. 247.
[4] Stork (1997), p. 65.
[5] *Ibid.*, p. 44.
[6] *World Resources* (*1996*), p. 247. There is even uncertainty about the actual number of species identified, and estimates range from 1.4 to 1.8 million. *See* Martin (1999), p. 207. Estimates vary because there is no single agreed-upon list of identified species, and many species may be known by more than one name.
[7] *World Resources* (1996), p. 248 tbl.11.1.
[8] Stork, (1997), p. 41.
[9] *Ibid.*, pp. 46-47.
[10] *Ibid*, pp. 62-63 tbls.5-6.
[11] *See, e.g.*, Ryan (1992), p. 9
[12] Myers (1979), pp. 4-5.
[13] Gibbs (2001), pp. 42-43.
[14] Wilson (2000), p. 9.
[15] *Global Biodiversity Outlook* (2001), p. 71.

will go extinct over the next fifty years. Such an extinction rate is unfortunate – and may well justify concerted international action – but it is a far cry from disaster.

Despite the high estimates, we know of only about 1,000 extinctions that have taken place in the last four centuries.[16] According to Ross D.E. MacPhee of the American Museum of Natural History, "No well investigated group of animals shows a pattern of loss that is consistent with greatly heightened extinction rates."[17] But the small number of recorded extinctions could be the result of poor knowledge about the number and distribution of species around the globe. Data from IUCN indicates that the rate of documented extinctions increased rapidly from the year 1600 until the middle of the 20th century.[18] In contrast to estimates of species extinction rates, however, the rate of documented extinctions appears to have slowed since the 1930s.[19] This does not mean that the rate of species extinction has declined, though, because the criteria for declaring a species to be extinct are quite conservative, and there is no way for scientists to determine the precise rate of extinction for the countless species that have yet to be identified and catalogued.

In sum, species extinction and biodiversity loss are real concerns, but predictions of imminent ecological collapse due to species loss lack an empirical basis and are implausible. Human activity has increased the rate of extinction and the loss of biodiversity, though it is uncertain by how much. The relative lack of knowledge about the overall number of species, and their distribution, is a barrier to more accurate estimates.

THE CAUSES OF BIODIVERSITY LOSS

Whether or not conventional extinction estimates are accurate, there is a general consensus that human activity threatens many species around the globe. Over one-third of documented animal extinctions were due to habitat destruction.[20] Saving biodiversity requires protecting plant and animal species in their native habitat – what is called *in situ* conservation.[21] *Ex situ* conservation through zoos, gene banks, and the like can complement *in situ* conservation, but it is no substitute. Protecting habitat is also the most important step to prevent the extinction of species from the wild. Degradation and loss of habitat are, however, not the only causes of species extinction and biodiversity decline. The introduction of exotic species and hunting are also leading causes.[22]

Most habitat loss is caused by human conversion of land to other uses.[23] "In particular, conversion of land to agriculture is the single greatest agent of habitat conversion, and associated displacement of species and increasing stress on biological diversity."[24] Since 1980, net agricultural land worldwide increased by over 4 percent or 200 million hectares.[25] Low crop yields and increasing human populations create substantial pressure to clear land for crops. In

[16] Stork, (1997), p. 45.
[17] Quoted in Gibbs (2001), p. 43.
[18] Edwards (1995), p. 218.
[19] *Ibid.* p. 219 fig. 7-2. See also *Global Biodiversity Outlook* (2001), p. 71.
[20] *Op cit.* p. 222.
[21] Wilson (2000), p. 11.
[22] Edwards (1995), p. 222.
[23] Vitousek (1997), p. 494; Sala (2000), p. 1771.
[24] Goklany (1999a), p. 108; *see also* Sala et al. (2000), p. 1771.
[25] Goklany (1999b), p. 164.

sub-Saharan Africa, for example, the use of land for agriculture and livestock poses a substantial threat to biodiversity.[26] In much of the continent "[p]overty is so intense that all land with agricultural potential will be exploited and even that with very little potential will be put to use—even if that use is unsustainable," notes Rowan Martin, a noted conservationist actively involved in the development of community-based conservation programs in southern Africa.[27]

Species are not evenly distributed across the planet. As a general rule, the level of species "richness" or diversity increases toward the equator.[28] There also appear to be "hot spots," which are particularly rich in species. Tropical forests, for example, typically contain a greater abundance of species than temperate forests or grasslands. Thus, the destruction or degradation of tropical forests and other habitats that are particularly rich in species can impose a substantial toll on biodiversity. Forest cover in many developed countries is stable or increasing. In stark contrast, deforestation of tropical forests, particularly in developing nations, is substantial and appears to be on the rise.[29] Between 1980 and 1995, net forest cover declined by 180 million hectares worldwide and by 200 million hectares in developing nations.[30] (Net forest cover actually *increased* in developed nations by approximately 20 million hectares over the period.[31])

