

Why is there a biodiversity convention?

The international interest in centralized development planning

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The Convention on Biological Diversity (CBD) was initiated formally in 1992 at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro. At that meeting an official text of the CBD was adopted by nearly one hundred states, and this text was then sent forward for ratification and implementation. After sufficient ratifications, an initial conference of the parties was held in the Bahamas in 1994. At this conference a permanent secretariat to the CBD was created and established in Montreal.

Despite appearances to the contrary, the CBD did not come into existence all at once between 1992 and 1994. To the extent that it now exists, it is as the confluence of a number of international dialogues that have existed for several decades, and as a monument along the pathway of increasingly active intervention in the process of national development planning and decision-making. Nor, indeed, did the CBD represent much of a point of departure from these discussions, or even a heightened level of intervention. To a large extent, it was and is only one stage in the long-standing and continuing debate over the need to intervene within the process of development as it makes its way across the face of the earth.

What does the Convention on Biological Diversity regulate?

How is the interventionism of the CBD distinguishable from that within other international environmental treaties? Any choice that a state makes might have impacts upon resources used in common with others, and hence might be a suitable subject for multilateral management. For example, it has long been recognized that a country making use of joint waters or common airspace cannot make a decision unilaterally regarding the management of these resources.¹ Some sort of joint international strategy for their use, conservation and development must be agreed. For a few of these resources the number of impacted parties is virtually unlimited—their management must occur at the

¹ See P. Sands, *Principles of international environmental law* (Manchester: Manchester University Press, 1996).

global level. The ozone layer is clearly one such, and the climate system is another. At UNCED the global community was acting to recognize the importance of some of these global resources.

The CBD lies outside this movement. It is in fact a clear example of a global management regime that is concerned with wholly domestic resources. That is, the subjects of the CBD are primarily terrestrial life forms that, unlike the ozone layer and the climate system, lie firmly and clearly within the boundaries of individual countries.² The CBD is concerned primarily with the management of national development choices that impact directly upon national resources. The only connection between countries regarding these terrestrial resources lies in their potential usefulness in some distant shared future, and in the interests that some countries are taking in other countries' development choices. These are exceedingly vague and undefined interests that could be used to justify intervention in almost any and every facet of national decision-making.

This raises the question of the intended meaning of the CBD. In the absence of a common natural resource, what is it intended to regulate? What is it supposed to achieve? The answers to these questions lie to some extent within the terms of the convention, but to a greater degree within the general movements that gave rise to the convention. The subjects of the CBD are the subjects of the movements that were subsumed within its terms, and the subject in common to all of these movements is the centralized management of global land use planning. Whether the movement involved parks and protected areas, agricultural genetic resources or bio-prospecting, the same theme recurs. There is a need for a division of functions across the globe, between lands used primarily for production and those set aside for a diversity of other functions (research and development, recreation and leisure, knowledge and information). Since the first countries to develop have already converted the bulk of their natural resources to productive purposes, this means that any substantial amount of land to be set aside for diverse functions must come from the developing world. However, the division of world production currently shadows this division, and the developing world perceives no real incentive to provide these less-compensated functions. The topics for discussion under the terms of the Biodiversity Convention concern the mechanisms for intervening within national development choices regarding land use, to effect a diversity of functions at the global level and to provide the incentives to do so. The CBD came into existence because there exists a common interest in the coordinated management of domestic resources, not on account of a joint interest in a common resource. The recognition of this more complicated form of commonality is an achievement in itself.

This theme is developed below by reprising the various movements that contributed to the development of the CBD, their motivations and main

² There are of course many life forms that lie within common jurisdiction, such as marine mammals and fish, but these are often the subjects of separate conventions.

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achievements. It covers the parks and protected areas movement, the debt for nature movement, the environmental fund movement, the sustainable utilization movement, the farmers' rights movement and the bio-prospecting movement. At the conclusion of this survey the article draws together the various strands of these movements into a common theme, and shows how the common interest in coordinated land use planning evolved. Through the examination of the convention's antecedents, it becomes possible to answer the question: Why is there a global convention on biological diversity when there is no global resource by this name?

The objectives of the Biodiversity Convention

The stated objectives of the CBD are 'the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources' (Article 1). The language and the legal content of this convention are such that they make the means for attaining its objectives exceedingly vague. For example, the convention enjoins party-states 'to develop programmes for the conservation and sustainable use' of biodiversity (Article 6), and to 'establish a system of protected areas' (Article 8). These objectives may be given more meaning through the recognition of the various 'movements' from which the different parts of the biodiversity convention derived, all of which have come together for the first time in order to generate the various terms and obligations set out within the biodiversity convention.

The CBD itself represents an opportunity to integrate and extend these initial steps towards the rationalization of these conservation movements. The convention as written represents little more than a monument to the existing state of play in these international conservation movements; there appears to be no novel perspective on the problem incorporated within the terms of the convention, nor very many wholly new obligations distinct from those inhering under already existing programmes and agreements (such as the International Undertaking on Plant Genetic Resources, or the various conservation treaties such as the World Heritage Convention or the wetlands convention RAMSAR).³

The biodiversity convention is best understood as the confluence of these major conservation movements: a 'snapshot' of the state of these various negotiations at the time of the Rio conference. The implementation of the biodiversity convention constituted an opportunity to integrate these concerns and to meet the problems that have arisen in the pursuit of their objectives. Therefore the convention represents more of an opportunity than a set of obligations for the contracting states. This opportunity should be used to develop a coherent and efficient policy framework for addressing the fundamental interests that lie at the

³ The biodiversity convention is of the nature of a so-called 'framework convention': it provides a framework for the continuing negotiation of explicit obligations and responsibilities for the parties to the convention.

core of the issue known as 'biodiversity', as they have been identified in the course of the discussions within the previous movements. In order to identify this core, it is necessary to reprise the essence of these movements.

The parks and protected areas movement: the first attempts at global land use planning

The modern parks and protected areas movement was initiated in 1962 with the First World Parks Congress in Seattle, USA, since when it has been spearheaded by the International Union for the Conservation of Nature (IUCN). Prior to that time there were about 1 million square kilometres of protected areas, nearly all in North America and colonial Africa. Between then and now the number of protected areas has risen sharply and the total area of protected land has increased approximately eightfold to 7.9 million square kilometres.⁴ The practice of designating areas as protected under the system established originally by the International Union for the Conservation of Nature is now universal, with nearly 37,000 such sites so designated. This represents about 4 per cent of the remaining undeveloped habitats globally.

Many of the long-standing objectives of the protected areas movement are listed within Article 8 of the CBD. This article concerns *in situ* conservation and it is one of the backbones to the convention. It requires that each party establish a system of parks and protected areas (Article 8(a)) and also that each party generally promote development policies in, around and outside protected areas that will contribute to the conservation of biological diversity. Such commitments, if taken and enforced to the limit by all of the parties, would in themselves transform the face of the earth. In that case nearly all of the world's undeveloped land would be subjected to intensive efforts for its protection and carefully planned development.

