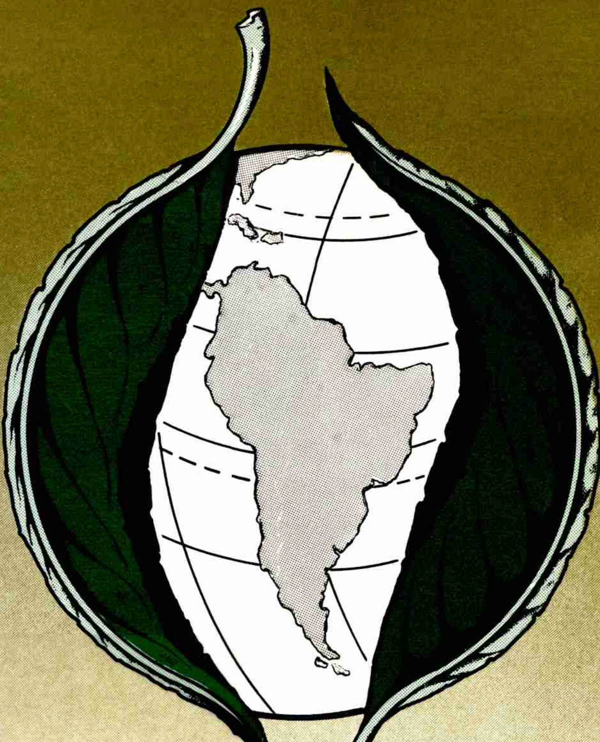
BIODIPLOMACY

Genetic Resources and International Relations

Editors
Vicente Sánchez and Calestous Juma



Foreword by
Wolfgang E. Burhenne

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Foreword

WOLFGANG E. BURHENNE

Biodiplomacy is one of the first publications on the Convention on Biological Diversity after it was concluded in Nairobi in May, and signed at the United Nations Conference on Environment and Development (UNCED) in June 1992.

To the surprise of many, the original promoters of the Convention were not within the scientific community but were instead within the legal community. Since the early 1970s, several members of the International Union for the Conservation of Nature and Natural Resources (IUCN) Commission on Environmental Law (CEL) had argued that the natural environment as a whole was not being adequately conserved through the existing legal instruments of the time. They criticized the fact that conservation legislation was simply old-fashioned: advanced environmental law existed for the technical aspects of achieving improved environmental quality, for instance for pollution control, but there was no comprehensive legislation concerning nature in general. Legislation—with few exceptions—existed for protected areas or was only species-oriented. Expressing such, Cyrille de Klemm called for a 'worldwide convention of a general nature'.[1]

To the 15th IUCN[2] General Assembly (Christchurch, New Zealand, 1981) the International Council of Environmental Law (ICEL) presented a relevant motion. The adopted resolution asked, among other things, that the IUCN Secretariat analyse 'the technical, legal, and economic and financial matters relating to the conservation, accessibility and use of these resources with a view to providing the basis for an international arrangement and for rules to implement it.' At the World Congress on National Parks (Bali, Indonesia, 1982) CEL lawyers[3] initiated a more comprehensive way to view genetic resources management. They challenged the protected area managers to redefine and extend their principles to land outside protected areas, and they also proposed a world treaty to protect wild genetic re-

sources for the future. The Congress invited IUCN to investigate 'possible development of international instruments to regulate the commercial exploitation of wild genetic resources.'

Resource limitations and other priorities caused three years to pass before further work on a convention was undertaken. At the 16th IUCN General Assembly ICEL members again took the initiative and, as a follow-up to the early resolution, the General Assembly adopted Resolution 16/24, which was the basis for a preliminary draft global agreement. The resolution enumerated several principles to guide the drafters; these included the role of genetic resources in maintaining ecological diversity, access to genetic resources, State responsibility towards genetic resource conservation, *in situ* conservation and national legislation, financial resources and commercial use.

The IUCN Environmental Law Centre (ELC) started preparing, with the assistance of CEL, a first draft of a convention which was later submitted to the IUCN Council. Grenville Lucas, then chairman of the IUCN Species Survival Commission, felt that *genetic diversity* was, in fact, not an ideal term and suggested using *biological diversity* instead. The drafting continued with ELC drawing on the extensive expertise of some of CEL's members as well as other IUCN commissions.

Meanwhile, the United Nations Environment Programme (UNEP) became increasingly interested with the work that had been undertaken thus far; this was also the case for a number of States. In 1987 the 14th UNEP Governing Council took up the matter of a convention. The resolution drafting process was in many aspects a difficult one. With the help of the United Kingdom representative, Dr. Martin Holdgate, a compromise wording wa worked out and adopted. It called for support of IUCN's efforts in developing 'a convention for the *in situ* preservation and conservation of biological diversity' and requested the UNEP Executive Director to 'establish an *ad hoc* working group . . . to investigate the desirability and possible form of an umbrella convention to rationalise current activities in this field.' The working group would work 'in close collaboration' with the Ecosystems Conservation Group of which IUCN is a member. The notion of an 'umbrella convention' created a lot of confusion; it was soon acknowledged that it was simply not possible to create an umbrella convention, if only because every existing treaty has different parties.

In early 1988, ELC presented another draft for a convention to a workshop at the 17th General Assembly meeting (San Jose, Costa Rica, 1988). The General Assembly noted in reference to the UNEP resolution the existence of 'numerous practical, political and legal obstacles' of an umbrella convention and recommended that the draft IUCN convention, as amended,

be circulated to governments and non-governmental organizations (NGOs) for comments.

The 15th UNEP Governing Council (1989) acknowledged the previous work on the draft articles and requested the UNEP Executive Director to convene, in close co-operation with the concerned international organizations, additional working sessions of the technical working group. It also authorized him to establish 'an *ad hoc* working group of legal and technical experts with a mandate to negotiate an international legal instrument for the conservation of the biological diversity of the planet.'

Vicente Sánchez of Chile was elected Chairman of the Intergovernmental Negotiating Committee (INC) for the Convention on Biological Diversity. IUCN was made a partner in the Secretariat, in addition to its observer status, with the right to speak in the plenary. These negotiations were difficult, long, and, at times, quite tense. Success ultimately came because of the combined vision and leadership of the Chairman, the UNEP Executive Director and many State delegations.

It must be recognized that in the many years it has taken to draft, adopt and finally sign this instrument, the ideas it embraces are much broader, complex and, in some instances, different than those originally proposed. The Convention is the first legally binding international instrument to comprehensively address biological diversity: it conservation, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from the utilization of genetic resources.

The Convention, by creating predominantly general goals, requires individual countries to determine, at the national level, how best to attain them. This is perhaps best evidenced by the provisions on conservation and sustainable use, which most notably call for the development of national strategies and actions plans. *Fulfilling* these goals will require all countries to identify national priorities and to systematically review, adapt and implement a mixture of laws and policies at the local and national levels.

The provisions on access to genetic resources and sharing of benefits also give countries a great deal of discretion on *implementation*. Here the relationship between developing and developed countries and its bearing on the success of attaining the Convention's goals is more apparent. Both provider countries and those who use genetic resources must implement legal measures to manifest and guarantee the new relationship. Thus the adoption of legislation concerning access in provider countries is a matter of priority. This also necessitates the adoption of legislation in user States in order to sanction the use of genetic resources obtained against the rules established by the providing State.

With regard to technology transfer, one of the most contentious issues in the Convention, both supplier and recipient countries will have to explore

and implement innovative measures to encourage the transfer of public and private sector hard and soft technologies. Many of these measures will undoubtedly be legislatively based on economic incentives.

The Convention also begins the process of altering the way other technologies—the knowledge and innovations of indigenous and local communities—are viewed and used. This informal technology, developed over generations, is valid in its own right. The Convention recognizes this. It also recognizes that this technology will become increasingly valuable not only in terms of developing new drugs, industrial products and food, but in the overall conservation of biological diversity and the sustainable use of its components. Consequently, countries are to promote its wider application and encourage benefit-sharing with its providers. The challenge in *implementing* this portion of the Convention rests nationally and internationally. At both levels, legal steps need to be taken so that this knowledge is given greater legal recognition, thus ensuring benefit-sharing with the indigenous and local communities which created it.

Biodiplomacy addresses issues which are of extreme importance to the Convention's successful implementation. We have to accept that the Convention's obligations are so new and far-reaching that it will not be possible to implement them nationally in one comprehensive legal instrument. This is not an excuse, however, for Parties not to legislate as fast as possible all that is possible and needed to bring the Convention into effect.

As someone who has worked with legislators for more that four decades, I have realized that the style of legislating has evolved. In more and more cases involving new scientific and technological knowledge, decision-makers have to take preliminary action in the common interest in the face of some uncertainty and to review and improve later. In the case of the conservation of biological diversity and the sustainable use of its components, there can be no other way: there simply is no more time to delay action.

Notes

1. de Klemm, 1975, pp. 10, 14; de Klemm, 1982, p. 117.
2. The IUCN was formerly known as the International Union for the Conservation of Nature and Natural Resources. It is now commonly known as the World Conservation Union, although the original abbreviation is used. In this volume, IUCN is the more frequent term.
3. Wolfgang E. Burhenne, Cyrille de Klemm and Barbara Lausche.

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The preparation of this book has benefitted from many people who have over the years devoted their time to the conservation of the world's biological heritage. We had the opportunity to interact with these people during and after the negotiations for the Convention on Biological Diversity. We have also worked closely with a number of them in identifying ways of implementing the Convention. The testimony of this collaboration is borne by the richness and depth of the chapters included in this volume. We therefore wish to thank our contributors who have not only prepared excellent contributions, but have also been ready to revise them at short notice owing to the rapid changes taking place in the field.

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Vicente Sánchez
Calestous Juma

Nairobi, May 1994

Introduction

VICENTE SÁNCHEZ AND
CALESTOUS JUMA

This book is about a new field of diplomacy that focusses on negotiations regarding the conservation and sustainable use of the world living resources. It is about *biodiplomacy*, a field that owes its origins to recent global concerns over the alarming rate at which living organisms are being lost due to human activity. This concern is emerging at a time when advances in science and technology are enhancing the economic potential that lies in the diversity of life on earth. *Biodiplomacy* deals with how the conservation of biological resources and their sustainable use impinge on international relations and vice versa.