Most of the loss of forest cover in developing nations is driven by the need to clear land for agriculture, and is exacerbated by poor land tenure regimes and government subsidies.[32] While some blame commercial timber harvesting for deforestation, Roger A. Sedjo of Resources for the Future notes that "forestlands that are commercially harvested typically remain as forestlands."[33] The FAO reports that "[n]atural forests are arguably the single most important repository of terrestrial biological diversity."[34] Tropical deforestation is expected to have a substantial impact on species survival rates as forest habitat houses an estimated 60 percent of the world's terrestrial biodiversity.[35]

The introduction of exotic species is also a substantial threat, not least because it can contribute to the deterioration of habitat. Habitat invasion by exotic species is generally considered the second leading threat to endangered species behind habitat loss due to human conversion.[36] By some estimates, up to 20 percent of endangered vertebrate species are threatened by exotic species.[37] While the introduction of species from one part of the world to another as crops or livestock can bring tremendous benefits, the occasional introduction of biologically invasive species has had substantial adverse consequences for many native species.

While invasions of exotic species and other threats to biodiversity will remain important, habitat loss is likely to be the greatest threat in coming decades. Global population hit an

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[26] Martin (1995), p. 230.
[27] *Ibid.*, p. 231.
[28] *Global Biodiversity Outlook*, (2001), p. 62.
[29] Sedjo (1995), pp. 198-201.
[30] FAO (1999), p.1.
[31] *Ibid.*
[32] *Ibid.* See also Southgate's chapter in this volume.
[33] Sedjo (1995), p. 188.
[34] FAO (1999), p. 8.
[35] Snape (1996), p. 85.
[36] *World Resources 1998-99* (1998), p. 197.
[37] *Ibid.*

estimated six billion in 1999.[38] At present, global population increases by one billion people every twelve to thirteen years. While many expect this rate of increase to slow, most analysts believe that there could be approximately ten billion people on the planet by 2050.[39] Increased population will mean more mouths to feed, and that will require increased agricultural production. Increased wealth in the developing world will also spur demand for greater caloric and nutritional intake, pushing up agricultural demand further still.[40] An estimated one-in-five people in developing nations suffer from chronic undernourishment. For these reasons, global demand for basic agricultural commodities, such as wheat, maize, and rice, will increase by 40 percent by 2020, or 1.3 percent per year, according to estimates by the International Food Policy Research Institute.[41]

Over the past several decades, global food availability has kept pace with the increase in agricultural demand.[42] Yet the explosion in agricultural productivity unleashed by the "green revolution" may be reaching its limits as annual increases in agricultural productivity appear to have been slipping. Cereal yields per hectare rose 2.2 percent per year in the late 1960s and 1970s, but only 1.5 percent per year in the 1980s and early 1990s, and rates of increase may fall even further.[43] Unless agricultural productivity increases substantially, this will mean putting thousands, if not millions, of additional hectares under plow—and consequently losing thousands, if not millions, of hectares of species habitat. Thus, a failure to enhance per-acre agricultural productivity will have severe consequences for global and regional biological diversity.

The threat to species, particularly charismatic megafauna such as elephants, rhinos, pandas and tigers, from poaching and commercial exploitation receives abundant media attention. In particular, there has been a tendency to blame international trade in animal parts (ivory, rhino horn, tiger penis) for the demise of these species. However, "there have been remarkably few, if any, species extinctions that can be attributed to exploitation for international trade."[44] Charismatic megafauna in particular compete directly with people for land use, often posing a threat to human well-being, if not life itself (tigers and lions kill animals, including humans; elephants and rhinos eat vast quantities of cellulose). So if the value of the land is higher in an alternative use, such as farming, than in conserving species, the locals will kill the animals. Even when species loss has been attributed to commercial exploitation, as with the passenger pigeon, the likelihood is that they would have disappeared due to other causes, such as habitat destruction or degradation.[45]

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[38] Eberstadt (1999), pp. 64-65.

[39] Georgia (1999), pp. 242-43 (indicating that the "medium projection" of the United Nations is for a global population just under 10 billion in 2050). It is worth noting, however, that some analysts expect population increases to slow more rapidly and top out at approximately 8 billion in 2040. *Ibid.* at 242. *See also* Eberstadt (1999).

[40] Paarlberg (2000), p. 21.

[41] Mann (1999), p. 310.

[42] *See* Georgia et al., (1999), pp. 256-57, 260-61 (indicating the continuous rise in per capita agricultural production and food production over the past four decades).

[43] Mann (1999), p. 310. *See also* Conway (2000), p. 13.

[44] Huxley (2000), p. 4

[45] du Plessis (2000), p.17.

In conclusion, the greatest cause of species extinction today is the loss of habitat. Therefore, the key to conservation of biodiversity is to increase the conservation of undeveloped land and other habitat. This, in turn, requires increasing the value of land in an undeveloped state, and reducing the economic pressures that drive land conversion. Conservation demands policies and institutional reforms that promote these processes. By contrast, most international treaties relating to conservation of biodiversity focus on regulatory responses. We now consider the role of these treaties.