This cannot happen without a lot of effort, expense and deliberately forgone development opportunities. It is not inexpensive to support diverse resources. This requires commitments of lands and management as well as a commitment to the resource itself. For example, it has been estimated that in Africa expenditures of more than \$200 per kilometre are required for the effective protection of large mammals such as the rhinoceros.⁵ This would imply that rhino management expenditures alone would absorb the entire park budget in many sub-Saharan countries, and this does not take into consideration the cost of the lands used by this species. When this is done it is apparent that conservation is a very expensive undertaking for many developing countries.⁶

⁴ See J. MacNeely, J. Harrison and A. Dingwall, *Proceedings of World Congress on Parks and Protected Areas* (Gland: IUCN, 1995).

⁵ N. Leader-Williams and S. Albon, 'Allocation of resources for conservation', *Nature* 336, 1988, pp. 533–5.

⁶ M. Norton Griffiths and C. Southey, 'The costs of conservation in Kenya', *Ecological Economics*, 12, pp. 211–34, 1994.

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The protected areas system fails to fulfil its promise when countries do not expend the resources required to comply with their conservation commitments. This gives rise to the widespread phenomenon of 'paper parks': protected areas that are protected in no sense other than the literary. Despite the existence of large numbers of protected areas in all parts of the world, there is very little real protection being afforded to many of these habitats and to their resident species. This is because protected status alone is insufficient to guarantee the conservation of the resources within the designated area; it is essential to back up such commitments on paper with real, and costly, efforts on the ground.

For example, the US budget for the management of its national protected areas exceeds \$2 billion (for 98 million hectares) or a mere \$20 per hectare, in one of the richest countries on earth where there is little pressure for further land conversion. Few other states with substantial protected areas are able to make such expenditures, and they are subject to much greater pressures on their lands. For example, Indonesia has had 20 million hectares under protected status with a *ten-year* budget of only \$45 million, or \$2 per hectare for the decade.⁷ As a general rule, management budgets for parks and protected areas across the globe are closely associated with national incomes, with the developing countries able to afford to spend only a fraction of the sums being spent in the developed world.⁸

Why does low management spending result in loss of real parks and protected areas? One reason is that management spending is closely associated with the assertion of real control over the resources within these areas. A topical example concerns the change in elephant populations in various African states in the 1980s. Almost half of the continental elephant population was lost during that period, as the population fell from 1.3 million to about 650,000 animals. This slaughter was attributed to the uncontrolled ivory trade at the time, but it was an often overlooked feature of that trade that four African states managed to eliminate over half a million elephants within their borders alone. These four states had wildlife management budgets ranging between \$5 and \$15 per square kilometre (as compared with those states with stable populations—South Africa and Zimbabwe—whose budgets were \$4,300 and \$475 per square kilometre, respectively). A small number of states had transformed the plight of this species simply by failing to allocate the resources required to maintain it. Their failure to allot adequate levels of spending was translated into ineffective assertion of control, and *de facto* open season on the elephant populations within their borders.⁹

Paper parks exist because countries find it virtually costless to designate certain areas as protected so long as they do not need to commit real resources to accompany that determination. An unreinforced designation may be adequate to solicit the international response that is desired, but it is clearly inadequate for

⁷ T. Swanson, 'Economics of a biodiversity convention', *Ambio* 21, pp. 250–7, 1992.

⁸ A. James, 'Biodiversity spending and development status: a cross-sectional analysis', PhD dissertation, Cambridge University, 1999.

⁹ T. Swanson, 'Regulating endangered species', *Economic Policy* 11, pp. 187–99, 1993.

Table 1 The inbuilt asymmetry between species and material richness: the top ten countries in species richness and their per capita incomes

Mammals			Birds		
Species (No.)	Country	GNP per capita (\$)	Species (No.)	Country	GNP per capita (\$)
515	Indonesia	570	1,721	Colombia	1,260
449	Mexico	2,490	1,701	Peru	1,160
428	Brazil	2,680	1,622	Brazil	2,680
409	Zaire	220	1,519	Indonesia	220
394	China	370	1,447	Ecuador	980
361	Peru	1,160	1,275	Venezuela	2,560
359	Colombia	1,260	1,250	Bolivia	630
350	India	350	1,200	India	350
311	Uganda	220	1,200	Malaysia	2,320
310	Tanzania	110	1,195	China	370

the conservation of biodiversity. This is evident not only in levels of spending, but in much more basic ways as well. For example, recent reviews of one developing country's protected area network indicated that 60 per cent of the national parks and 92 per cent of the sanctuaries had not even achieved an adequate legal basis within that country; virtually nothing had been accomplished beyond its listing with the IUCN.¹⁰ This is indicative of the striking asymmetry between the levels of international display and the actual domestic implementation of conservation commitments. Even when countries possess the best of intentions and goodwill on this count, they often lack the resources to give effect to them. A more fundamental question, however, concerns whether these countries are motivated to meet their obligations at the outset: What is the perceived relationship between diversity and development?

The core of the biodiversity problem: conserving diversity in excess of national interests

The problem for the protected areas movement lies within the conundrum that the major remaining sites for biodiversity conservation lie primarily within the developing world, in part because the developed world has achieved that status through the conversion of its lands to their most productive uses. This is indicated in table 1, which demonstrates the global asymmetry between diversity and material wealth.

There are several important points to be taken from this asymmetry. First, diversity and development appear to be inversely correlated. Those countries

¹⁰ World Conservation Monitoring Centre (WCMC), *Global biodiversity*, London: Chapman & Hall, 1992.

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that are most developed have (for many reasons) the least diversity to conserve. The perception of this inverse relationship provides few incentives in less developed countries to pursue diversity as a fundamental objective. Many countries in fact perceive the prevalence of diverse life forms in their countries as non-productive and backward.¹¹ Second, this asymmetry also implies the need for international management of land use—the conservation of diversity from a global perspective will be most cost-effectively attained by targeting resources in these less-developed countries, both because they have the most diversity and because they have the least resources to conserve it. Finally, this combination of non-existent domestic incentives but apparent international interests implies that a system of international management will be required to develop the incentives to maintain these resources domestically.

This is the first indicator of the international nature of the biodiversity management problem. It is derived from the global community's expressed interest in retaining some of the world's biodiversity, and the implied necessity of systematized incentives for the host countries to conserve these resources.¹² This is the fundamental nature of the international facet of the biodiversity problem, i.e. how to cause countries to make their decisions about their own domestic resources taking into account the interests of others outside their boundaries. Countries will need to see some sort of incentive to balance the costs they must incur before they will undertake the real efforts required to conserve biodiversity at a level exceeding their national interests. In the contexts of parks and protected areas, the problem is that each country will provide land use planning and restrictions in accord with its own needs, rather than in accordance with the preferences of the global community.