The world's biological resources have been considered as the common heritage of humankind and as sovereign property of nations. The debate was resolved through protracted negotiations that resulted in the Convention on Biological Diversity which was adopted in 1992 and came into force in December 1993. The Convention has established a new international regime for governing the utilization and conservation of biological resources. This convention delicately balances on four main pillars: conservation of genetic resources, technological development, regulated access to genetic resources and international equity.

The issues of conservation of biological diversity have been extensively covered in scientific and technical studies and will not be addressed in this book. What is of interest is how these interact with technology, rules of access to sovereign resources and concerns over international equity. The effective implementation of the Convention will depend largely on these interactions, which form the basis for this book.

Biodiplomacy offers an analysis of the main features of the Convention and elaborates on the concept of *biodiplomacy*, which is understood to mean international negotiations to reach agreements on matters related to

biological resources and the essential ecological services rendered by the earth's ecosystem. The realization that most development activities are so far not sustainable—basically because ecological concerns have not been duly taken into account during planning and implementation—has triggered a series of negotiations on the biological aspects of reality that impinge on economic activities in general.

To develop sustainably, to trade and co-operate, states must attend to the effects of their activities on the environment of other states, whether neighbouring or distant. These effects can be on the biological resources themselves, on the services rendered by their ecosystems or on their economy, through the biotechnological use of their genetic resources and the deterioration of the environment.

While international negotiations that deal with the biological aspects of international relations have increased, those in charge of international negotiations in governments and international organizations are not necessarily knowledgeable on these matters and of the special conditions they bring to negotiating processes. Not only do the issues require specialized knowledge about living organisms, technological development and international trading rules, but they challenge the traditional norms of international law.

The field of biodiplomacy, as this book will show, underscores the fact that the prevalent paradigms of development must be replaced by new approaches that build on the principles of sustainable development. International relations have also to be redefined along these lines. Indeed, this is starting to take place, and a number of nations are now treating the conservation of biological diversity as a matter of national security. This shift illustrates the fact that biodiplomacy is not just an issue of relevance to the nearly forty international treaties dealing directly with *in situ* conservation, but it represents a fundamental shift towards a new world-view.

To develop the concept of biodiplomacy, this book is divided into five parts. The first part presents an overview of the basic principles of international environmental law and how they relate to genetic resources. This concept is analysed from a historical perspective and then applied to the negotiations for the Convention, with particular reference to the cases of India and the US. The central message here is that the international community has abandoned the approach of treating genetic resources as a 'common heritage of humankind'. This notion has been replaced by one which asserts national sovereignty over genetic resources but recognizes the international implications of such assertions. The result is a recognition that the fate of the world's biological resources is a 'common concern of humankind'.

Part II of the book addresses the issue of access to genetic resources and the protection of the rights of indigenous peoples and local communities. The section argues that the regimes that preceded the Convention did not

take into account the needs and interests of the countries providing biological material. The chapters stress the need for new principles to be developed to protect the rights of indigenous peoples and local communities. They note that biodiversity conservation cannot be separated from culture and other factors such as the role of women in society. They present specific ideas on what could be included in model laws governing or regulating access to genetic resources.

Issues related to access to and transfer of biotechnology are addressed in Part III, which stresses that building capability in biotechnology cannot be done independent of the technological transformation of countries. It is argued that the ability of the developing countries to benefit from advances in biotechnology will depend largely on the nature of national technology policies, prior technological capability and the ability of these countries to negotiate for favourable terms of access to the international fund of technological knowledge.

Issues of intellectual property protection are addressed in Part III and it is noted that they represent a small—though controversial—element in a larger array of technological issues. This part challenges the conventional views about intellectual property rights. It is acknowledged that the rights can pose special challenges to conservation efforts. However, it is argued that intellectual property institutions, especially patent offices, can play an important role in facilitating access and transfer to biotechnology.

Part IV analyses the theme of sharing the benefits of biotechnology. It explores ways of valuing biodiversity and forging partnerships that can facilitate the sharing of the benefits of biotechnology. It presents a specific case study which outlines some of the features of a partnership between a developing country institution and a multinational pharmaceutical firm. The part shows that there are prospects for creating innovative institutional arrangements that can facilitate the sharing of the benefits of biotechnology. However, it also points to the need for developing countries to build up their own initial institutional and technological capacity which will put them in a better position to negotiate with other countries (many of which may, in fact, be other developing countries).

The last part presents ways by which the Convention can be implemented. It stresses the importance of international financial mechanisms, access to and transfer of technology (including biotechnology) and national initiatives. The last theme is critical to the implementation of the Convention because it deals with the measures needed to give domestic legal effect to the treaty. It is through such measures that new ways can be found on how to implement the Convention without relying too heavily on external support. The emphasis here is that much of what needs to be done in the context of the Convention is already being undertaken under various legal

regimes. The process of domesticating the Convention will, to a large measure, involve bringing existing practices in line with the provisions of the Convention.

In addition to presenting issues related to financing and technology, the last part also deals with specific issues which require urgent consideration. These include the relationship between the Convention and other treaties and international trading rules, the fate of genetic resources collected prior to the coming into force of the Convention and the role of protocols in implementing the Convention. The new regime of biodiplomacy is set to revolutionize the way nations relate to each other and the way governments manage their internal affairs, for much of the future will depend largely on how well humanity acts as part of a complex global system that demands ecological discipline.

Part I

National Sovereignty and Biological Resources

The Convention on Biological Diversity: Negotiation and contents

1

VICENTE SÁNCHEZ

The Convention on Biological Diversity was adopted in Nairobi in May 1992, signed by 157 governments during the Earth Summit in Rio de Janeiro in 1992 and entered into force in December 1993. It is the culmination of a process that was started several years ago and will probably continue for some time in the future. The basic objective of this process has been and still is to accomplish real—national and international—action for the requisite conservation of biodiversity and the sustainable use of biological resources.

Background

Biodiversity, which refers to the variety of living organisms, can be approached at three levels namely, genetic, species and ecosystem diversity. It is the main source of raw materials used in agricultural, medical and some industrial innovations and, therefore, is critically needed for sustainable development.

For several decades, most of the scientific community in the world has shown increasing concern over the loss of biodiversity. The work on the matter carried out over the years by the World Conservation Union (IUCN) gave institutional backing to the worldwide concern for the erosion of biological diversity.

The United Nations Conference on the Human Environment in Stockholm in 1972 granted the issues of biodiversity political and legal legitimacy at an international level. The Conference, as is well known, basically underscored the link between development and conservation.

Several years later, in 1983, by decision of the United Nations General Assembly, the World Commission on Environment and Development (WCED) was established. In 1987, the WCED finished its work and published a report entitled *Our Common Future*, which emphasized that in order to ensure 'sustainable development', environmental concerns had to be integrated into economic programmes. The WCED brought to the public domain the critical issues of biodiversity loss and conservation which had for a long time been confined almost exclusively to scientific and technical discussions.[1]

The United Nations Environment Programme (UNEP) took the global concerns regarding the management of biodiversity several steps further. Its Governing Council argued for strong international measures to protect biodiversity and by decision 14/26 of June 1987 established an *ad hoc* Working Group of Experts on Biological Diversity. After holding three sessions, between November 1988 and July 1990, it was transformed by the Governing Council of UNEP into the *ad hoc* Working Group of Legal and Technical Experts on Biological Diversity. In 1991 the Group of Legal and Technical Experts was re-established and named the Intergovernmental Negotiating Committee (INC) for a Convention on Biological Diversity. It was this intergovernmental body that carried through the actual negotiation of the text of the Convention.

The negotiations

The process of negotiation lasted from March 1991 to May 1992 and comprised, among other things, five formal sessions of ten working days each—and sometimes nights—which can be described as difficult and at times confrontational. Nevertheless, they were carried through in the understanding, shared by the negotiators, that an agreement on this subject would stand as an important pillar for the achievement of *sustainable development*, a central issue in the preparatory process for the United Nations Conference on Environment and Development (UNCED).

It should be remembered that this preparatory process had started in 1990; therefore, the political environment of the negotiations for the Convention on Biological Diversity—as well as for the Convention for Climate Change—was part of the UNCED preparations. In all three parallel processes there was concern with the financial issues involved in achieving sustainable development and the responsibilities of developed versus developing countries in causing environmental problems. In other words,

these negotiations were carried through as part of the process of defining sustainable development and defining different kinds of responsibilities for achieving it.

The process that led to the adoption of the Convention was initiated with the conviction—particularly among developed countries—that it would be an all-encompassing convention on the conservation of species: a convention on parks and reserves. From the very beginning of the negotiations, this approach proved to be incomplete and began changing to include aspects of the complex environment/development interaction. Consequently, as negotiations progressed, the character of the proposed convention was modified, and the process became much more complicated than had originally been envisaged. Certain questions and issues became central aspects of the negotiations:

- the cost of taking measures to conserve biodiversity versus the cost of not taking any such measures;
- access to genetic resources and the different possibilities of regulating it;
- whether the focus should be only on wild species or whether it should include both wild and domesticated species;
- access to and transfer of technology—including biotechnology—which must be considered for conservation and rational use of the components of biodiversity;
- eventual sources and methods of funding the costs of the measures that would have to be agreed upon;
- the consequences and impact of biodiversity conservation on trade and development.

Synopsis of fundamental contents of the Convention

The objectives of the Convention are:

> the conservation of biodiversity, the sustainable utilization of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies and by appropriate funding (Article 1).

Article 3 of the Convention only establishes one principle:

> in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

This article literally reproduces Principle 21 of the Stockholm Declaration. Thus, an important international norm, that had a merely political, non-binding character, changed after 20 years, into an international norm, at least in the field of conservation of biodiversity.

Based on the objectives mentioned, the Convention establishes a set of norms on general measures, identification and monitoring, *in situ* and *ex situ* conservation, sustainable use of the components of biodiversity, incentive measures, research and training, public education, access to genetic resources, access to and transfer of technology, exchange of information, technical and scientific co-operation, handling of biotechnology and distribution of its benefits, financial resources and mechanisms and institutional mechanisms. Since it is not possible to examine all these topics here, this introductory chapter concentrates on the three objectives mentioned.

Concerning conservation of biodiversity, the Convention in Article 8, states that 'each Contracting Party shall, as far as possible and as appropriate', carry out a set of actions for the conservation *in situ* of biodiversity, for example, establish a system of protected areas or areas where special measures need to be taken for the preservation of biodiversity and ten more specific actions. This article, which establishes the responsibilities assumed by the Contracting Parties in matters of conservation *in situ*, is one of the basic dispositions of the Convention.