THE CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES (CITES)

The Convention on International Trade in Endangered Spedies (CITES) is among the oldest multi-lateral environmental agreements. It is also one of the most controversial. Agreed in 1973 by 80 nations, it entered into force two years later. Today 158 nations are parties to the convention. As the name suggests, CITES focuses on the threat to wildlife from international trade in species. By its own terms, it does nothing to address habitat loss and degradation, domestic consumption, or other threats to wildlife or their habitat. In some cases, CITES may make habitat conservation more difficult.

The primary function of CITES is to identify endangered and threatened species and restrict international trade in such species and products derived therefrom. Species 'protected' by CITES are placed on one of three appendices. Those "threatened with extinction" are listed on Appendix I. Trade in Appendix I species is generally prohibited in all but the most exceptional circumstances. Species that are not threatened with extinction, but that nonetheless might be imperiled if trade is not restricted, are placed on Appendix II. Export of Appendix II species is controlled through a permitting system. Appendix III contains those species that have protected status in at least one country that is a party to CITES and has asked for controls on trade in that species. Unlike listing under the U.S. Endangered Species Act, the CITES listing process is more political than scientific.

Over 33,000 species have been listed on the three appendices since CITES inception. The CITES Secretariat proudly proclaims that "not one species protected by CITES has become extinct as a result of trade since the Convention entered into force."[46] This is faint praise, for it is well acknowledged that many species have gone extinct in the decades since CITES entered into force. CITES has done little, if anything, to stem this tide. In fact, it is doubtful whether CITES has ever helped any species in danger of extinction. There are startlingly few populations of species that have recovered while they were listed on CITES. This should not be surprising, as CITES does absolutely nothing to address the primary causes of species extinction. The wildlife trade is rarely a major threat to the survival of a species. This does not mean CITES has been without effect. Quite to the contrary, in some cases, CITES has undermined species conservation. As Jon Hutton and Barnabas Dickson of Africa Resources Trust explain: "By restricting trade in wild species, and so limiting the benefits that humans can derive from them, CITES has actually reduced the incentive to maintain wildlife habitat."[47]

In the 1960s, there were an estimated 70,000 black rhino in Africa, yet their numbers were already in decline. Demand for rhino horn from Asia was encouraging widespread hunting,

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[46] "What is CITES?" available at http://www.cites.org/eng/disc/what_is.shtml.
[47] Hutton and Dickson (2000), p. xvi.

and the black rhino was listed on Appendix I in 1975. Yet black rhino populations continued to plummet. By 1991, the IUCN Species Survival Commission African Rhino Specialist Group estimated there were fewer than 3,500 black rhino left in Africa.[48] In just five years, from 1987 to 1992, Zimbabwe's black rhino populations dropped by over 75 percent (1,750 to 430).[49] The Appendix I listing merely drove the trade in rhino horn underground, and prices soared. The economic demand for rhino horn remained and poaching increased.

Faced with the failure of the CITES Appendix I listing, some southern African governments successfully sought a relisting of the black rhino onto Appendix II so as to allow trade in live rhino specimens. This trade, albeit modest, provides some economic incentive for rhino conservation. Live rhinos are auctioned to private landowners, generating much needed funds for habitat protection and conservation. The downlisting of South African white rhino populations in 1994 had similarly positive effects on conservation.

While CITES did little to protect rhino populations, for species such as the leopard and the African elephant, an Appendix I listing likely caused more harm than good. The prohibition on trade greatly reduced the economic value of the species to local communities, thereby reducing local incentives to engage in and cooperate with conservation efforts. At the same time, the leopard and elephant listings did nothing to reduce the costs of living near such species. To people living in the wealthy nations of the North, leopards and elephants are majestic creatures – charismatic megafauna – but to rural villagers and farmers in the poor nations of the South they can be giant pests, trampling crops, preying on livestock, and generally competing for land. Appendix I listing did nothing to discourage the poisoning and shooting of leopards or the clearing of vital habitat to make room for cows and plows. Rather, "landholders came to see [the leopard] not as an asset and something to conserve, but as a nuisance to be exterminated."[50] Only once limited export of leopards was allowed were they then an asset for landowners.

In the 1980s, elephant populations in much of sub-Saharan Africa were declining rapidly, despite the creation of wildlife preserves and strict controls on hunting. In East Africa especially, poaching was rampant. In southern Africa, on the other hand, elephant populations were stable or increasing. Governments in the South opposed the Appendix I listing for fear the resulting trade restrictions would eliminate elephant-related revenue. The African elephant was listed nonetheless. The listing of African elephants did nothing to reduce crop damage caused by elephants or otherwise endear them to African peasants. Nor did it appear to reduce the demand for ivory; the ivory trade was merely driven underground.[51] Indeed, insofar as the Appendix I listing reduced the legal supply of ivory, it increased black market ivory prices, thereby increasing the incentive for poaching.