The second facet of the problem: adopting incentives for land use designations

How has the protected areas movement dealt with the problem of creating incentives for the establishment of truly protected areas in countries with limited resources? A very basic method which has evolved for inducing other countries to designate parks and protected areas is reciprocity in kind, i.e. the establishment of a mutual commitment to the maintenance of natural habitat by listings on a common 'notice board'. The 1971 Convention on Wetlands of International Importance, known as the RAMSAR Convention, was the prototype of this genre. Under RAMSAR, each country designates certain of its lands as protected wetlands, often for the use of common waterfowl species, and receives the designations by other countries in turn. This makes a lot of sense in the case of waterfowl species, which are often spread across a large number of disparate countries.

¹¹ Zimbabwe had legislation on its books that proscribed the growing of traditional landraces (plant varieties) on the grounds of their backwardness. In the past that same country has undertaken wildlife eradication campaigns for the elimination of associated pests and the introduction of domesticated livestock species from Europe.

¹² See Swanson, 'Economics of a biodiversity convention'.

Listing has been used in a number of other contexts as well. Probably the most extensive set of listings has derived from the UNESCO Man and Biosphere programme, initiated in 1976. This programme has focused on the conservation of important biomes, rather than specific species or habitats. There are also listing arrangements developed under numerous regional conventions: the Western Hemisphere Convention, the Berne Convention (for Europe) and the ASEAN Convention (for South-East Asia). This 'listing' approach to natural habitat conservation is very effective for certain shared regional resources, e.g. a lake, river or wetland, or shared species, e.g. the waterfowl managed under RAMSAR. It operates by providing that each of the states with an interest in the common resource make an express commitment to its conservation, by listing a preservation site. All states have an interest to take part, in order to encourage the others to do likewise; the listing operates as a form of barter mechanism, with each state compensating the others 'in kind' for their respective listings.

Such an approach is very effective for truly 'common resources', where equal access allows for equal sacrifices to be made. It is not very useful in the case of resources that are distributed very unevenly, as are biodiversity assets. In this case, there is little that the fully developed world has to offer the unconverted countries of the developing world in the way of 'in kind' compensation. The converted countries must compensate the unconverted with some assets other than biodiversity. This asymmetry in endowments renders the simplest international conservation strategies infeasible; it will be necessary to create mechanisms that can be applied on a non-reciprocal basis.

This is where the protected areas movement begins to intersect with the environmental funding mechanisms movement, discussed in the next section. The problem lies in creating incentive mechanisms that will induce developing countries to provide more than a simple designation in respect to their biodiversity-rich areas. Real protection requires carefully constructed mechanisms for inducing the expenditure of the financial resources required to ensure that protection. This is why the protected areas movement has come to blend into the funding mechanism movement. Although the movement has been very successful in soliciting the designation of protected areas within most states across the globe, it has had less success in generating the funding levels required to sustain these areas. One important role for the biodiversity convention must be to secure a basis for the funding of the existing protected areas.

The parks and protected areas movement has represented the core of the international commitment to land use planning at the global level. Its weaknesses lay in the fact that it was focused on the designation of desirable land use districts (e.g. parks, reserves, buffers) without the incentive system that would make these districts a reality. The need for an incentive system has given rise to new movements to redress these problems, e.g. debt-for-nature movements, environmental fund movements and sustainable use movements. We turn now to these various incentive systems, their development and their shortcomings.

The debt for nature movement: internationally transferable property rights

It has been argued by some commentators that what is required to solve both sides of the biodiversity problem is the creation of some form of internationally recognized 'transferable development right': a right to certain uses of land that is transferable across national boundaries.¹³ The creation of a market in such rights would allow individuals or organizations in particular countries to express their preferences regarding land uses in other countries through the purchase of rights to certain uses in those countries, e.g. the right to clear and burn the forests of Brazil.¹⁴ In addition, this mechanism would simultaneously provide the incentives for the implementation of its solution. The theory is that the landowner could be induced to transfer such rights in return for a stream of rental payments for those rights. If such rights were freely transferable, then it would be anticipated that the optimal distribution of global land uses would result. The broader community would continue to acquire any particular designation of land use rights (burning, clearing, ranching, timber extraction) so long as the value of the services obtained from denying such uses was higher than the value of that use to the landowner. When exchanges stopped, the landowner would continue to hold all uses that were not expressly transferred, and would have been compensated for all of those that were. So long as all of the uses of a given area are valued, the property rights approach allows for the allocation of land uses between the various competing users.

This is the theory behind the transferable development rights approach to biodiversity conservation. In short, when it is possible to unbundle the various services flowing from the ownership of a parcel of land, it would be possible in theory to use a form of property rights to allocate the various rights of land use efficiently among the interested parties. If it were possible to do this in the case of biodiversity services, then there would be no biodiversity problem. The people who wanted biodiversity would simply acquire the rights from those who are able to supply it. This is the motivating idea for looking at property rights forms of solutions to the biodiversity problem.

The problem with this theoretical solution to the biodiversity problem is that, although it is possible to unbundle the development rights in a piece of land, it is illogical to give any of these rights to 'absentee landlords' concerned with the conservation (or non-development) of those lands. There is far too great a conflict of interest between the local communities' drive for development and the conservationists' interest in conservation. Instead, it has been learned that the property rights and hence the ultimate decision-making power should remain

¹³ T. Panayotou, in 'Biodiversity conservation and economic development', unpublished manuscript, 1992, proposed the marketing of conservation districts by developing countries to foreign entities.

¹⁴ R. Schneider, in *Brazil: an analysis of environmental problems in the Amazon* (Washington DC: World Bank, 1992), conducted an analysis of the cost of purchasing the burning rights in large areas of the Amazonian forest. He concluded that the international community could acquire these rights for small amounts of cash, and leave most of the uses of the Amazon to the Brazilians.

with the locals, while conservationists should attempt to influence those choices through the creation of incentives and institutions for development of those resources in a manner consistent with their conservation.¹⁵

This lesson has been learned in previous attempts to influence land uses in the developing world, for example the so-called 'debt for nature' movement. The motivating idea was to substitute holdings of land for the massive holdings of debt instruments in the North. These lands might then be given conservation area status. This has long been the approach of, for example, the Nature Conservancy in the United States to the resolution of American conservation problems: buy it and bank it. The difference lies in the fact that the Nature Conservancy always made local subscription a major tenet of its land acquisition policy, while there were few, if any, locals able to put up funds to acquire lands in their own heavily indebted countries.

Nevertheless, the debt for nature movement was initiated in the belief that distant conservationists might be able to determine local land uses. It was seen at the time that one means by which people in developed countries might be able to invest in biodiversity would be to do so directly, namely by attempting to purchase natural habitats within the borders of other countries. In general, the notion of a property title in the territory of another state does not transfer easily across national boundaries. This is because property titles merely represent the state's promise to enforce the rights of a given individual to the use of the indicated resources, to the exclusion of all other individuals. As with all ownership, it is an instrument that is used for the advancement of society's interest, by the use of incentives to motivate the individual owner in the desired direction.