Concerning the sustainable utilization of the components of biodiversity, Article 10 establishes the responsibilities of the Contracting Parties when it specifies that each one of them will integrate the conservation and sustainable use of biological resources into national decision-making; will support local populations to develop and implement remedial action in degraded areas; and will encourage the co-operation between governmental authorities and the private sector in developing methods for sustainable use of biological resources.

Regarding the fair and equitable sharing of benefits arising of the utilization of genetic resources, Article 15 of the Convention establishes rules concerning access to genetic resources, stating that the regulation of this access is in the hands of national governments and subject to national legislation and also that Contracting Parties will create conditions to facilitate other Contracting Parties access to genetic resources leading to adequate utilization and not to impose restrictions contrary to the objectives of the Agreement. Also, it establishes that Contracting Parties will endeavour to carry out scientific research based on genetic resources provided by Contracting Parties, with their full participation and, if possible, within their territories.

Closely related to the above, Article 16 regulates the access to technology and technology transfer, including biotechnology, establishing the

compromise of each Contracting Party to secure and/or facilitate to other Contracting Parties the access to pertinent technologies for the conservation and sustainable utilization of biodiversity as well as the transference of those technologies. The access and transfer of technology to developing countries is a matter of special regulation within the same article, where it is specified that it will be secured and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed and, where necessary, in accordance with the financial mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate protection of intellectual property rights. These articles pay particular attention to the matter of Contracting Parties which provide genetic resources also obtaining access to and transfer of technology which makes use of those resources.

Regarding biotechnology and the distribution of the benefits arising from its use, it is established (Article 19) 'that each Contracting Party will take legislative, administrative or political measures as appropriate,' to secure the effective participation in its research activities on biotechnology of the Contracting Parties that provide genetic resources for such research, and to ensure that those activities take place, whenever feasible, in the same country that provides the resources. Furthermore, the article establishes that each Contracting Party will adopt all applicable measures to promote and foster, in fair and equitable conditions, priority access of the Contracting Parties, in particular developing countries, to results and benefits derived from the biotechnology based on genetic resources given by said Parties.

With respect to the financial arrangements, Article 20 establishes that each Contracting Party undertakes to provide, in accordance with its capabilities, financial support and incentives for the activities which are intended to achieve the objectives of the Convention, as well as the commitment of the Parties which are developed countries to provide new and additional financial resources so that the Parties which are developing countries can meet the agreed full incremental costs to them of implementing measures in fulfillment of the obligations of the Convention and to benefit from its provisions. On the other hand, Article 21 stipulates that a mechanism will be established for the provision of financial resources to the Parties which are developing countries, on a grant or concessional basis. While the mechanism is established, its functions shall be performed by the Global Environment Facility (GEF) (Article 39), provided that this fund has been fully restructured according to the criteria spelled out in Article 21.

The Convention establishes a Conference of the Parties, which is the most important institutional instrument (Article 23), a Secretariat (Article 24), that provisionally will be the one established by the Executive Director of UNEP (Article 40), the need to present reports on the measures adopted for the application of the Convention (Article 26) and agrees on mechanisms for the settlements of disputes.

The Convention enters into force on the ninetieth day after deposit of the thirtieth instrument of ratification, acceptance, approval or accession (Article 36). This number was reached in September 29, 1993, and governments continue to ratify.

Some reactions to the Convention

A first, very positive reaction to the Convention, was the signing of it by 166 governments (more than 90 per cent of the members of the UN) and its very rapid entry into force (December 29, 1993), all of this within 18 months of the adoption of its text. It will be important, nevertheless, to obtain as many ratifications as possible and hopefully a well balanced Conference of the Contracting Parties—planned for November 1994—with a satisfactory representation of both developing and developed countries. The latter would be a *sine qua non* condition for an expeditious and real implementation of the Convention.

There have been criticisms of different kinds from varied sources. Some say, for example, that the Convention does not adequately protect the rights and interests of indigenous and peasant communities who have been the custodians of genetic resources for many years and who have accumulated knowledge about these resources and their uses. The Convention does not really tackle one of the major causes of the destruction of biodiversity, that is, overutilization and careless use of resources in order to satisfy consumer patterns of the majority of the population of developed countries and of the small affluent elites of developing countries. Different aspects of biotechnology and their relationship with the conservation of biodiversity deserve further clarification. (In Agenda 21 of UNCED, section 16 on biotechnology, adopted in Rio, there was some progress made in this respect.) There is harsh criticism to the fact that the provisions in the Convention regulating access to genetic resources do not apply to those resources that were removed from a country before the Convention entered into force; eventually existing genebanks (including those of the Consultative Group on International Agricultural Research (CGIAR) may decide to patent their germplasm, thereby forcing developing countries to buy their own genetic resources as patented organisms. Some fear that agreements reached in the recently finalized Uruguay Round of GATT Negotiations could contribute to damage the environment, particularly the

possibilities for the conservation of biodiversity and the rational use of its components. Experience is showing that GATT tribunals—or their equivalents in the future—are likely to acquire the power to make binding decisions to resolve trade disputes among member nations overruling national tribunals pronouncing themselves on problems which are really environmental.

The above criticisms come basically from developing countries and NGOs, but there is also criticism from some industrialized countries. A few have recently made it known that it is difficult for them to ratify the Convention if some articles are not 'clarified' or if an agreement is not reached on their 'interpretation'. This refers specially to issues relating to intellectual property rights, biotechnology and the funding mechanism.

Follow-up activities and ratification

A convention remains a piece of paper if no concrete action is undertaken to implement its contents. So, it was necessary to insure that a concrete follow-up process was organized as soon as the treaty had been signed. In relation to this, it is interesting to note that the negotiators, together with the adoption of the agreed text of the Convention (in Nairobi, May 1992) also adopted four resolutions. They dealt with interim financial arrangements, international co-operation for the conservation of biodiversity pending the entry into force of the Convention, the interrelationship between the Convention and the promotion of sustainable agriculture and a tribute to the Government of Kenya.

The second resolution requests a series of actions which are meant to keep the process moving during the transitional period until the Convention enters into force and can be implemented fully. In this context several activities were organized by UNEP with the help of some very generous interested donor countries, particularly Canada and Sweden.

The Conference on National Studies for Biodiversity took place in Costa Rica in November 1992. A follow-up to it was a panel dealing with proposed guidelines for country studies; this panel met subsequently in Nairobi and Montreal and finished its work. Four panels of no more than 14 experts, acting in their personal capacity, were organized and met three times each: Panel I discussed eventual programmes for scientific and technical research in biodiversity; Panel II discussed the economic costs of conservation and the ways to ascribe value to biological resources; Panel III discussed funding and technology transfer and Panel IV discussed the need for and modalities of a protocol concerning the handling and use of living modified organisms resulting from biotechnology. The panels were carefully balanced from a regional and developed/developing country participation and concentrated on subjects on which there is no satisfactory

agreement. Their reports[2] were delivered to the Executive Director of UNEP in the understanding that they would be taken into account in preparing the documentation for the Intergovernmental Committee that should meet before the Convention entered into force or, at any rate, before the first meeting of the Conference of the Parties. In accordance with Resolution 2 of the Nairobi Final Act[3] the Governing Council of UNEP established (May 1993), the Intergovernmental Committee for the Convention on Biological Diversity (ICCBD), a committee to which signatories were invited. It met for the first time in October of 1993 and focussed basically on the follow-up activities carried out in accordance with the resolution mentioned and on other preparations for the first Conference of the Contracting Parties, unfortunately accomplishing very little. Other meetings have taken place as part of the follow-up process: the most notable being those organized by the African Centre for Technology Studies in January 1993 and the one by the Government of Norway in Trondheim in May 1993.[4]

The basic objectives of all these activities were to find adequate solutions for some issues not completely or satisfactorily resolved, thereby contributing to expedite ratification and to prepare substantive contributions for the first Conference of the Contracting Parties.

In the time gone by since the Earth Summit, important follow-up activities, besides those mentioned above, took place and deserve a few comments. It has to be kept in mind in reviewing what has happened, that most of the work—if one considers carefully the text of the Convention itself—is supposed to be done by national governments, non-governmental organizations as well as the communities themselves. UNEP, nevertheless, has to play a central stimulating, co-ordinating and monitoring role in carrying out decisions.

In October 1993, during the first meeting of the ICCBD it was a pleasant surprise to be informed by more than 50 countries that they had started taking action at home to implement the Convention. National studies, new legislation and draft biodiversity conservation strategies were being formulated and implemented. These activities had been mostly carried out by developing countries on their own or with the help of a very few industrialized countries that had made these activities possible.

On the other hand it was painful to watch that some of the major donors were dragging their feet in complying with the commitments made in UNCED and that based on a so-called 'serious recession' allegedly were unable to contribute the funds to really start moving on the implementation of the Convention. (It should be mentioned that at the same time some considerable 'financial packages' were put in place by those same countries to help the Eastern European countries, implying that UNCED's outcome had only a second or third priority in their eyes.)

The process of negotiating the restructuring of the GEF went on very slowly—partly because of the rigidity of some of the industrialized countries and the distrust of some of the developing countries—until an agreement was reached in March 1994. There was also an agreement reached by the donor countries in March 1994 to replenish the GEF with US$2 billion for three years, which is half the sum that had been mentioned at UNCED.

The governing bodies of the United Nations Development Programme (UNDP), UNEP and the World Bank—the three implementing agencies—will have to approve the Instrument for the Establishment of a Restructured Global Environment Facility agreed upon in March 1994. It is after this that the newly-established GEF Council will be able to meet to start the new phase of GEF. But it is the Conference of the Contracting Parties of the Convention on Biological Diversity (as well as of the Framework Convention on Climate Change) that will decide if the restructured GEF conforms with their expectations and could continue as the institutional structure that will manage the financial mechanism.

All these difficulties and the continuous mistrust of some countries towards the GEF have led to the consideration that alternative and parallel sources of funding should be actively sought. There is also concern that the criteria used by GEF to decide funding priorities may exclude a large number of conservation needs, requiring support from other sources. It is against this background that the ICCBD has invited regional development banks, bilateral aid agencies, and some private banks to attend its meetings.

On its side, UNEP, the UN body which has had the basic responsibility for this Convention, needs to take a number of measures aimed at improving its effectiveness in facilitating biodiversity conservation. At the moment there are concerns that there is limited capacity in the institution to provide the necessary technical support for the implementation of the Convention and other biodiversity conservation objectives.