Sustainable utilization is the key for many species' survival. Yet the structure of CITES is hostile to sustainable utilization. Its primary mechanisms – trade restrictions – reduce the economic value upon which sustainable utilization may depend. Commercial utilization of species, even through eco-tourism or safari hunting, can provide a substantial economic incentive for conservation. "If people can benefit from wildlife, they have an incentive to maintain wild

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[48] Edwards (1995), p. 246.
[49] 't Sas Rolfes (2000), p. 72.
[50] Jenkins (2000), p. 50.
[51] Sugg and Kreuter (1994), at p. 40.

habitat and not to convert it to other uses such as agriculture."[52] As wildlife becomes more valuable, private landowners will invest more in its protection. As Grahame Webb found in the case of crocodiles, legal trade in a species can "be a significant deterrent to illegal trade, which is now markedly reduced around the world."[53] Where wildlife does not have value, there may be few viable conservation options. Secure land tenure, local control of or proprietary rights in wildlife, and the opportunity to create economic value in wildlife are key elements in sustainable utilization. Trade restrictions are not.

THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

Nearly twenty years after the adoption of CITES, United Nations representatives agreed upon a new convention to address the loss of species: the Convention on Biological Diversity (CBD). The CBD was initially signed at the United Nations Earth Summit in Rio de Janeiro in 1992. As of March 2002, 183 nations are parties to the convention. An additional five nations, including the United States, have signed, but not ratified, the CBD.

The CBD is a framework convention with three stated objectives, 1) "the conservation of biological diversity," 2) "the sustainable use of its components," and 3) "the fair and equitable sharing of the benefits arising out of the utilization of genetic resources." Toward these ends, the CBD contains a range of provisions that are intended to promote the conservation of biological diversity and limit the environmental impacts of human development. Like many environmental treaties, the CBD explicitly endorses a precautionary approach to the protection of biodiversity. The preamble to the Convention states "where there is a threat of significant reduction or loss of biological diversity, *lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat*"(emphasis added). In this regard, the CBD echoes Agenda 21, the Rio Declaration, and other international calls for adoption of the precautionary principle in environmental policy.[54]

The CBD imposes numerous broad obligations upon its signatories, though as of yet there is no enforcement mechanism. The CBD obligates parties to develop "national strategies, plans or programs" for the conservation of biodiversity, which shall include, among other things, a) "a system of protected areas," such as parks or reserves with protective buffer zones, managed to ensure "conservation and sustainable use"; b) "measures for the recovery and rehabilitation of threatened species," including the reintroduction of species into their native range; and c) measures to "facilitate access to genetic resources for environmentally sound uses" and the transfer of advanced technologies to other nations. In addition to developing "national strategies," CBD parties are to engage in efforts to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species." Under Article 8(j), parties are also instructed to "respect . . . indigenous knowledge" and "encourage . . . equitable sharing" of the benefits of biological resources.

Different countries interpret these obligations in different ways. As with most framework conventions, negotiators from member countries seek to clarify the CBD's ambiguous language

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[52] Hutton and Dickson (2000b), p. xvi
[53] Webb (2000), p. 105.
[54] See Morris (2000).

at a series of COP – Conference of the Parties – meetings. In April 2002, for instance, negotiators at the Sixth COP meeting drafted voluntary guidelines on access to genetic resources and benefit sharing. For many countries, however, it seems that the CBD is merely another potential source of foreign assistance for government bureaucracies.

The CBD's emphasis on the need for governments to establish official "protected areas" is misguided. Substantial amounts of land are already in officially designated "protected areas" around the globe, but such designations have done little to prevent the continued loss or degradation of habitat and ecosystems. Most nations lack sufficient resources to establish, demarcate, defend, and manage wildlife preserves on a scale sufficient to stem the loss of biological diversity. Even in wealthy nations, such as the United States, national parks, wildlife refuges and other protected areas also fail to safeguard ecological resources due to persistent political mismanagement and rent-seeking.[55] In poorer nations, the prospect of protecting biological diversity thorough a series of government-owned and managed protected areas is even more bleak. As a recent report by IUCN and Future Harvest found, agricultural production threatens habitat and biodiversity in approximately half of all the major wildlife preserves in the world.[56] The officially "protected" nature of these areas has had little effect. The creation of protected areas can be quite controversial as well, as it often results in the economic – or even physical – dislocation of local communities.[57] "Local people often view wild animals as pests who destroy crops, raid granaries, and sometimes cause loss of life."[58] Though well-intentioned, the creation of protected areas through government fiat can increase local opposition to conservation efforts, further hampering conservation efforts, particularly in remote areas.