However, if a given owner's interest in the use of land comes into conflict with that of the society, it is generally accepted that the state has the right to retake some or all of the owner's rights in the property. This is precisely what happens in cases of planning, or eminent domain, in most countries; the state is asserting its pre-eminent right to dictate land use as against the owner's interests. In the usual context, this involves restricting the owner's rights of development, when the owner's incentives are such that the property would be developed more intensively than the community would prefer. No person or interest group is able to hold absolute rights in land, in the sense that they are exercised in a manner that is contrary to prevailing national interests; a property right is only a creature of the domestic regime and it is subject to that regime's discretion.

International transfers of land rights for the conservation of biodiversity are necessarily in conflict with national interests. This is because the nature of biodiversity is such that many of its values must flow to foreigners. The developed nations would like to purchase 'development rights' in developing nations in excess of the level which those countries see as being in their own

¹⁵ The distinction may seem subtle but it is crucial. There is a fundamental difference between a society's retaining all of its rights of choice but being induced by relative prices down a given development path, and a society's limitation to a specified choice by an external agent. See T. Swanson, 'Conserving biodiversity via encouraging alternative development paths', *Biodiversity and Conservation*, 1999, forthcoming.

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interest to set aside. This tension between domestic and foreign interests renders the mechanism of an internationally transferable property right in residual development rights untenable, despite its immediate appeal.

Nevertheless, a substantial part of the conservation community has attempted to implement some form of rights-based policy. Given existing rates of exchange and land prices, it has been possible in theory to purchase titles in quite substantial chunks of Third World real estate. It was this perceived value for money that motivated the debt for nature swaps of recent years. In 1990 \$350 million worth of debt for nature swaps were reported to be in process. However, these swaps never actually existed in the form in which they were often advertised, i.e. as purchases of protected areas within developing countries. Once it is recognized that property rights cannot be exercised in a fashion that clearly conflicts with state interests, then it also becomes clear that the strategy of transboundary transfers of property rights cannot have any real long-term impact on state decision-making regarding resource development. In this sense, international 'title transfers' are essentially equivalent to one-time payments to countries in exchange for a promise not to develop a specified habitat. These sorts of mechanisms have no dynamic incentive structure to them, and therefore they must fail over time as internal pressures for development increase.

Since real debt for nature swaps were infeasible, the alternative to international transfers of title has been the transfer of development rights to groups within the country concerned. These debt for nature exchanges have been organized around a local conservation group, which is then vested with the management or development rights regarding the real estate. Of course, national governments need not honour the property rights of internal groups any more than external, when their rights clearly conflict with the social interest, but this now becomes a matter of national politics. In effect, the transfer of resources to a domestic conservation group builds a political power base within the country whose objectives are consonant with the global conservation interests. It is something akin to the development of an internal pressure group, and its empowerment with hard currency. It may be a very effective agent for change, but the direction of that movement is unclear and uncertain.

This approach to the establishment of conservation has continued to evolve with the establishment of many independent 'environmental trust funds' throughout much of the developing world. These funds are of interest in that many have been established on a quasi-permanent basis, through the establishment of a capital fund from which the income alone is to be used. In this way, the need for a dynamic and permanent source of funding has been recognized and implemented; to this extent, these trust funds represent the state of the art in the creation of effective funding mechanisms. They clearly do have the long-term capability for affecting the investment paths of the countries in which they reside.

It is unclear how this power will be exercised. These trust funds exist outside any particular international legal structure, as creatures of domestic law with representation from various external bodies. The national environmental fund

movement has arisen out of the debt for nature movement, and it has institutionalized the features that characterized many of the previous swaps, notably the establishment of a local power base with objectives consonant with the conservation interests. A random example indicates the structure of these funds. The Indonesian Biodiversity Foundation was established under Indonesian law on 28 February 1994. It was conceptualized and provided with start-up funding through \$5 million of USAID monies, and it is to be capitalized at the level of \$40 million by virtue of a grant agreement between the governments of Japan, the United States and Indonesia. The board of trustees will invest the proceeds of the fund into activities in furtherance of the Biodiversity Conservation Strategy and the National Biodiversity Action Plan. That board is necessarily devoid of governmental representatives and is constituted from NGOs (7), natural scientists (6), social scientists (3), private sector representatives (4) art interests (1), and donor organizations (2).

The evolution of the environmental trust fund movement out of the debt for nature movement brings us full circle. Despite the capacity of these domestic institutions to bring some global interests into the equation, it is clear that these institutions cannot satisfy in any certain or stable fashion the need to finance domestic resource management for the benefit of foreign interests. This will require the establishment and institutionalization of an international mechanism for influencing domestic conservation decisions. We turn now to the consideration of attempts at the creation of such international institutions.

The international funding mechanisms movement: direct incentive mechanisms

The lack of international property rights transferability means that more dynamic solutions to the problem are required. It remains necessary to develop methods for applying foreign funds to the conservation of domestic resources, in a way that provides incentives for that conservation to occur. One of the first international conventions in this arena—the World Heritage Convention—is still one of the best examples of a true funding mechanism, and provides a good case study in the distinction between mere funding and a funding mechanism. The Convention Concerning the Protection of the World Cultural and Natural Heritage was adopted within the General Conference of UNESCO in 1972, making it one of the first international environmental laws in place.¹⁶ Its fundamental importance lies in the groundwork it laid for the internationally financed management of domestic resources.

The World Heritage Convention probably represents the first context in which global interests were deemed important enough to justify foreign financing of the management of wholly domestic resources. Originally, the world community was asserting its interest in various cultural resources (e.g. the

¹⁶ S. Lyster, *International wildlife law* (London: Grotius, 1985).

Table 2 Funding available under the World Heritage Convention (US\$000)

Type	1983	1984/5	1986/7	1988/9	1990/1
Voluntary	2,278	805	1,082	1,260	633
Mandatory	1,842	1,842	931	1,442	2,110
Total	4,110	2,647	2,113	2,702	2,743

Source: World Heritage Commission.

Pyramids, the Taj Mahal), and recognizing the responsibility then incumbent upon it to participate in payment for the management of these resources. Article 6(1) of the World Heritage Convention provides that: 'While fully respecting the sovereignty of the States on whose territory the cultural and natural heritage ... is situated, and without prejudice to the property rights provided by national legislation, the States Parties to this Convention recognise that such heritage constitutes a world heritage for whose protection it is the duty of the international community as a whole to cooperate.' This is an example of a shared management system, whereby the domestic regime undertakes the responsibility for management of the resource at the level that its global values recommend, while the global community undertakes the responsibility for funding this incremental management.

The World Heritage Convention operates as a funding mechanism through the workings of the World Heritage List (Article 11) and the World Heritage Fund (Article 15). The World Heritage List has been developed by a committee of delegates from 21 of the states which are parties to the convention (elected at each meeting of the conference of the parties). It is composed of various areas submitted by their host states as potential World Heritage Sites, and, if accepted by the committee, they are then eligible for funding from the World Heritage Fund. The World Heritage Fund was established by compulsory donations of 1 per cent of each member state's then existing UNESCO contribution. Since UNESCO contributions are derived from a general United Nations' formula based upon ability to pay, the fund is similar to an income tax on the states that join the convention.