The first step is to enhance its internal competence in biodiversity issues and to use this capacity to strengthen other international, regional and national institutions in line with its mandate. Because of its status, UNEP is in a position to promote biodiversity conservation through other international treaties and to promote co-operation between these treaties and the Convention. A strengthened UNEP will play a greater role in shaping the direction of future efforts to implement the Convention. A number of important meetings are scheduled in the next few years which will test the ability of UNEP to play an important role in shaping the agenda for global conservation efforts.

Final comment

The text of the Convention, although it may have some weak points and elements which need clarification before they can be implemented easily and satisfactorily for all concerned, is a step forward in international legislation for the protection of biodiversity.

A very important number of governments have agreed, exercising their sovereignty, to carry out a series of actions of a varied nature in their territories in order to achieve the objectives of the Convention. To borrow some words from Agenda 21 (Chapter 15):

> . . . States have the sovereign right to exploit their own biological resources pursuant to their environmental policies, as well as the responsibility to conserve their biodiversity and use their biological resources in a sustainable fashion, and to ensure that activities within their jurisdiction or control do not cause damage to the biodiversity of other States or of areas beyond the limits of national jurisdiction.

This conforms to new ways of dealing with the concept of sovereignty and the rights and duties that exercising it entail, having in mind the eventual damage or benefit to 'Mother Earth'.

This treaty has also incorporated—as does the Climate Change Convention according to the World Resources Institute (WRI)—into the international legislation the notion that the nations have to consider the global environmental consequences of domestic economic decisions. This concept, which is becoming more acceptable, is fundamental and may have a very important impact on the formulation and implementation of national development economic policies.

While all the legal procedures and ratifications are fulfilled and even after the Convention enters into force, people can and must work at a national and international level—governments, NGOs and IGOs—in order to really prevent the erosion of biodiversity and achieve more satisfactory levels of sustainable development.

Notes

1. International Conference on the Convention on Biological Diversity, Background Information, African Centre for Technology Studies (ACTS), September 1992.
2. UNEP, 1993a, 1993b, 1993c, 1993d.
3. UNEP, 1992a.

4. Proceedings of the Norway/UNEP Expert Conference on Biodiversity, published by Directorate for Nature Management and Norwegian Institute for Nature Research, Norway, July 1993.

2

International environmental law and national interests

CHARLES OKIDI

The Convention on Biological Diversity which was opened for signature at Rio de Janeiro on June 5, 1992 is one of the latest in an increasing number of global and regional agreements focussing on either the protection of the environment or the promotion of rational management of natural resources. The agreements derive analogies from certain legal doctrines as well as case law which have enunciated specific norms to restrain states from engaging in conduct likely to harm the territories or interests of other states.

The purpose of this chapter is to give an overview of international environmental law, the ultimate intention being to show the place of the Convention within the general corpus of international environmental law, thus acknowledging that it is not the first international environmental agreement. The range of agreements and issues relevant to such a discussion is vast, and therefore this chapter is by no means exhaustive.

Key concepts in environmental management

The global discourse emphasizing the imperatives of environmental protection has gained momentum since the United Nations General Assembly decision of December 1968 which paved the way for the June 1972 Stockholm Conference on the Human Environment.[1] The number of participants in the discourse, as well as their countries of origin and disciplines, has also increased steadily. The fact that environmental issues cut across both geographical and disciplinary boundaries necessitates a definition of some of their key concepts.

A useful attempt was made by the Commission of Environmental Law of the World Conservation Union (IUCN) in the Draft Covenant on Environmental Conservation and Sustainable Use of Natural Resources developed by an *ad hoc* Working Group.[2] The commission defines *environment* as the totality of nature and natural resources, including the cultural heritage and infrastructure essential for socio-economic activities. In other words, the environment may be perceived as the total context of nature, where *nature* is defined as the earth's geosphere, biosphere and associated processes. Thus, water, atmosphere, forests, wildlife, soil and the general flora and fauna are simply components of the environment. *Natural resources* are defined as those components of nature which are or can be used to satisfy the needs of human beings and other living species. It is against this background that the concepts of *conservation, preservation* and *sustainable use* must be understood. *Conservation* is a management term meaning to manage renewable resources sustainably and to avoid waste of non-renewable resources. Thus, conservation must be purposive, based on specific objectives and clearly perceived benefits and a fundamental requirement for sustainable development.[3] *Sustainable use* of renewable natural resources means use which maintains or enhances the renewable natural resource base in a manner which meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

From the foregoing definitions, the concept of *preservation* has found its place as meaning to set aside and protect selected natural resources such as unique biological or geological formations, endangered or threatened species, representative biomes or other natural and cultural sites of importance. This is so as to maintain their natural characteristics to the fullest extent possible in a manner unaffected by human activities. An underlying assumption of the definition is that preservation may be permanent or temporary. The latter case involves allowing threatened or endangered species to regenerate to the levels amenable to sustainable harvest. Preservation measures may be taken as per season, or by an ecological unit or a combination of both, depending on the nature of species and the threat posed.

The Convention defines *biological diversity* as the variability among living organisms. It describes the interdependence and wealth of the components of the environment at genetic, species and ecological levels which offer medicinal, agricultural and other scientific advantages. Thus, though biodiversity can be used for sustainable development, it must be preserved. Indiscriminate use, over-harvesting or other forms of environmental destruction may endanger biodiversity. Similarly, *pollution*, defined as the introduction of any energy or substance which results or is likely to have deleterious effects on living biological resources and human health, to

hinder activities such as fishing, to impair water, soil or air quality and reduce amenities, is a danger to biodiversity. Similarly, the destruction of habitats, via for instance, the indiscriminate reclamation of wetlands which are breeding grounds for various species of aquatic life, constitute a threat to biodiversity.

Doctrines governing international environmental law

The bulk of international environmental law is in the form of treaties, most of which stand alone and are not predicated on any single doctrinal preamble. A glance at legal doctrines, therefore, does not ascertain the common propositions governing all aspects of international environmental law but rather attempts to identify analogous doctrines. The actual question is how one would characterize the doctrinal basis of the international obligation on states not to cause environmental harm to others.

In a pioneering work on the legal basis for the prevention of pollution of international rivers, Anthony Lester identifies and examines three doctrines which may be applicable here.[4] These concepts are international servitude, abuse of rights and neighbourliness.

Servitude in municipal law describes a permanent relationship over an interest in land which dictates that one party renders certain fixed services to the other. In his analysis, Lester views servitude as too rigid a principle which would restrict the expansion and modification of the use of natural resources on one's land. In his view, '[A] doctrine based upon private property cannot be transferred to the different context of international community without modification.'[5] Although Lester finds the doctrine of servitude unworkable, the notion of 'permanence' it implies may be relevant. In the definition of preservation above, it is agreed that certain practices, such as pollution, are permanently undesirable, and there are several treaties in which the parties undertake to prevent pollution. Thus, there is but a limited application of servitude.

The second doctrine is the abuse of rights. Presently, an activity within a territory which causes harm to another state may be characterized as an abuse of rights because states have sovereign rights over their territories. Lester argues that, whenever the doctrine of abuse of rights is applied, there must also be a set of rights that can be forfeited by the offending party as a consequence of the abuse. In the international scene, however, there would be no rights to be forfeited. Therefore, Lester sees the doctrine as inapplicable due to the concept of sovereignty.

The third doctrine is that of neighbourliness which requires reciprocity in the conduct of states which share a neighbourhood.[6] This derives from the physical interdependence of contiguous states. Exactly how contiguous the states should be is not decreed. Indeed, problems such as air pollution,

pollution of international drainage basins or ocean pollution have created neighbourhood among otherwise distant states. It may be argued that states on opposite ends of a large ocean are neighbours, so joined rather than separated by the physical presence of the ocean. In such cases pollution may reach the 'neighbours' through the wind or currents. A situation where neighbours within a problem shed conduct themselves so as to avoid causing transboundary environmental harm may be called one of good neighbourliness. Although this seems self-evident as a doctrine on which to found obligation of states not to cause harm to others, Professor Goldie considers it only 'an emerging principle of international law, with many transnational law qualities.'[7] It may be submitted, however, that the neighbourliness doctrine obliges a state to prevent environmental degradation not entirely out of goodness but out of self-interest and reciprocity. In the first instance, the environment is shared and in most cases, any harm caused may, in fact, harm the perpetrator. It is also out of reciprocity because one who causes harmful effects to the detriment of neighbours may have similar or worse problems.

Good neighbourliness has its roots in the old Roman maxim, *sic utere tuo ut alienum non laedas*, meaning 'use your own that it does not cause harm to the interests of others'. Albert Utton traces the application of the maxim in the common law jurisdictions. His conclusion is that international law has applied the doctrine to the control of international environmental behaviour and, in particular, to the use of international drainage basins.[8] Several declarations and resolutions by international institutions addressing environmental issues have reiterated the principle embodied in the maxim. A good example of such an international agreement due to its timing and impact is the Stockholm Declaration of Principles.

Principle 21 of the Declaration of Principles adopted by the 1972 Stockholm Conference is directly linked to the general obligation of states not to cause environmental harm as embodied in the doctrine of good neighbourliness and the maxim *sic utere tuo*. The principle found increasing support and was adopted verbatim in the Convention. It says:

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or areas beyond the limits of national jurisdiction.[9]

The first part of the Principle restates the notion of state sovereignty while at the same time acknowledging the concomitant responsibility to ensure that such activities do not harm the environment of other states. Thus far, the declaration expressed the notion of *sic utere tuo*, limiting the rule to the

legally protected interests of states. The last part of the declaration referring to 'areas beyond the limits of national jurisdiction,' can be intepreted as an extension of the maxim *sic utere tuo* to the commons such as the high seas and outer space and hence an appreciation of the doctrine of good neighbourliness.

Case law

Direct case law affording broad international analogy on environmental matters is rather scanty. The three cases which have popularly afforded analogies for international environmental law are: *Trail Smelter Arbitration*, *Lake Lanoux Arbitration* and the *Corfu Channel Case*. What they have in common is the direct expression that there is an international obligation not to permit activities on one's territory which might cause harm to others.[10] The *Nuclear Tests* cases, despite a disappointing ruling, are other examples.