More promising would be efforts to increase the value of habitat and undeveloped land through various forms of commercial utilization. One possibility is the creation of local game preserves that can provide hunting and eco-tourism opportunities. As noted above, those species most subject to poaching and illegal hunting can typically be managed for commercial gain, funding species conservation in the process. Community-based management efforts have shown substantial progress in conserving species and the ecosystems upon which they depend, largely by giving local peoples an economic incentive to care for and protect natural resources.[59]

Another possibility in this regard actively promoted by some CBD proponents is bioprospecting. Bioprospecting agreements have the potential promote the sustainable utilization of biological resources by encouraging pharmaceutical and biotechnology companies to contract with local communities or governments to fund habitat conservation in return for access to genetic resources. Perhaps the most prominent example of how bioprospecting for genetic resources can provide economic incentives for conservation is the 1991 INBio-Merck agreement in Costa Rica.[60] Under the terms of the agreement, Merck & Company, a pharmaceutical firm, agreed to pay the Instituto Nacional de Biodiversidad (INBio), a non-profit foundation, $1 million in return for several thousand plant, insect, and soil samples collected by INBio - in the Costa Rican rainforest. Merck received exclusive rights to the use of the samples

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[55] Brown and Leal (2000), p. 129.
[56] McNeely and Scherr (2001), p. 10.
[57] See, for example, James et al. (1999), p. 323; Inamadar et al. (1999), p. 1856.
[58] Getz (1999), p. 1855.
[59] *Ibid.;* Edwards (1995).
[60] *See* Blum (1993), p. 17.

collected by INBio, while INBio and the Costa Rican Ministry of Natural Resources were guaranteed a portion of any royalties from pharmaceuticals or other products developed from the samples. With these funds, INBio and the Costa Rican government can fund additional conservation efforts. Merck also supplied INBio with substantial amounts of technical equipment to assist in sample collection and testing.

The Merck-INBio agreement has been almost universally heralded as a model for the sustainable utilization of biodiversity. To be sure, this arrangement has provided substantial funds for conservation and has helped to spur additional bioprospecting agreements. Nevertheless, funding mechanisms based upon the potential value of genetic material found in undeveloped areas are likely to be of only limited value because one the prospecting has taken place, the primary economic need for the land in question is greatly reduced. The original Merck-INBio agreement was for only two years. The promise of a share of royalties is, in a sense, the promise of a lottery ticket. The potential payoff is quite large, but the chances of a payoff are actually quite slim. In addition, gene banks and the like can serve as *ex situ* catalogs for genetic information without providing much incentive for *in situ* conservation. Bioprospecting can certainly help fund conservation efforts, but it is no panacea.

While two articles of the CBD – Article 15 and Article 16 – focus on access to genetic resources and the transfer of technology, it is not clear that CBD implementation will further profitable bioprospecting agreements. It is not even clear whether the CBD – or any international agreement – is necessary for private firms to enter into prospecting agreements with local communities. The Merck-INBio deal was inked before CBD negotiations were concluded. Economic and legal institutions in the host country, particularly a legal system in which contracts can be entered into and enforced, are more important than an international agreement. Indeed, there is some concern within the biotechnology industry that the CBD will lead to international standards that hamper bioprospecting agreements. This would only reduce the role of such agreements in biodiversity conservation. In May 2002, the *New York Times* reported that in some countries the CBD is spawning "paralyzing biological bureaucracies" that are obstructing bioprospecting and other conservation efforts.[61]

The CBD's emphasis on the sustainable utilization of biological resources represents a step forward for international environmental agreements. Insofar as the Convention can spur greater reliance upon economic incentives and community-based management to promote conservation efforts, it will enhance global efforts to stem the loss of biodiversity. Yet insofar as the Convention promotes greater government control of natural resources, hampers profitable bioprospecting agreements, and limits conservation through commercial use of biological resources, it will retard future progress.

THE CARTAGENA PROTOCOL ON BIOSAFETY

Whilst the net effect of the CBD on biodiversity conservation is unclear, the effect of the Cartagena Protocol on Biosafety is not. Although the protocol espouses the need to protect biodiversity, insofar as it impacts biological diversity, it is likely to undermine habitat conservation efforts, particularly in those parts of the world in which such conservation is most needed. For imperiled species, there is nothing "safe" about the Biosafety Protocol.

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[61] *See* Revkin (2002).

Under Article 19 of the CBD, parties to the convention were to "consider the need for and modalities of a protocol" regulating "the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have an adverse effect" on biological diversity. In particular, parties were entreated to determine when "advance informed agreement" is necessary before genetically engineered organisms or GMO-derived products are imported to one country from another.

The final Protocol language, agreed on January 29, 2000 in Montreal, establishes an international framework for the regulation of all "living modified organisms" ("LMOs") "that may have adverse effects on the conservation and sustainable use of biodiversity, taking also into account risks to human health." While not as stringent as some environmental activists and negotiators demanded, the Protocol text creates mechanisms whereby national governments will be able to restrict, or even prohibit, the importation of LMOs, such as genetically engineered crops. The Protocol's terms may allow government authorities to restrict the import of foodstuffs as well. The Protocol also requires the labeling of bulk shipments of LMOs intended to be used for food, feed, or processing. Such shipments must bear a label that says they "may contain" LMOs. These provisions could have a substantial impact on the diffusion of agricultural biotechnology, particularly in developing nations.