The World Heritage Convention broke much new ground. In addition to developing the first income tax system for assisting countries in the management of domestic resources for the global good, it also created express obligations on states to do just that,¹⁷ and it provided the incentive system—the fund—for the enforcement of those obligations.

The World Heritage Convention remains an excellent example of funding mechanism-based conservation. It is now being replicated to an extent by the

¹⁷ Article 4 of the convention obliges each of the parties to do 'all that it can ... to the utmost of its resources' to conserve listed sites.

development of international trust funds within the context of other international regimes. For example, the RAMSAR Convention has now established a trust fund for the compensation of wetland sites listed in developing countries. The difference between a 'funding mechanism' and simple funding is the presence of a system of incentives which directs that funding into conservation. The World Heritage Convention accomplishes this object through its list and fund, and thus qualifies as a funding mechanism. Development aid without inbuilt incentives relies more upon a state's good intentions, and is distinct from a 'mechanism' for supplying global public goods. Much of the international development assistance that flows to the Third World does so without a dynamic framework of incentives, and therefore does not provide much incentive for long-term investments in resources that primarily benefit foreigners.

A project-based mechanism for funding biodiversity conservation is the Global Environmental Facility (GEF). This fund has been established by donors in order to allow a programme in globally important environmental projects to be funded. The facility initially consisted of bank special drawing rights in the amount of \$1.2 billion, of which approximately \$500 million was allocated to biodiversity conservation projects. Once the Biodiversity Convention was signed, the GEF was designated as the funding mechanism for the convention on a temporary basis. Since that time it has passed through several additional funding phases, but it has not developed many of the characteristics of a true funding mechanism.

The basis on which the GEF funds biodiversity contains some of the elements of an efficient funding mechanism; however, once again there is no provision for a permanent dynamic incentive structure within the system of projects that it funds. The breakthrough in the case of the GEF occurred in the terms on which the funds are allocated. They expressly recognize the importance of allowing compensation to countries for externally supplied benefits. That is, the GEF charter provides that the funds are to be allotted to projects where the domestic benefits would not warrant the project, but the inclusion of benefits flowing to other countries would provide a reasonable return to the investment. Clearly this allows for the payment of compensation to countries which devise 'projects' including conservation as a significant component of their product.

However, the GEF funds biodiversity projects on the same basis as any other World Bank project, with the exception of the global benefit clause. There is no provision for ongoing compensation for these public goods, and so there is no incentive to provide for their existence beyond the time horizon of the funded project. In a traditional development banking context, this approach to funding would be advisable, since the objective would usually be to put into place a new capital structure in the country based on productive assets that would then allow that country to continue operations on a sustainable basis. This is the manner in which development projects are usually funded, by financing the acquisition of productive capital that then becomes self-financing by virtue of its efficient implementation.

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The need for a funding mechanism in the case of biodiversity is of a very different character. The problem of biodiversity lies in the relatively unproductive nature of these resources from a domestic perspective, in combination with their relatively important role in providing a diversity of functions at the global level. No matter what values become appropriable by local communities, these external values will continue to exist, and it is necessary to rechannel these values to the local communities if the correct quantities of diversity are to be retained. The biodiversity problem is not a case of assisting developing countries in the development of new capital stocks, but rather one of the need to aid them in financing the conservation of their existing (natural) ones. A broad-minded development bank approach is no solution to this problem.

A funding mechanism for biodiversity must put into place a permanent fund that generates a flow of funding so long as specified forms of conservation are pursued. It cannot be based on the funding of alternative capital assets that generate their own returns, simply because the biodiversity problem emanates from the existence of natural capital which generates values that are not appropriable domestically. The GEF 'project-based' lending may aid in the appropriation of certain values (such as tourism or extraction) but these are different problems. The fundamental task of a biodiversity funding mechanism is to provide long-term incentives for investments in the provision of the non-appropriable values of diversity.

The sustainable utilization movement: international trade regimes and incentives

Of course there are many important forms of values that originate from unconverted lands that are appropriable: the timber and firewood from forests; the foods and medicines from exotic plants; the tourism associated with wildlife. Much of the value of these uses of biodiversity flows from foreigners to the domestic state; tens of billions of dollars are generated each year by virtue of the international trade in wildlife.¹⁸ This is a significant stream of funding, flowing largely from developed to developing countries. The issue is whether this form of use might itself be turned into an instrument for long-term and biodiversity conservation: can sustainable wildlife utilization be translated into incentives for broad-based biodiversity conservation? The sustainable use movement has grown out of the discussions and debates surrounding this controversial question.

The leading piece of international legislation concerning trade in wildlife is the Convention on International Trade in Endangered Species (CITES), signed in Washington DC in 1972 with a conference of the parties convened biennially since then. Of all the many international environmental conventions, CITES has probably the single most detailed control structure. It was the first international wildlife treaty to provide for both express obligations and international

¹⁸ T. Swanson and R. Luxmoore, *Industrial reliance on biodiversity* (Cambridge: WCMC, 1998).

monitoring. Therefore, CITES represents an important step along the road towards making substantive international law with concrete impacts.¹⁹ The CITES-based 'trade control movement' has played an important role in the development of one part of wildlife conservation policy.

However, CITES was drafted with little attention to the problems of the developing countries in maintaining their diverse resources. It focused instead on the identification of endangered species and the banning of trade in them. This might make sense from the perspective of persons resident in the North; however, for those who share their lands with the vast majority of the remaining wildlife, it is not a very constructive approach to conserving this biodiversity. There are many paths to extinction, and overuse is only one of them. Trade bans address this one source of endangerment but leave the same species even more vulnerable to the other, more fundamental threats, namely conversions. What is required instead is a 'trade control mechanism': an instrument through which destructive trade is quashed and constructive trade is encouraged. The sustainable use movement has evolved out of the recognition that trade must be constructively channelled as well as controlled.

CITES itself functions as a potential trade control mechanism primarily through the operation of two appendices, in which potentially endangered species are listed. Appendix I is a list of those species which are currently threatened with extinction (Article II(1)), while Appendix II is a list of species for which there is some indication that they might become threatened (Article II(2)). The conference of the parties to CITES makes these determinations at its biennial meetings.

Once a species is listed on either of the CITES appendices, it becomes subject to the permit requirements of the convention. An Appendix I species may not be shipped in the absence of the issuance of an 'export permit' by the exporting state (Article III(2)). This permit may not be issued, under the terms of the convention, unless the exporting state certifies that the export will not be detrimental to the species and the importing state certifies (by the issuance of an import permit) that the import will not be used for commercial purposes (Article III(3)(c)). Therefore, an Appendix I listing acts as an effective ban on the trade in those species; even if exporters wish to continue the trade, the importing states have the duty to deny all commercial imports.