The *Trail Smelter Arbitration* arose from a dispute between the United States of America and Canada. The issue was gaseous fumes containing sulphur dioxide emitted into the atmosphere from a smelting firm located at Trail in British Columbia, Canada. The ensuing precipitation, in the form of acid rain, caused damage to crops in Columbia Valley in the state of Washington, USA. The United States complained, and following a special agreement signed and ratified by both parties, an arbitral tribunal was set up. In its highly acclaimed ruling, the tribunal stated that: '. . . under the principles of international law as well as the law of the United States, no state has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of a serious consequence . . .'[11] The tribunal further added a significant statement on responsibility to make good the injurious act. It said: 'The Dominion of Canada is responsible in international law for the conduct of Trail Smelter. Apart from the undertaking in the Convention, it is, therefore, the duty of the Government of the Dominion of Canada to see to it that this conduct should be in conformity with the obligation of the Dominion under international law herein determined.'[12] The emphasis here is on the responsibility of Canada to control pollution despite Trail Smelter being a private firm. This is the point which brings the jurisprudence of the *Trail Smelter Arbitration* close to that of the *Corfu Channel Case*.

In the latter case, the International Court of Justice (ICJ) held Albania responsible for explosive mines that blew up British ships in the Corfu Channel even though there was no evidence linking the Government of Albania to the mines. The decision was based on the concept of sovereignty over the territorial waters where the explosion occurred. Clearly, the *Corfu Channel Case* and the *Trail Smelter Arbitration* underscore the rule that

places responsibility on states to prevent activities within their territories from causing injuries to the interests of other states. It has been submitted, too, that the *Trail Smelter* decision actually builds on the celebrated case of *Ryland* v *Fletcher* which expresses the rule of strict liability.[13]

In the *Lake Lanoux Arbitration*, Spain argued that a dam which France proposed to construct on River Carol would prejudice the interests of Spain as a lower riparian. The river drains Lake Lanoux, which is wholly in France and is fed by a number of streams, also wholly within the French territory. France proposed to construct the dam on River Carol to raise the capacity of Lake Lanoux and create an appropriate head for hydroelectric power generation. France produced complete plans for the restoration of the entire quantity of water to River Carol. In the negotiations, which extended from 1917–1955, Spain vigorously rejected all proposals, including one offering a larger quantity of water than that of the natural flow of the River Carol. Relying on the Treaty of Bayonne and the Additional Act,[14] Spain objected to the very presence of the dam on the river, arguing that the construction would introduce a human discretion into the regime of the river. This, they argued, could jeopardize Spanish interest in irrigation. The Tribunal rejected the argument that Spain had a right under the Treaty of Bayonne to veto any project which did not clearly pose any injury or threat. The Tribunal observed, by way of dictum, that if it was demonstrated that the works would bring about pollution of the waters of the Carol or that the waters returned would have a chemical composition or temperature or some other deleterious characteristics injurious to Spain, the conclusion would have been different. The Tribunal concluded that neither the dossier nor the subsequent submissions carried any trace of such allegations. It is the reference to objectionable qualitative change in the water which makes the *Lake Lanoux* decision a significant analogy for international obligation not to cause transboundary environmental harm.

The *Nuclear Tests* cases are actually two separate applications brought to the ICJ by Australia and New Zealand, against France, praying for judgement against the French nuclear tests in the South Pacific as contrary to international law. Since the two decisions are similar, this discussion is confined to the Australian application.[15]

In their application, Australia relied on the General Act for the Pacific Settlement of International Disputes enacted in Geneva, Switzerland on September 26, 1928 read together with articles 36(1–2) and 37(1) of the Statute of the Court. The basis of the application was the announcement by the French Government that it intended to carry out a series of atmospheric nuclear tests on Muroroa atoll in the South Pacific territory of French Polynesia, some 6,000 kilometres from the Australian mainland. Prior to this instance, France had actually conducted tests in the area, annually from

1966–1968 and 1970–1972.[16] The exercise requires, in every case, the creation of 'Prohibited Zones' for aircraft and 'Dangerous Zones' for aircraft and shipping. The United Nations Scientific Committee on Effects of Atomic Radiation had recorded successive reports to the UN General Assembly that the testing of nuclear devices in the atmosphere had released measurable degrees of radioactive matter. Australia asserted that the French tests had caused some fall-out of this material over its territory and requested the ICJ to issue interim measures of protection until the merits of the application were decided. The Court granted the request.

France argued that the radioactive matter produced from the tests was 'so infinitesimal that it may be regarded as negligible and that such fall-out on the Australian territory does not constitute a danger to the health of the Australian population.' The clearly environmental dispute had Australia contending that the French activities would have detrimental effect on the health of their national population. The two agreed that the tests had transboundary environmental impact; they disagreed on the degree of this impact. The second contention submitted by a letter of May 16, 1973, by France was that the Court lacked jurisdiction in the case. France consequently decided not to appoint an agent as requested by the Court and further asked the Court to disqualify itself. The Court argued that it had jurisdiction and that it would be improper to remove the case from its list. Australia informed the Court that France had in fact conducted two more series of atmospheric tests flouting the Court's order of June 22, 1973 indicating the interim measures of protection.[17]

Thereafter, there was a dramatic turn of events as the Court observed that a number of authoritative statements had recently been made on behalf of the French Government which were tantamount to a commitment to stop atmospheric tests. Thus, the Court was to submit that consequent upon the statements, the issue had become moot. Below and some of the events. The president of the French Republic issued a communiqué on June 8, 1974 which stated:

> The Decree reintroducing the security measures in the South Pacific nuclear test zone has been published in the Official Journal of 8 June 1974.
>
> The Office of the President of the Republic takes this opportunity of stating that in view of the stage reached in carrying out the French nuclear defence programme, France will be in a position to pass on to the stage of underground explosions as soon as the series of tests planned for this summer are completed.[18]

This communiqué was then delivered to the Australian Department of Foreign Affairs in an obvious move to underscore its legal significance to

the proceedings before the Court. The point was successively reiterated in an address to the UN General Assembly on September 25, 1974, when the Minister of Foreign Affairs stated, 'We have now reached a stage in our nuclear technology that makes it possible for us to continue our programme by underground testing, and we have taken steps to do so as early as next year.'[19]

In its judgement, the Court concluded that the French Government issued these statements with the clear undertaking to be bound not to conduct any further atmospheric nuclear tests. The Court went to great pains to establish this point arguing, *inter alia*, 'Of the statements made by the French Government now, before the Court, the most essential are by the President of the Republic. There can be no doubt, in view of his functions, that his public communications or statements . . . as Head of State are, in international relations, acts of the French State.'[20] Thus, the Court concluded that the French had undertaken to discontinue the atmospheric nuclear tests. As a result, the dispute was resolved. The Court found that no further pronouncement was required in the case since the object of the claim was no more. The Court, however, advised the applicant that should the French resume tests, the issue could be revisited. France can be presumed to have remained committed to the undertaking in the public declarations. The significance of this case inheres in the fact that the French ceased atmospheric nuclear tests in response to the Australian and New Zealand complaint and also in a bid to discontinue Court proceedings.

The significance of unilateral declarations as an indication of firm legal commitment in customary international law is rather controversial. This is due to the requirement that the declaration be made *opinion juris sive necessitatis* or with the clear intent and knowledge to be legally bound.[21] Hence, the communiqué by the French president and the foreign minister's address could not have been made without awareness of the direct legal significance.[22] This is a doctrine which cuts both ways. It was developed as a safeguard against extravagant claims against a state based on casual statements made by its officials. At the same time, it may be invoked to subvert operation of international commitment by a mercurial state. In this case, the Australian attorney-general feared that France had not given sufficient assurances that it would not revert to the atmospheric nuclear tests in the South Pacific.[23] The Court analysed the situation and concluded otherwise.

It may be argued that the Court should have pronounced itself on the matter. Indeed, a declaratory judgement would have had broad significance for all subsequent, similar activities. However, in this case, the Court deliberately decided to give greater significance to the value of unilateral declarations in cognate international legal issues. The clause urging the applicant

to return to Court should France resume the atmospheric tests was a thinly veiled threat to France in case it had sinister intentions.

The picture would have been much clearer if Australia had raised the question of damages. Whether the Court would have proceeded to award such damages following the French declaration is uncertain. In its judgement the Court simply observed that the applicant had not raised the question of damages either prior to or during the proceedings, its original and ultimate objectives being to seek protection against further atmospheric tests.

Treaty law

Treaties in the environmental field are numerous. Efforts by the United Nations Environment Programme (UNEP) to compile a list of treaties for ease of reference came up with 132 treaties in two separate volumes. The IUCN Commission on Environmental Law seeking to identify only agreements on biodiversity came up with 26 treaties. UNEP, in a bid to classify the agreements, identified a total of 35 agreements which mention fauna in any of its provisions and 20 which deal in any degree with flora. In their publication, UNEP categorizes treaties under: Antarctica, atmospheric pollution; biodiversity–fauna; biodiversity–flora; cultural heritage; energy; fisheries; forest resources; marine environment—global; marine pollution; marine/coastal resources and environment; nuclear energy and materials; ozone layer protection; peace and environment; pests and diseases; toxic and hazardous substances; water resources (fresh water); working environment.[24] While the list is illustrative of the richness and variety of fields covered by the 132 treaties, it is repetitive and could be misleading. The outline of the sectors does, however, show the variety of topics covered in existing treaty law.

International watercourses and lakes

Over the centuries there has been a vast and increasing proliferation of treaties on international watercourses and lakes. The majority of the early treaties were for the delineation of spheres of influence by various European powers or for the purposes of navigation as part of the broad range of treaties of friendship, commerce and navigation. Thus, the first treaty was on the Rhine and was in the form of a unilateral declaration by Emperor Charlemagne in AD 805 to grant freedom of navigation to a monastery. In some cases, treaties which are essentially for delineation of spheres of influence also made some provisions for the consumption of water.[25]

Treaties focussing specifically on the prevention of pollution or consumption emerged largely in the 20th century. Out of 253 treaties listed in a

United Nations survey of non-navigational use of rivers, only 49 were concluded in the 19th century. One of the best known examples is the Boundary Waters Treaty between the United States and Great Britain (on behalf of Canada) concluded in 1909. Unfortunately, it has been only a limited success. Efforts between Mexico and the United States on rivers Colorado and Rio Grande have not been successful in their implementation either.[26]

In Europe three rivers have been the focus of treaties on non-navigational uses. They are the 1958 Convention Concerning Fishing in the waters of the Danube, which was signed in Bucharest by six riparian states; the Protocol concerning the Constitution of an International Commission for the Protection of the Mosel against Pollution signed in Paris in 1961 by France, Germany and Luxembourg; and the 1963 Agreement Concerning the International Commission for the Protection of the Rhine against Pollution, signed by five riparian states. The Rhine has a deeply troubled past as far as pollution is concerned, and efforts to control the problem date back to 1950 when the International Commission for the Protection of the Rhine was created by the riparians.[27] As the pollution problem became more differentiated, the riparian states concluded the Convention for the Protection of the Rhine against Chemical Pollution and the Convention on the Protection of the Rhine against Pollution by Chlorides, both signed in Bonn in 1976.