The primary mechanism for limiting the importation of genetically modified crops in the Protocol is a set of provisions for "advance informed agreement." These provisions make the first shipment of any LMO intended to be planted as a crop or otherwise released into the environment conditional upon the approval of the importing country. Technically, once the importing nation is notified of the intended shipment, it is supposed to respond within 90 days, acknowledging the notification, and provide an answer within 270 days, indicating whether or not it approves of the import. Yet there is no provision of the Protocol to enforce this time limitation, and an importing nation's failure to respond does "not imply . . consent" to the shipment. "Cooperative procedures and institutional mechanisms to promote compliance" are to be agreed upon at a later date.

The advance informed agreement provisions of the Protocol embrace the precautionary principle advocated by environmental activists. They provide that "lack of scientific certainty due to insufficient relevant scientific information and knowledge regarding the extent of the potential adverse effects" of an LMO "shall not prevent" the importing nation from limiting transboundary shipments. These provisions are reinforced by the statement in the preamble "reaffirming the precautionary approach" to environmental regulation "contained in Principle 15 of the Rio Declaration on Environment and Development."[62] The importing nation may also take into account "socio-economic considerations arising from the impact of living modified organisms" in making its determination. In other words, parties to the Protocol can effectively bar the importation of genetically modified crops irrespective of whether there is *any* scientific basis for the refusal.

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[62] The Rio Declaration provides that "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" and "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities." U.N (1992).

During the Protocol negotiations, an Indian agricultural scientist who teaches in the United States released a petition of scientists endorsing "the use of recombinant DNA [rDNA] as a potent tool for the achievement of a productive and sustainable agricultural system."[63] Echoing a wealth of scientific literature on the likely benefits of agricultural biotechnology, the proclamation declared that rDNA techniques are a "powerful and safe means for the modification of organisms" that "can contribute substantially in enhancing quality of life by improving agriculture, health care and the environment."[64] Just one week earlier, *Science* published research documenting the successful creation of vitamin A-enhanced rice.[65] This so-called "golden rice" was immediately hailed as a "major advance in global nutrition" because vitamin A deficiency, which can cause blindness and other ills, affects up to 250 million children worldwide.[66]

The broad scientific support for expanded use of rDNA techniques to engineer more productive, nutritious, and environmentally benign crops is, however, not reflected in the text and structure of the Biosafety Protocol. While the scientific community generally supports advances in biotechnology, environmental activists charge that the spread of LMOs – also known as genetically modified organisms or "GMOs" – could pose untold threats to human health or the environment. As written, the Protocol could inhibit the spread of genetically engineered crops, particularly to those nations that need agricultural biotechnology to increase agricultural productivity. Parties to the Protocol will be able to bar importation of modified crop varieties for valid scientific reasons, questionable economic reasons, or no reason at all. Henry Miller and Gregory Conko explain:

> "Rather than creating a uniform, predictable, and scientifically sound framework for effectively managing legitimate risks, the biosafety protocol establishes an ill-defined global regulatory process that permits overly risk-averse regulators to hide behind the precautionary principle in delaying or deferring approvals."[67]

In addition, the Protocol could expand opportunities for economic interest groups to erect trade barriers to competing agricultural products under the guise of environmental protection.[68]

As noted above, the stated purpose of the Biosafety Protocol is to establish safeguards against potential "adverse effects on the conservation and sustainable use of biological diversity." Yet the Biosafety Protocol may well retard, rather than advance, the protection of biodiversity. The Protocol's operative provisions will do little, if anything, to promote or enhance habitat conservation. Worse, the net effect of the Protocol could actually be to *increase*

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[63] AgBioWorld, "Scientists in Support of Agricultural Biotechnology" (visited Mar. 3, 2000) <http://www.agbioworld.org/petition.html>. The petition was opened for signatures on January 18 and released to the public at a press conference on January 22, 2000.

[64] *Ibid.* As of March 3, 2000, over 1,300 scientists had endorsed the petition. Signatories of the petition include Nobel winners James Watson and Norman Borlaug, World Food Prize recipient Gurdev Khush, and 1998 National Medal of Science recipient Bruce Ames. *See* "Nobel Prize Winners Endorse Agricultural Biotechnology" (visited Mar. 3, 2000) <http://www.agbioworld.org/watson.html>.

[65] Ye et al. (2000), p. 303.

[66] Gugliotta (2000).

[67] Miller and Conko (2000), p. 360.

[68] *See* Adler (2000), pp. 202-04.

risks to biodiversity by making it more difficult for farmers to feed a growing global population without clearing more species habitat.

Population growth and economic development are rapidly increasing the demand for food in much of the developing world. This creates a trade-off between increasing agricultural productivity and reducing the threat to biodiversity from land conversion. Meeting global food needs can be achieved either by clearing more land for agriculture or enhancing the productivity of existing agricultural lands. Increasing agricultural productivity a scant 1.4 percent per year from 1993 to 2050, which may be necessary to meet global food needs, would produce an overall increase in agricultural output of 121 percent.[69] To achieve this same increase through the use of more cropland alone would probably require increasing the amount of cropland by *more than* 121 percent, or over 1,700 million hectares.[70] If anything, this is a conservative estimate, as it does not fully account for the diminishing marginal returns that are likely as less productive lands are converted to agricultural use. It also does not include the conversion of land to other agricultural uses, such as pasture.