An Appendix II listing, on the other hand, leaves the decision on trade control wholly to the discretion of the exporting state. That is, there is no role for the importing state, other than to ensure that an export permit is issued for each specimen (Article IV(4)). These permits may be issued so long as the exporting state itself certifies that the export will not be detrimental to the survival of the species within the exporting state (Article IV(2)). The other important responsibility of member states is to provide annual reports to the CITES secretariat on

¹⁹ W. Wijnstekers, *The evolution of CITES* (Lausanne: Secretariat of the Convention on International Trade in Endangered Species, 1988).

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the amounts of trade in listed species (Article VIII(7)). The secretariat also sometimes acts as the intermediary between exporting and importing states, in order to confirm the authenticity of trade documents, for example.

This system of bans on commerce in endangered species is required of all parties to CITES. In addition, there is the requirement that the member states adopt internal legislation implementing the terms of the convention. Many states, particularly developing countries, have implemented absolute bans on all wildlife exploitation. In many developing countries it is illegal to hunt, capture, trade or export any part of the wildlife resource. This is true for most of the states of South and Central America. For example, Brazil and Bolivia have total bans on all wildlife exports, as does Mexico. Many of their neighbours have partial or full bans in place. In sub-Saharan Africa, too, there are half a dozen states with complete wildlife exploitation bans in place, and many others with severe use restrictions. Of course, all of these impediments to the development of diverse resources make it difficult to foster these as alternative development paths.

In short, the CITES convention was not drafted to provide incentives for the constructive use of diverse resources; it was instead focused on shutting down the trade at a time when it was deemed to be out of control. It has not always been effective, even in this more limited goal. The history of CITES has witnessed some species progress from Appendix II to Appendix I, as potentially unsustainable trade levels raise concerns about the viability of the species. The most publicized case of this has been that of the African elephant, for which a 12-year listing on Appendix II ended in 1989 with its 'uplisting' by the conference of the parties.

The primary drawback of the CITES Appendix I approach has been the 'blanket' nature of most of these trade bans: they apply equally to those countries investing and those countries not investing in the conservation of the specified species. This punishes the various producer states equally, despite the fact that their approaches to conservation might vary widely. Thus, Zimbabwe and Zaïre were affected equally by the ivory trade ban, despite the fact that the former was investing in elephant management at a rate approximately a hundred times greater than the latter. Such a blanket approach to trade control provides dangerously inappropriate signals to those states investing in their diverse resources.

Recently, the conference of the parties to CITES has been taking steps towards a more sensitive approach, with the attempted development of various sorts of constructive utilization systems. Although these are still in their formative stages, they represent the recognition of the developing countries' perspective on the problem. At various times, important but not always effective steps towards the construction of a rationalized international control structure have been taken. These are all part of the sustainable utilization movement for biodiversity conservation.

As early as 1979 the delegates from developing countries brought the anomaly of 'indirect extinction in lieu of direct overexploitation' to the attention of the conference of the parties. In San Jose, Costa Rica, they argued that there

must be an economic benefit from the controlled species if they were to be able to justify protecting their habitats from development. These concerns gave rise to the first step towards the reform of CITES, with the adoption of conference resolution 3.15 at the New Delhi conference of the parties in 1981. This resolution provides for the downlisting of certain Appendix I populations for the purposes of sustainable resource management. The criteria which specify how Appendix I species may be utilized in order to procure compensation for their habitats are known as the 'ranching criteria', and each conference of the parties usually sees a large number of such proposals for review and possible acceptance. The first ranching proposal accepted involved the transfer of the Zimbabwean population of Nile crocodiles to Appendix II in 1983.

This approach to trade management was then generalized in 1985 with resolution 5.21, which provided for the systematic downlisting of populations where the countries of origin agree a quota system that is sufficiently safe to avoid endangering the species. Under this resolution, five different species have been subject to quota systems: three African crocodiles, one Asian crocodile, and the Asian bonytongue (a fish much admired by the Japanese as a wall hanging) for which the Indonesians were allowed a quota of 1,250 specimens. None of these ranching systems went any further than the development of a species-based quota. In particular, no external control structure was ever implemented, this being left to the discretion of producer states. Thus, predictably, these quotas can be abused. For example, Indonesia is believed to have issued permits for about 140 per cent of its first year's quota of bonytongues.

The third avenue of innovation under CITES was the creation of a management quota system for the African elephant populations under resolution 5.12. This system was founded upon the idea of management-based controls with consumer-based enforcement. Annual quotas were to be constructed at the outset of each year, and producer states were then to issue permits not exceeding these quotas. Then consumer states were to disallow all imports unless accompanied by a management quota system (MQS) permit. For one very important reason, this did not result in an effective control system. The MQS provided no external checks on the discretion of the producer states in the issuance of permits: the determination of annual quotas and the issuance of MQS permits were within their unsupervised discretion. Specifically, there was no mechanism for ensuring that these permits were issued in accordance with a sustainable management system. Consumers purchasing ivory under MQS permits had no assurance whatsoever of the meaning of that permit. In fact, most states based their annual 'management quotas' of ivory on the 'expected' confiscations from poachers, implying little or no effective investment in elephant management. Nor were there any disincentives for cross-border exploitation, since consumer states were allowed to import ivory unquestioningly from any exporter issuing permits. Thus Burundi, with one elephant, became the single largest exporter of ivory in Africa under this control regime. The management quota system failed as a consequence of these clear

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inadequacies, resulting in a collapse of public confidence in the capacity of trade controls to work. The African elephant was then listed on Appendix I in 1989 and the legal trade in ivory was halted for a decade.²⁰ Of course, this failure of international institutions translated into a substantial penalty for all of the states with elephants—and it was imposed equally on those investing in their conservation and on those that were not. This is precisely the opposite sort of incentive system to that which is required at the international level for inducing effective domestic conservation.

At the most recent conference of the parties, held in Zimbabwe in 1997, this situation has been rectified to some extent. The ban on the trade of ivory from the African elephant has been lifted for a set of five southern African countries with substantial elephant populations, so long as they are able to develop and maintain a secure international trading mechanism. This international sanction is a small but imprecise step in the right direction. What is required is a systematic method for segregating those states that are investing in sustainable use of their resources from those that are merely divesting. The most recent CITES resolution recognizes rather than institutionalizes this distinction.

In sum, with the increasing recognition that the criminalization of consumptive values does not halt the general decline of wildlife species, the conservation movement has instead shifted to a model of 'sustainable utilization'. This represents an attempt to encourage the transfer of values through the mechanism of the wildlife trade, so long as the producers use their wildlife sustainably. CITES has evolved to recognize this need by means of the creation of various forms of 'sustainable utilization' exceptions to its broad-based bans: 'ranching exemptions', species-based quotas, and now the discriminating ivory trading regime. None of these regimes has involved a concerted attempt to target value on those investing in biodiversity conservation measures, but they do represent the recognition of the need to provide for sustainable utilization within the international trading regime.