In Latin America, several drainage basin agreements have been signed over the years. The best known are on River Plate, signed in Brasilia in 1969, by five riparian states and the Treaty for Amazonian Cooperation adopted in Brasilia in 1978 by eight riparian states. In 1989, an Amazonian Declaration—a special agreement focussing on environmental matters and the interests of the indigenous peoples—was adopted in Manaus, by the parties to the 1978 Convention.[28]

In Asia, three drainage basin agreements for the Indus, Mekong Delta and Ganges are best known.[29] The Indus Treaty signed in 1960 between India and Pakistan is known for the controversies which surrounded the water apportionment and which necessitated the intervention of the World Bank with an Indus Development Fund to induce an agreement. Like the Indus treaty, the Agreement on Sharing of the Ganges Waters signed in Dacca by India and Bangladesh in 1977 focussed on water apportionment between the two parties. It was intended to last for five years but could be extended by mutual agreement.

There are five noteworthy agreements from Africa: on the Nile, Niger, Senegal, Kagera and the Zambezi rivers.[30] The Nile waters agreement between Egypt and Sudan, signed in 1959 was to determine apportionment of waters from the Blue and White Nile. In 1960, the two states signed a pro-

tocol creating a Permanent Joint Technical Commission to oversee the apportionment. The Niger River has a long history of agreements. The latest is the Convention Creating Niger Basin Authority signed by nine basin states at Faranah in 1980. The Senegal River is perhaps the most advanced in its basinwide organization and implementation of projects. Although the initiatives of the basin states date back to 1935, it was the 1972 agreement creating the Organization for the Development of the Senegal River (OMVS) that systematized the current multipurpose development programme. The agreement creating the Kagera Basin Organization was signed by three riparian states in 1977 and joined by the fourth one in 1980. It provides for multipurpose and basinwide development to include environmental protection, wildlife conservation and the protection of wetlands. The latest basin agreement in Africa is the Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System signed by five riparian states at Harare in 1987. Signed under the aegis of UNEP, it is designed to be an experiment for other basins.

It would be clear from a detailed examination of the drainage basin agreements and the African cases in particular that drainage basin approach offers an ideal opportunity for intensive implementation of the imperatives of environment and development. Multipurpose management of drainage basins depends on rational management of the natural resources and not external monetization. The external resources are only necessary to construct the basic infrastructure eliminating the bottlenecks to development.

By their very nature, the treaties on inland water resources are regional, involving, in most cases, the basin states. Attempts have been made to develop a framework treaty stipulating common and basic rules to be incorporated as appropriate to specific basin agreements. The first effort was the Draft Principles of Conduct in the Field of Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources shared by Two or More States.[31] More specifically, the International Law Commission produced, in draft form, the articles for a framework Law of Non-Navigational Uses of International Watercourses in July, 1991.[32] The document was submitted to the UN member states with the request that they return comments in January, 1993.

Protection of marine environment

Treaties for the protection of marine environment have evolved in response to the increasing gravity of pollution from specific sources. The first salient problem to be manifest was pollution by oil from ships. The second category was the deliberate dumping of hazardous wastes into the oceans. Alongside this was the gradual development of pollution caused by exploitation of marine resources. All along, pollution from land (although

also grave) was avoided in the diplomatic negotiations because states were reluctant to expose this as a territorial matter to international regulation.

The first attempt to negotiate a global treaty on marine pollution was at the 1930 Conference on the Unification of International Law convened at The Hague under the auspices of the League of Nations. This was unsuccessful. Thus, the first successful plenipotentiary conference to negotiate regulation of marine pollution was convened by the British Government in London from April 26–May 12, 1954.[33] The result was the 1954 International Convention on the Prevention of Pollution of the Sea by Oil, dealing with both deliberate and accidental discharges. The deliberate discharges comprised largely oily water from deballasting and tank flashing. The beginnings were modest. Two primary mechanisms were adopted. The concept of prohibited zones—a belt ranging from 20–150 miles of coastline and in closed seas, within which no discharges were allowed—and the requirement for reception facilities at ports and terminals for storage of oily waters.

Very soon, the inadequacy of the prohibited zones became clear. In 1962, an amendment was adopted to the 1954 Convention increasing minimum breadth of the prohibited zones to 50 miles from the coastline. There was also a proviso that coastal states may request even wider zones.[34] The dramatic *Torrey Canyon* incident of March 1967 demonstrated that the effect of wind and currents rendered the concept of prohibited zones useless for the control of marine pollution. In 1969, a new amendment was adopted abandoning the concept of prohibited zones. Instead, the restrictive discharge standards, formerly applicable to the prohibited zones, were generalized to apply to all oceans. Thereafter, only one more amendment was adopted to protect, preserve and maintain the cays and corals constituting the Great Barrier Reef located 1,250 miles from the shores of Australia.

The *Torrey Canyon* incident and its consequences revealed two other inadequacies of the existing regime. First, there was a necessity for a legal mechanism to authorize intervention in the high seas in event of an oil tanker accident. Secondly, there was a need for legal machinery for compensation to those whose interests are adversely affected by a polluting incident. Accordingly, in 1969, the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties and the International Convention on Civil Liability for Oil Pollution Damage were adopted.

It was the 1973 Convention on the Prevention of Marine Pollution from Ships which brought together the amendments to the 1954 Convention and incorporated several other conditions to seek completeness of the measures to control marine pollution. This Convention was further amended and strengthened by an implementing Protocol adopted in February, 1978. In

the 1973 Convention, *ship* was defined as a vessel of any type whatsoever operating in the marine environment. This includes hydrofoil boats, air-cushion vehicles, submersible, floating craft and fixed or floating platforms. The Convention also has several annexes containing discharge standards, ship construction standards and modes of carriage of various loads.

Using ships and aircraft to dump industrial wastes from land became an industry in its own right in Western Europe in the 1960s.[35] This was a reaction to the increasingly stringent environmental regulations in the countries. On February 15, 1972, 12 Western European states signed the Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, at Oslo, to apply to the north-eastern Atlantic Ocean. The Convention empowered the flag and port states to take measures to prevent loading, transport and discharge of such wastes. It was clear, however, that this would not entirely prevent loading, transport and discharges in other areas or from non-contracting states. Speedy negotiations led to the conclusion of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London, December 29, 1972).

Pollution arising from the exploitation of marine resources includes oil blow-outs such as the Santa Barbara incident of January, 1969 and the exploitation of solid mineral resources or fishing activities.[36] Article 5 of the 1958 Geneva Convention on the Continental Shelf requires parties to take all appropriate measures to protect living resources of the sea. Similarly, Article 24 of the 1958 Geneva Convention on the High Seas requires all contracting states to prescribe and enforce regulations to prevent pollution from the exploitation or exploration of the resources of the seabed and subsoil.

Land-based sources constitute approximately 80 per cent of marine pollution. Although states have generally been reluctant to negotiate agreements to control this category of marine pollution, two regional initiatives led the way. The Convention on the Protection of the Marine Environment of the Baltic Sea Area was signed by seven states in Oslo on March 22, 1974. It focusses on pollution from land-based sources, ships, by dumping and exploitation of marine resources. The second one is the Convention for the Prevention of Marine Pollution from Land-based Sources signed in Paris on June 4, 1974 by eight states and the European Community (EC).[37]

By the mid-seventies, the lessons were clear. Although the pollution of the marine environment had drastic global implications, it was primarily a regional problem requiring concerted regional approaches. UNEP established a Regional Seas Programme to organize and co-ordinate regional initiatives based on closed seas and modified coastal problem sheds. These started with the piecemeal approach of the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution signed by 15 states

and the European Community on February 16, 1976. It focussed on prevention of pollution by dumping and oil emergencies. The Protocol on the control of land-based sources was finally adopted at Athens on May 17, 1980 by 15 states and the EC.[38]

Within the same framework, the parties to the Barcelona Convention adopted a Protocol on Mediterranean Specially Protected Areas in Geneva on April 3, 1982. After the initial Mediterranean experience, there was a rapid growth in regional agreements: the Abidjan Convention signed by the ten states on the west coast of Africa, on March 23, 1981; the Lima Convention signed by five states on November 12, 1981 to cover the south-east Pacific region, with two supplementary Protocols, focussing on land-based sources and one on emergency pollution signed on July 22, 1983 at Quito by the parties to the Lima Convention; the Jeddah Convention signed by six states and the Palestinian Liberation Organization on February 14, 1982 to cover the Red Sea and the Gulf of Aden; the Catagena Convention adopted by 17 states on March 24, 1983 to apply to the wider Caribbean region; the Nairobi Convention signed by four states and the EC to cover East Africa; and the Noumea Convention signed by ten states on November 24, 1986 to cover the south Pacific region.

Almost all these conventions cover pollution originating from the land, the co-operation to combat pollution emergencies and regulations in specially protected areas. The UNEP survey posits that these regional arrangements now involve over 100 states, the EC and more than 50 international organizations. Thus, this is now the most pervasive range of agreements to protect marine environment.

The history of the legal protection of the marine environment has established that an umbrella or framework treaty does not have to precede the specific or component agreements. Component agreements could be used by states to test the acceptability of certain provisions. This may be the case with treaties on the marine environment. The United Nations Convention on the Law of the Sea, adopted in Montego Bay on December 10, 1982 is a framework for the treaties analysed herein. The Convention negotiation started in 1973. Section 2 (Articles 116–120) is the Conservation and Management of Living Resources of the High Sea, while Part XII covers the Protection and Preservation of the Marine Environment. Within the latter part, global and regional arrangements are stipulated. Specific articles deal with pollution from the land, sea-bed activities, dumping, ships and the atmosphere. It includes provisions for enforcement based on experience.[39]

One of the new and innovative provisions of the Law of the Sea Convention is the exclusive economic zone (EEZ) which is a belt of the sea extending to 200 nautical miles from the baseline. The EEZ is reserved to the coastal state which has sovereign rights and exclusive jurisdiction for the

exploration and exploitation of living and non-living resources therein. Articles 61–68 make provisions for the international regulation regarding the conservation of living resources, stocks occurring in the EEZ of two or more states, highly migratory species, marine mammals, anadromous species, catadromous species and sedentary species. Access to the EEZ by foreign fishermen or for scientific research is subject to the consent of the coastal state.