If gains in agricultural productivity do not outpace the rising demand for agricultural production, biodiversity will suffer as forests are cleared and grasslands are plowed to make room for crops. As environmental analyst Indur Goklany explains, the difference between an average annual increase in agricultural productivity of 1 percent and 1.5 percent between 1993 and 2050 is "the difference between converting 368 Mha [million hectares] of habitat (globally) to new cropland or reducing cropland by 77 Mha."[71] By Goklany's estimates, to protect biodiversity from the encroachment of agriculture, annual increases in agricultural productivity worldwide must exceed 1.4 percent. Even these estimates may be a bit optimistic. In some parts of the world, such as sub-Saharan Africa, it may be necessary to achieve an annual productivity increase of 1.8 percent to 3 percent to avoid clearing habitat for cropland.[72]

Genetically engineered crops are likely to play an integral role in increasing the productivity of existing croplands and thereby reducing pressures on species habitat—if their use is not stifled by an overly burdensome regulatory regime. A scientific panel convened by the World Bank and Consultative Group on International Agricultural Research (CGIAR) concluded that genetic engineering could increase agricultural yields by as much as 25 percent.[73] Early transgenic harvests in the developing world are promising results, such as a modified rice variety with increased yields of 5 percent to 15 percent.[74] Corn and cotton engineered to produce the a natural pesticide has increased crop productivity as well.[75] Even delaying ripening in fruits and vegetables could substantially enhance food supplies, as post-harvest and end-use losses are estimated to be as high as 47 percent in some countries.[76]

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[69] Goklany (1999a), p. 120.
[70] *Ibid.*
[71] *Op cit.* at 126.
[72] Musters et al. (2000), p. 1760.
[73] "Bioengineering of Crops Could Help Feed the World; Crop Increases of 10-25 Percent Possible," World Bank (Oct. 9, 1997) available at <http://www.worldbank.org/html/cgiar/press/biopress.html>.
[74] Conway (2000), p. 14.
[75] Moffat (1998), p. 2177
[76] *See* Goklany(1999a), p. 120.

The negative impacts of a protocol on habitat conservation will be felt most in sub-Saharan Africa. "The African continent, more than any other, urgently needs agricultural biotechnology, including transgenic crops, to improve food production," notes Kenyan biotechnologist Florence Wambugu.[77] Indeed, the agricultural biotechnology revolution is potentially even more valuable for some developing countries than the original "green revolution" because the use of transgenic crops will not require the same costly inputs that many "green revolution" techniques do.[78] Without the contribution of new generations of genetically modified crops, it will be immensely difficult to meet the rising food demands of the world's peoples and still preserve large areas of undeveloped habitat. Even if the use of genetically engineered crops allows for the further intensification of agricultural production, which has environmental impacts of its own, these impacts pose a lesser threat to biodiversity than the unabated loss of native habitat throughout the world; "the environmental costs of expanding the area tilled are enormously greater than those of increasing yield."[79]

While the Biosafety Protocol will likely retard efforts to protect habitat from the encroachment of agriculture, some hope that the protocol will help to reduce other ecological risks from the introduction of LMOs. One prominent concern is that the introduction of LMOs into the broader environment could disrupt local ecosystems. The introduction of non-indigenous animal and plant species, ranging from the brown tree snake in Pacific regions to Zebra mussels in North America to feral cats in New Zealand, has had a significant impact on biodiversity and is a substantial contributor to species extinction.

The introduction of exotic species into new environments is a legitimate concern. The Biosafety Protocol, however, is ill-equipped to address it. There is no basis for presuming that LMOs pose a distinct threat of ecosystem invasion. The National Academy of Sciences noted that "a mutation made by traditional techniques may be accompanied by many unknown mutations."[80] The 1992 report of the National Biotechnology Policy Board reached the same conclusion that "biotechnology processes tend to reduce risk because they are more predictable."[81] The additional precision offered by rDNA techniques utilized in GMOs, however, makes the introduction of a new "pest" species less likely, as it reduces the chances of inadvertently transferring unwanted genetic traits from one species to another.[82] Moreover, most scientists believe that those genes introduced to transgenic crops "in fact decrease their fitness in the wild."[83] In other words, good crops make bad weeds. Existing regulatory measures may well be insufficient to prevent the introduction of invasive exotic species, yet a protocol focusing on biotechnology does little to remedy this problem. Consider that in 1998, 27.8 million hectares were planted with genetically modified crops around the world, albeit focused in a handful of countries. One year later, such crops covered 39.9 million hectares. Yet despite the millions of

[77] Wambugu (1999), p. 15.
[78] Paarlberg (*supra* note 40), p. 22.
[79] Barton (1996), pp. 95, 99.
[80] NAS (1987), p. 11.
[81] NBPBR (1992), p. 2.
[82] Butler and Reichhardt (1999), pp. 651, 653.
[83] Johnson (2000), p. 133.