This movement is the longest-standing, and most advanced, attempt at taking concrete tradables and translating them into instruments for providing broad-based incentives for biodiversity conservation. The products from 'sustainably produced wildlife' may be viewed as the surrogates for the invisible flows of benefits from managed lands held in reserve. For this reason the international community has good reason to erect a system of incentives that pays a premium to products which flow from such habitats, while paying little or nothing for identical products that flow from unmanaged habitats. This is the way in which the tangible products from these areas may become instruments for their broad-based compensation and preservation. CITES did not commence in this vein, but the sustainable use movement has been moving it in that direction.

²⁰ E. Barbier, J. Burgess, T. Swanson and D. Pearce, *Elephants, economics and ivory* (London: Earthscan, 1990).

The farmers' rights movement: *ex situ* conservation

There is one set of biological resources in international trade that has generated a disproportionate amount of controversy: namely, the plant varieties on which modern agriculture is now based. The 'green revolution' has generated significant increases in average yields in most countries adopting the methods of modern agriculture; between 1960 and 1983, world food production increased by almost 3 per cent per annum, largely through the adoption of such methods. One of the linked inputs in modern agricultural production is the specialized high-yielding varieties developed for use in intensive agriculture. These varieties are developed by plant-breeding industries through selective breeding techniques making use of the entire gene pool available through the gene bank networks and through screening the various traditional plant varieties still in use. Therefore, in recent history, a fundamental input into the modern agricultural process has been the range of varieties still being used by the non-modern (traditional) sector of agriculture.

However, despite the need for the inputs from the traditional sector, there has been little return from modern agriculture through investment in the traditional sector in order to maintain it for this purpose. Inevitably, given the choice, farmers have converted their production methods to the modern high-yielding varieties, resulting in the continued expansion of the modern agricultural frontier across the developing world. Therefore, the very success of the modern agricultural sector has resulted in the erosion of the traditional sector upon which it has depended for raw material. The continuing losses of plant genetic resources closely related to those in use in modern agriculture has become one of the clearest depictions of the biodiversity problem: the loss of crucial reserves in the pursuit of maximum productivity.

This conservation problem was first addressed through the establishment of the gene bank system under the Consultative Group for International Agricultural Research (CGIAR) in 1971, and the development of 13 International Agricultural Research Centres (IARCs) for the assembly of germplasm collections. The 13 IARCs now manage 227 seed banks in 99 countries which hold 90 per cent of known landraces of such crops as wheat, corn, oats and potatoes. There are also many other gene banks of use in agriculture that are owned and managed by national governments or private concerns; however, the IARC network remains a very important source of agricultural germplasm.

For many years there have been discussions within the UN Food and Agricultural Organization concerning the appropriate policies for the management of the IARC network, and germplasm generally. Of course, one of the fundamental issues concerns the distribution of the world product from global agriculture. The varieties held within the gene banks come from all over the world, yet their breeding and translation into high-yielding varieties are undertaken largely by a small number of multinationals.²¹ These plant breeders

²¹ C. Juma, *The gene hunters* (London: Zed Books, 1989).

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combine reserved plant varieties with well-trained scientists and high technology in order to produce new high-yielding strains for use in modern agriculture. Of course, all three facets (scientists, technology and diversity) are important to the production of a high-yielding variety, but only two have been compensated.²²

The distribution of the global proceeds from agriculture might be perceived to be unfair because much of the material supplied to the gene bank network was derived from countries where traditional agriculture still flourished, which tended to be the less developed countries. These countries, when converting to modern agriculture, were then charged high prices for modern varieties developed by plant breeders. This was possible because the plant breeders had registered 'plant breeders' rights' in the modern varieties under the so-called UPOV convention (Union International pour la Protection des Obtentions Vegetales, 1961). This international agreement allows plant breeders to claim exclusive marketing rights in new uniform varieties developed (in the past) by means of crossing previously existing ones. Member states agree to recognize the exclusive marketing right claimed by the first registrant of a new modern variety. Meanwhile, the germplasm held within the IARC gene bank network has been managed under a 'free access' scheme that provided germplasm to any applicant requesting it for use in research and development. They were to be made available for access under mutually agreed terms (i.e. by means of bilateral agreements), but most gene banks made germplasm freely available for research purposes in the belief that this strategy was important for fostering agricultural research and development. This dichotomy between the treatment of raw germplasm from developing countries and improved germplasm from the developed caused a great furore within the FAO general assembly.

In 1986 this controversy resulted in the adoption of the International Undertaking on Plant Genetic Resources (IUPGR), in which the developing world agreed to recognize the legitimacy of the concept of plant breeders' rights in return for the creation of a reciprocal concept termed 'farmers' rights'. The IUPGR (and its associated FAO General Assembly Resolution 5/89) has seen the further development of the concept of 'farmers' rights'. These are rights granted in recognition of the contributions of farmers towards the conservation of genetic resources for use in the plant-breeding and seed industries generally. Through these, the farmers are intended to participate fully in the benefits derived from the development of genetic resources. At present, these rights have been vested in the international community (as a sort of 'trustee') for the benefit of the world's farmers and farming communities.

There has been a lot of discussion of the mechanism by which farmers' rights might be implemented. The mechanism is currently described as an 'international fund' managed by the FAO to support conservation activities, particularly in the developing countries. This international fund remains to be implemented, and

²² T. Goschl and T. Swanson, 'The management of plant genetic resources for agriculture', Discussion Paper 98-12 (London: CSERGE—UCL/UEA).

there is no agreement as to the scale or the source of the contributions that it should contain. Of course, this situation renders the concept of 'farmers' rights' largely ineffective to date. It remains another indicator of the understanding of the basic nature of the problem, but also of the absence of a solution.

The bio-prospecting movement: property rights approaches

The farmers' rights movement demonstrated the use of a property rights approach for the compensation of one of the crucial functions of biodiversity, namely, the research of relatively unused life forms for solutions to problems arising by reason of evolved resistance, and the development of these forms into highly productive varieties. The problem in that arena concerns the fact that the property rights approach developed there rewards only the function of diversity at the end of the pipeline. It is difficult to perceive the manner in which these property rights will be channelled back upstream to the individuals or states conserving the lands from which the plant variety issued.²³ The property rights approach is not being directed to the solution of the diversity problem.

A related movement concerns the use of natural habitats for general screening purposes in regard to genetic resources. These uses often concern species not already in human use (unless it is restricted to locally known usages) and are often screened for usage in the pharmaceutical industry. Such screening can occur on a purely random basis, through the collection of samples and their investigation in the laboratory, or by reference to local usage. A large number of currently marketed pharmaceuticals have been developed from such a starting point. One study estimated that 25 per cent of all US-marketed pharmaceuticals were plant-derived.²⁴ Despite the importance of lands in providing necessary inputs into this production process, there has been little or no planning to retain lands for this function.