Atmospheric interference and air pollution

Atmospheric pollution associated with industrialization has been rampant for a long time.[40] The *Trail Smelter Arbitration* discussed earlier arose from an instance of air pollution. More ominous and widespread problems arose in Western Europe with acidic precipitation over the Scandinavian countries which threatened all forms of life in lakes. These problems triggered negotiations which were done within the North Atlantic Treaty Organization (NATO) by its Committee on the Challenges to Modern Society and in the Organization for Economic Cooperation and Development (OECD). Due to the elusive nature of air pollution, treaties and remedies are difficult.

The first agreement, the Convention on Long-Range Transboundary Air Pollution was concluded in Geneva on November 13, 1979. The parties undertook to take measures to combat the discharge of air pollutants, to exchange information on policies and scientific research and to hold consultation among those exposed to risks of such pollution. Three protocols to the Convention were subsequently adopted. The first was the 1979 Convention on Long-Range Transboundary Pollution, reducing sulphur emissions or their transboundary fluxes by at least 30 per cent; it was signed on July 8, 1985 at Helsinki by 19 contracting states. The protocol to the 1979 Convention on Long Range Transboundary Pollution Concerning the Control of Emissions of Nitrogen Oxide or Their Transboundary Fluxes was signed in Sofia on October 31, 1988 by 24 states. The third one is the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe, signed in Geneva on September 28, 1984 by 31 parties. Canada and the United States are non-European states which have signed the three protocols, to solve similar problems in North America.

The array of details for a convention on air pollution underscore the complexity in treaty requirements and implementation. Such details were never gone into for the Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water (Test Ban Treaty) adopted in Moscow on August 5, 1963, and signed by 110 states. By this treaty the

parties undertook to prohibit, prevent and not carry out any nuclear weapon test explosion within their areas of jurisdiction. Although the primary concern was disarmament, it had the secondary purpose of stopping the effect of radioactive radiation on life.

The prohibition of environmental modification is the subject of the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques signed in Geneva on May 18, 1977. It currently has 28 signatories.

The depletion of the ozone layer is a recent development for which the first instrument was the Vienna Convention for the Protection of the Ozone Layer adopted on March 22, 1985 and which now has 72 contracting states. The Montreal Protocol to that Convention, adopted on September 16, 1987, gave a programme for the reduction of the substances which deplete the ozone layer. The Adjustment to the Montreal Protocol and an Amendment to the Montreal Protocol, both done at a meeting held in London on July 29, 1990 seek to reduce the emission of chlorofluorocarbons which deplete the ozone layer.

The final agreement on atmospheric interferences is the United Nations Framework Convention on Climatic Change which was opened for signature in Rio on June 5, 1992. Its primary objective is to control or stabilize the greenhouse gas concentrations in the atmosphere as well as to prevent all forms of anthropogenic interferences with climate. Further, it commits the parties to initiate and implement research and exchange information which promotes the objectives of the Convention.

Protection of flora and fauna

Social movements involving the conservation of nature and natural resources have been traced to the Middle Ages.[41] The thrust of the movements was that wildlife and vegetation should be utilized with restraint. Most of these efforts were, understandably, concentrated at the national level. International measures did not commence until the second half of the 19th century. The first known attempt was in 1875 when Austria/Hungary and Italy signed a Declaration for the Protection of Birds Useful to Agriculture. These early efforts resulted in the 1902 Convention to Protect Birds Useful to Agriculture which is perhaps the earliest sign of global sensitivity to the conservation of biodiversity.

The number of treaties has increased steadily. UNEP has so far registered 35 treaties covering fauna. Out of the 35 treaties only eight are truly global. The Convention Relative to the Preservation of Fauna and Flora in the Natural State is one of the earliest in the century, adopted at London and signed by nine rather diverse states in Europe, Africa and Asia. The International Convention for the Protection of Whaling was adopted on

December 2, 1946 and amended in 1956 and 1959. The International Convention for the Protection of Birds was adopted in Paris on October 18, 1950 and signed by ten European countries. The Geneva Convention on Fishing and the Conservation of the Living Resources of the High Seas was one of the four instruments adopted by the first UN Conference on the Law of the Sea on April 29, 1958. Though largely superseded by the Montego Bay Convention, this agreement has been accepted by 34 states.

The remaining global agreements are the new generation and include the Convention on Wetlands of International Importance Especially as a Waterfowl Habitat, otherwise known as the Ramsar Convention, adopted on February 2, 1971 and adopted by 27 states. None of these countries are from North or South America. Under the aegis of UNESCO, the Convention for the Protection of the World Cultural and Natural Heritage was adopted in Paris on November 23, 1972 and has been accepted by 53 states spread globally. It is within the rubric of natural heritage that floral and faunal resources are subsumed. The best known and also controversial agreement in nature conservation is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), adopted in Washington, DC on March 3, 1973 and accepted by 65 states. The controversy arises partly because of the lucrative business gains from sale of trophies of the species considered endangered and partly because of difference of opinion about appropriate strategies for implementation of some of its provisions. The latest in this category is the Convention on the Conservation of Migratory Species of Wild Animals adopted in Bonn on June 23, 1979 and accepted by 22 states, only two of which—India and Sri Lanka—are Asian. It is interesting that Canada and the United States, both of which have had about a century of concern with migratory species, are not signatories to this Convention.

Two unique agreements with largely European and American participation are the Convention for the Conservation of Antarctic Seals and the Agreement on the Conservation of Polar Bears, both of which are open to global participation. The former has been accepted by 11 states and the latter by only six states, a clear reflection of the range of states with commercial interest in the animals which inhabit the non-settled areas.

Nine recent agreements are primarily applicable to Europe and the North Atlantic. They are the European Convention for the Protection of Animals during International Transport adopted in Paris on December 13, 1965 currently adopted by 19 states, the Benelux Convention on the Hunting and Protection of Birds signed by only the three respective states on June 10, 1970 and the Agreement Concerning Measures for the Protection of Stocks of Deep-Sea Prawns, European Lobster, Norwegian Lobsters and Crabs, adopted in Oslo in 1952 and amended in 1959.

The European countries showed special differentiation when in Strasbourg on March 10, 1976, they adopted the European Convention for the Protection of Animals Kept for Farming Purposes. It has since been adopted by 17 states plus the EC. Later it became the European Convention for the Protection of Animals for Slaughter also signed in Strasbourg on October 10, 1979 currently signed by ten states. An all-encompassing European Convention on the Conservation of European Wildlife and Natural Habitats was adopted in Bern on September 19, 1979. The three final European agreements are the Benelux Convention on Nature Conservation and Landscape Protecting adopted by the three respective states on June 8, 1982, the Convention for the Conservation of Salmon in the North Atlantic adopted in Reykjavik on March 2, 1982 and the European Convention for the Protection of Pet Animals adopted in Strasbourg in 1987.

Locally generated conventions on the protection of fauna and flora are scanty in Africa. The first treaty in Africa was the Convention for the Preservation of Wild Animals, Birds and Fish in Africa, adopted in London on May 19, 1900, an extension of the domestic interest of the European powers to their African colonies. Since then, six agreements have been adopted in the post-independence era. Out of the six, three apply specifically to desert locusts. The Convention on the African Migratory Locust Organization was adopted at Kano on May 25, 1962 and was signed by nine African states. It is open to accession by any state. The second agreement, like the Kano one, was done under the aegis of the FAO. Titled Agreement for the Establishment of a Commission for Controlling Desert Locust in the Near East, it was adopted on July 2, 1965 in Rome. Since then, it has been accepted by 13 states in north-west Africa and the Middle East. The third locust treaty is the Agreement for the Establishment of a Commission for Controlling the Desert Locust in North-West Africa, adopted in Rome, again under the aegis of the FAO on November 11, 1970 and signed by four states.

The Phyto-Sanitary Convention for Africa South of the Sahara was adopted in London on July 29, 1954 to prevent the introduction of diseases, insect pests and other enemies of plants into any part of Africa south of the Sahara. It has been accepted by 22 states. All except Portugal and Rhodesia, acceded to the Convention after 1960. Portugal is the only European state party to the Convention.

The African Convention on the Conservation of Nature and Natural Resources was adopted in Algiers, under the auspices of the Organization of African Unity (OAU) on September 15, 1968. It addresses individual and joint action for the conservation, utilization and development of soil, water, floral and faunal resources for the present and future of all people. It enun-

ciated the concept of sustainable utilization of natural resources for sustainable development. It also provided for respect of customary rights, a matter which has now become vogue under the rubric of protection of indigenous rights, and environmental education. To date it has been accepted by 27 states.

From 1983, there was a move to amend the Convention in view of recent developments such as the adoption of CITES in 1973, the World Charter of Nature of 1982 and the 1982 Law of the Sea Convention. A meeting of experts in 1983 reviewed the proposed amendments which were eventually referred to member states by the Council of Ministers. To date, no action has been taken to resolve the status of the recommended amendments.

To this list one can add the specific provisions on flora and fauna found in the instruments adopted under the UNEP Regional Seas Programme and which have been enumerated under the discussions on the protection of the marine environment. A representative case is the Protocol Concerning Protected Areas of Wild Fauna and Flora in the Eastern African Region, adopted alongside the Nairobi Convention on June 21, 1985.

There is an equally small number of treaties listed for the Asian region on the protection of flora and fauna. As they did in Africa, the FAO initiated a locusts control treaty for Asia: The Agreement for the Establishment of a Commission for Controlling the Desert Locust in the Eastern Region of its Distribution Area in South-West Asia, adopted in Rome on December 3, 1963. Only four states have accepted the agreement.