acres planted, most in plots with extensive oversight systems, there is scant evidence that transgenic crops are having any adverse environmental effect. [84]

> "This remarkable record of safety for crop plants would indicate that either (1) the risks to the environment are low; (2) the extensive field testing prior to commercial use and the institutional assessments and decisions on which plants or varieties to grow as crops have been sound; and/or (3) the management practices in place have been adequate to mitigate any risks inherent with plants."[85]

Any of these conclusions would suggest that a biosafety protocol is unnecessary. There similarly has yet to be any indication of any health risk from any genetically engineered food product commercially available in the United States.[86]

While the Biosafety Protocol is unlikely to increase the protection of rural environments in developing countries, it could well retard the use and development of genetically engineered crops. The more uncertain and costly the regulatory structure becomes, the more research and investment will steer clear of biotechnology. According to former Food and Drug Administration official Henry Miller, "[u]nnecessary governmental scrutiny in the form of case-by-case reviews will cause delays in the testing of biotechnological products, increase the potential for corruption and markedly inhibit the diffusion of this useful technology to the developing world."[87] An overemphasis on the potential risks of using agricultural biotechnology ignores the equal, if not far greater, risks of doing without such advances. "For the world's developing countries, one of the greatest risks of genetic engineering is not being able to use this technology at all."[88]

CONCLUSION

Habitat loss around the world poses a real threat to biodiversity. Absent advances in agricultural production, the world's burgeoning population, and the consequent increased demand for food production, will accelerate this trend. If the parties to the Convention on Biological Diversity want to arrest this trend, their efforts would be better spent building institutional capacities for habitat conservation.[89] A global regulatory regime for biotechnology will not do much to stem the loss of biological diversity. If anything it could make this real problem worse.

Sustainable utilization of wildlife will be necessary to ensure the continued survival of many species. This is true not only for those species which have substantial economic value, such as elephants, rhinos, leopards, and other charismatic megafauna. Protecting such species in the wild necessarily entails protecting the habitat upon which they depend. This not only benefits the charismatic megafauna – the species for which tourists and hunters will pay

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[84] *See* Paarlberg (2000), p. 20.
[85] Cook (2000), p. 123.
[86] Prakash (1999) (citing David Aaron of the U.S. Commerce Department).
[87] Miller (1999), p. 189.
[88] Tangley (2000) quoting Calestous Juma, a Kenyan advisor to the Harvard University Center for International Development and former executive secretary of the CBD.
[89] *See generally* Edwards (1995); Martin (1999).

handsomely to photograph or shoot. It also benefits the other species which rely upon the same or similar habitat.

Insofar as wildlife management can be more profitable than traditional ranching or agriculture, it can also reduce the economic pressure to clear additional habitat elsewhere. In southern Africa, wildlife management is the highest-value use for must nonarable land.[90] Thus, where landowners have had proprietary rights in wildlife in developing nations, the land devoted to habitat has expanded. From 1975 to 1990, private landowners in Zimbabwe nearly doubled the amount of land devoted to wildlife, largely due to the ability to manage wildlife for profit.[91] Indeed, prior to the recent political unrest, the amount of private land managed for wildlife in Zimbabwe was more than double the area of Zimbabwe's national parks.[92] Where land is not privately owned, the extension of quasi-property rights in wildlife to rural communities has also led to increased wildlife populations and greater habitat for species. "In the developing world, wildlife is competing with humankind for limited resources. Denying wildlife a commercial value denies it the opportunity to compete successfully with alternative land use practices."[93]

Both the sustainable utilization of wildlife and increased agricultural productivity depend, in large part, upon liberal economic and legal institutions. Secure land tenure, economic liberty, and the rule of law are essential elements of an institutional environment in which conservation can thrive. This is borne out empirically: as economic liberty and the rule of law improve, agricultural productivity increases and rates of deforestation decline.[94] Both measures correlate more strongly with economic and legal institutions than they do with rates of population growth.[95] This should not be surprising, as there is ample evidence that "environmental quality and economic growth rates are greater in regimes where property rights are well defined than in regimes where property rights are poorly defined."[96]

The conservation of biological diversity is possible. Meeting this challenge requires greater attention to institutional reform than to the adoption of international conventions. Insofar as the CBD encourages sustainable utilization and eschews regulatory measures that suppress the commercial value of wildlife and habitat, it could help conservation efforts turn the corner. Insofar as the Biosafety Protocol suppresses increases in agricultural productivity and CITES prevents conservation through use, these conventions will not advance conservation. Without reform and redirection, the conservation conventions themselves could be the greatest threat to conservation.

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[90] Martin (1999), p. 231 and studies cited therein.
[91] Sugg and Kreuter (1995), p. 52.
[92] *Ibid.*
[93] Kievit (2000), p. 93.
[94] Norton (2002).
[95] *Ibid.*
[96] Norton (1998), p. 51.

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