The property rights dispute in this case relates to the fact that courts in the United States (and EU patent law) have stated that naturally occurring organisms are not subject to property rights regimes while human-modified ones are. Exclusive marketing rights may be claimed in living organisms, but only those in which it is demonstrated that human intervention has produced an organism that was not previously existing in nature. Otherwise it is necessary to synthesize the useful products of natural systems, in order to claim rights in them. This means that a useful chemical within a naturally occurring plant may not receive a protected return, while its synthetic counterpart (the same chemical in the form of a little white pill) receives the full protection of the patent system.

This is an indicator of the manner in which global land use planning will require institutions that distribute returns to the global production in a very

²³ T. Swanson and T. Goeschl, 'Issues concerning property rights in plant genetic resources', *Ecological Economics*, 1999, forthcoming.

²⁴ N. Farnsworth and D. Soejarto, 'Potential consequences of plant extinction in the United States on the current and future availability of prescription drugs', *Economic Botany* 5: 39(3), 1985.

Table 3 The distribution of biotechnology property rights^a

Citizenship of recipients of Europatents granted (%)	Citizenship of recipients of Latin American patents granted (%)
United States (36)	Developed countries (89)
EU states (32)	Latin American countries (11)
Japan (23)	
Rest of world (9)	
Latin America (0)	

^a Data are for the first quarter of 1990.

Source: H. Hobbelink, *Biotechnology and the future of world agriculture* (London: Zed Books, 1991).

different manner from that which has prevailed in the past. For example, developed countries might best be described as those societies that are biased towards 'human' forms of capital (education, training) while the developing countries are best described as more biased towards natural forms of capital (natural resources, biodiversity). It has long been recognized that it is necessary to create novel forms of property rights in the products of research and development. The name given to these rights-based systems ('*intellectual property rights*') indicates the existing biases within these international institutions. The international legal systems are requiring the processing of nature's information by human and human-made capital before granting exclusive marketing rights in it. The primary reason to engage in global land use planning, i.e. the retention of reserves for use in various forms of research and development, is clearly not within the purview of this incentive mechanism.

This bias is captured in some rough indicators of patent protection. Much of the intangible value of biodiversity is represented by the specific chemical and genetic structures of the different varieties present there. Given that the vast majority of the world's natural genetic wealth exists in the developing world and this is an important input into biotechnical research, it might be expected that there would be some bias towards the granting of patent rights to citizens of these countries. However, nothing could be further from the truth. Although the bulk of the world's genetic wealth resides in the less developed countries, nearly all of the world's biotechnology patent rights are held by the developed countries. An example is provided by the distribution of European versus Latin American biotechnology patents (table 3).

Since the holders of the natural capital stock are not vested with rights in the returns they generate, there is very little incentive for them to undertake substantial investment programmes to maintain that natural stock of capital. The rights in the joint products of both biology and technology are instead vested in

those countries whose advantage lies in technology rather than biology. This bias exists on account of clearly drafted laws that discriminate against naturally occurring genetic capital in favour of human-altered varieties. For example, Article 53(b) of the European Patent Convention states that no protection is available for 'plant or animal varieties or essentially biological processes for the production of plants or animals'. Similarly, in the landmark US decision, *Diamond v. Chakrabarty*, which established the first rights to patents in live organisms, plants and animals in 1980, the court stated that the basis for awarding a patent in a living organism was that 'the patentee has produced a new bacterium with markedly different characteristics than any found in nature ... His discovery is not nature's handiwork, but his own; accordingly, it is patentable subject matter under patent law.' In the United States extremely wide patents are being granted to living organisms, so long as they have been subject to some application of human technology: examples are the famous 'onco-mouse' patent and the infamous patent application on behalf of the Human Genome Project.

These instances provide an indication of the extent of the bias that exists in favour of rights from national investments in human rather than natural capital stocks (i.e. investments in education and technology rather than reserves). In essence, the legal system treats the information flowing from nature as subject to 'open access', and the information from human thought as private property. Again, such a bias actively discourages any investment in the maintenance of the stocks of natural genetic capital, instead encouraging the development of capital stocks that are compatible with the international property rights structure. This is one of the reasons why developing countries want 'technology transfers': it is only by virtue of acquiring technology that compensation for already existing natural capital services may be acquired.

Recently there has been a movement to develop a mechanism for compensating for this use of plant genetic resources. It has been based on the idea of making payments for prospecting rights, and it has been advocated by the World Resources Institute (and other NGOs) and suggested by an agreement between Merck Inc. and INBio in Costa Rica. The idea of a bio-prospecting agreement is to make an exclusive arrangement for plant screening concerning a certain geographical area on terms agreed between the two parties involved. This agreement can provide for up-front prospecting fees or use-based royalties or both. The fundamental idea is to base compensation upon bilateral negotiations between the supplier and the user of the (basic) plant screening services. Once again, these attempts are too piecemeal to represent a systematic approach to the resolution of the biodiversity problem. They indicate that property rights-based solutions to the biodiversity problem are a very long way from being understood, let alone implemented.

Conclusion: why is there a convention on biodiversity?

All these various movements have come together in the Biodiversity Convention. Collectively, they represent two aspects of a problem that requires international action for its resolution, despite the fact that none of them involves any international resource. The first facet of the biodiversity problem is the need for global land use planning. If each state pursues its own narrowly defined self-interest in the determination of its land uses, then each will pursue maximum productivity and this will eliminate the base of reserve lands that currently supply all other uses. The global community definitely requires some substantial amount of lands to be held in reserve for purposes of research, recreation and resilience. The determination of this quantity is one very important function that international cooperation must achieve. The parks and protected areas movement has been directed to the appraisal of the earth's territories and the assessment of the significance and diversity of the life forms present in all of these regions.

The second facet of the biodiversity problem is the creation of incentive mechanisms that will translate the need for designated reserves and resources into their effective maintenance and management. Most of the other movements discussed in this paper concern this latter aspect—how is it possible to create incentives for countries to pursue objectives other than the conversion of their lands to their most productive use, narrowly defined? Over the past few decades many approaches have been considered or attempted—transferable property rights, environmental funds, sustainable use of wildlife, property rights in genetic resources. None of these mechanisms has been notably successful in achieving a solution. It is apparent that the rationale for continuing international dialogue in this arena lives on.

The reason why that resolution remains difficult is also apparent. There are fundamental issues involved here; issues that are often implicit in these problems but seldom addressed head-on. The only exception is in the context of the debates concerning plant genetic resources for agriculture. Here the debate is set in its starkest terms—the contest for appropriation of shares of the global product from agriculture based on high-yielding varieties. However, the contest in this sphere is simply emblematic of the larger picture. Global productivity is always based on both sectors—the production sector and the reserve sector. We cannot engage in continuing production without both sectors. Nevertheless, to date we have not had to be concerned about generating a return to reserves, as they were the rule and high-productivity sectors were the exception. As this balance tips, we now require a reworking of our institutions in order to provide returns to both activities. Something as complicated as the rethinking of the division of global product between high-productivity uses and reserve uses is required. This is the global issue embedded within the biodiversity convention.