Two agreements in the list are truly Asian. They are the 1985 Association of South-East Asia Nations (ASEAN) Agreement and the 1988 Bangkok Aquaculture Agreement. The ASEAN Agreement on the Conservation of Nature and Natural Resources was adopted in Kuala Lumpur on July 9, 1985 to promote joint and individual state action for the conservation and management of the natural resources of the ASEAN region. It has been accepted by six states. In Bangkok, on January 8, 1988 the Agreement on the Network of Aquaculture Centres in Asia and the Pacific was adopted. Its primary objective is to assist the contracting states in their efforts to expand aquaculture development. So far, it has been accepted by nine states.

The Americas have adopted a small number of treaties on the protection of flora and fauna. These treaties cover very diverse subjects. The Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere was adopted in Washington, DC on October 12, 1940 and has now been accepted by 17 states. The primary objective of the Convention is to preserve native American fauna and flora from extinction. The spirit of conservation was also contained in the Convention for the Establishment of an Inter-American Tropical Tuna Commission whose objective was to main-

tain the population of yellow fin and skipjack tuna in the eastern Pacific, to permit maximum sustainable catches. The Convention was adopted in Washington, DC on May 31, 1949 and has six contracting states. The preoccupation with tuna fishing extended to the Atlantic with the International Convention for the Conservation of the Atlantic Tuna adopted in Rio de Janeiro on May 14, 1966. To date, the Convention has been accepted by 18 states on both sides of the Atlantic and Japan.

The concern with the conservation of Atlantic resources was reinforced by the Convention on the Conservation of the Living Resources of the Southeast Atlantic adopted on October 23, 1969 in Rome; the primary objective is to enhance co-operation in the conservation and rational exploitation of living resources. Two other specific agreements, one on fur seals and one on vicuna, were adopted in close succession. The Convention on Conservation of North Pacific Fur Seals was adopted in Washington, DC on May 7, 1976 and ratified by four states, with a view to ensuring the maximum sustainable productivity of the animals. The Convention for the Conservation and Management of the Vicuna was signed in Lima on December 20, 1979 and has been accepted by four Latin American states.

There is a rich variety of subjects covered by the respective agreements and regional disparity in the topics taken and the number of treaties signed. There is greater sensitivity over the specific species constituting national economic assets. Most of the African countries have done little to incorporate natural resources into modern economic activities. This is probably the reason for the poor attention accorded to the proposed amendments to the 1968 Algiers Convention. Otherwise, treaties are rather evenly distributed in the continental regions of the world.

Soft law

The term *soft law* evolved in diplomatic parlance during the 1980s to describe resolutions and declarations of global conferences not having the force of law as such but which are important enough to be considered a declaration of *de lege ferenda*—'what the law ought to be'. The significance may inhere in the nature of the preparation of the document and/or the conference which enunciates the principles.

Fundamentally, the objection to binding force of soft law arises from the distinction between such resolutions and treaties. States have different constitutional requirements for accepting treaties. Thus, diplomatically, a state representative may accept an enunciation of principle and vote accordingly, in the clear knowledge that should they be required to undertake a commitment to be bound, an additional range of actions will be required. This is the reason why the steps taken in the preparation of the resolutions and the conference may increase the legal value of a resolution.

Resolutions are, thus, a way of developing an international consensus. The resolutions, though not binding *per se*, do present evidence of global acceptance. Judge Tanaka in the *South West Africa* cases observed that a court cannot admit that individual resolutions, declarations and judgements have a binding force but that repetition of the same practice is legally significant. He stressed:

> Parallel with such repetition, each resolution, declaration, etc being considered as the manifestation of the collective will of individual participant States, the will of the international community can certainly be formulated more quickly and more accurately as compared with the traditional method of normative process. This collective, cumulative and organic process of custom generation can be characterized as the middle way between legislation by convention and the traditional process of custom making, and can be seen to have an important role from the point of view of development of international law. In short, the cumulation of authoritative pronouncements such as resolutions, declarations, decisions concerning the interpretation of the Charter by competent organs of the International community can be characterized as evidence of custom referred to in Article 38 para (1) (b).[42]

Resolutions and declarations are not equally significant. Yet, there is no line to delineate those that should constitute soft law and those that should not. The IUCN Environmental Law Centre lists the World Charter of Nature adopted by the UN General Assembly as Resolution 37/7 on October 29, 1982; The Declaration of Principles by the United Nations Conference on the Human Environment at Stockholm on June 16, 1972; the International Undertaking on Plant Genetic Resources adopted as Resolution 8/23 of the twenty-second session of the FAO conference, at Rome on November 23, 1983; and the General Principles Concerning Natural Resources and Environmental Interference developed by the Experts Group on Environmental Law of the World Commission on Environment and Development (WCED) in June 1986 as soft law.[43] The Rio Declaration on Environment and Development adopted by the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992 should also feature in future profiles of soft law.

The respectability of the soft law will also increase as specific provisions are incorporated into regional and global treaties. Principle 21 of the Stockholm Declaration is a case in point. It has been incorporated *de lege lata*, in Article 3 of the Convention on Biological Diversity.

Salient features

The field of international environmental law is vast, making it virtually impossible to give a brief overview without being sketchy. What is readily

apparent is that tribunals seized with environmental issue, need laws to enforce any decisions made. What matters is how the parties decide to arbitrate a dispute. Most states prefer signing treaties as they are legally binding on the parties. This does not rule out the possibility of a tribunal applying analogous rules to a given dispute.

Treaty law, both global and regional, is legion. Most treaties, however, have been adopted piecemeal, usually in response to some specific and pressing problem. Marine pollution conventions are perhaps an extreme case. One possible explanation is that previously the global community was unaware of the nature and potential gravity of environmental problems. As such it could only be moved by dramatic manifestations.

A framework convention provides broad and comprehensive framework provisions allowing for specific and detailed protocols to prescribe strategies and timetables for implementation. At the same time, such a convention allows states to adopt detailed regional agreements for implementation at an appropriate pace. The Convention on Biological Diversity as a framework agreement is clear on the adoption of protocols (Article 28). Although it may be construed rather strenuously under Article 18 which requires scientific co-operation at national and international level, the Convention makes no explicit provision for adoption of specific regional conventions.

The concept of national sovereignty has been a stumbling block to the implementation of various environmental agreements and could prove to be so in the case of the Convention on Biological Diversity. However, the increasing awareness of the inextricable interdependence of the environment and development could solve this problem. Entering into an agreement should not be viewed as a relegation of sovereignty but as the highest level of exercise of sovereignty. Only the sovereign enter the commitment, agreeing on the rules and procedure of what is to be done. Each state must have its people educated and committed to the environmental cause for changes to occur.

Reservations are not acceptable under the Convention on Biological Diversity (Article 37). This is not a frequent feature in treaties but is essential in cases where reservations may undermine the overall purpose of the agreement. Parties-to-be must initiate studies to ascertain the technical and economic problems which might impede the implementation of the Convention by developing countries and find remedies to the problems, thereby obviating the necessity for reservations.

In Africa, the situation is complex. In 1968, for instance, the African states were able to adopt the Algiers Convention on the Conservation of Nature and Natural Resources. Yet, two decades later, they are unable to update the treaty. It is not that they reject the amendments; they simply do not take any action. It would be best to conduct a study to find out what

hinders these states, whether it is poor leadership at national or regional level or the substance of the proposed amendments. The primary concern of most international lawyers is that a treaty is adopted and that there are so many signatories, accessions and ratifications. Rarely is there a similar degree of concern with what happens after the agreement enters into force, save in the event of a blatant breach. To enhance the efficacy of environmental treaties, particularly technical ones, lawyers must undertake early studies at national level to ascertain the technical and economic factors which hinder the implementation of treaties.

Notes

1. The decision to convene the Stockholm Conference was first made by UNGA Res. 2398 (XXIII) of December 3, 1968 and subsequent confirmations by UNGA Res. 2581 (XXIV) of December 15, 1969; UNGA Res. 2657 (XXV) of December 7, 1970 and UNGA Res. 2849 (XXVI) and 2850 (XXVI) of December 20, 1971.
2. Interim revision of draft 4 of the Covenant on Environmental Conservation and Sustainable Use of Natural Resources was prepared by the meeting of the *ad hoc* working group held in Bonn, Germany on September 7–9, 1992 convened by the IUCN Commission on Environmental Law in conjunction with the International Council of Environmental Law.
3. See detailed discussion in Okidi, 1985.
4. Lester, 1967. See further discussion in Okidi, 1992.
5. Lester, 1967, p. 98.
6. Lester, 1967, p. 97.
7. Goldie, 1972, pp. 104–129.
8. Utton, 1974, p. 158.
9. Stockholm Declaration on the Human Environment UN Doc. A/CONF.48/14 (1972).
10. *Trail Smelter Arbitration* (*US* v *Canada*) in United Nations, *Reports of International Arbitral Awards* (hereinafter UNRIAA), vol. 3 (1938), p. 1905 ff (for initial decision) and 1941, p. 1938ff (for final decision). *Lake Lanoux Arbitration* (*France* v *Spain*) in UNRIAA, vol. 12 (1957), p. 281 ff (for English translation see Green, 1978, pp. 318–328). The *Corfu Channel Case* (*Great Britain* v *Albania*) *ICJ Reports*, 1949, p. 4.
11. For the details of the facts, see UNRIAA, vol. 3, pp. 1916, 1965–1966.
12. UNRIAA, vol. 3, 1965–1966.
13. Utton, 1974.
14. Treaty of Bayonne, May 26, 1866; Additional Act, May 26, 1866.
15. *Nuclear Tests* (*Australia* v *France*) and *Nuclear Tests* (*New Zealand* v *France*) Judgement of December 20, 1974 in *ICJ Reports* 1974, pp. 253, 457. The Government of Fiji requested the Court to permit it to intervene in the proceedings, under Article 62 of the Statute of ICJ because its national interests were involved. Similar requests were made by Argentina and Peru which requested the pleadings under Article 48 (2) of the Rules of the Court. See *ICJ Reports* 1974, pp. 256–257. Since this case has not received much commentary, more details are presented here than for the other cases.
16. *ICJ Reports*, 1974, p. 258.

17. *ICJ Reports*, 1974, pp. 256, 257, 258.
18. *ICJ Reports*, 1974, p. 265.
19. *ICJ Reports*, 1974, p. 266.
20. *ICJ Reports*, 1974, p. 269.
21. For a detailed analysis of the doctrine see D'Amato, 1971, p. 66–102.
22. Unilateral statement, not requiring reciprocal action, but carrying legal obligations was accepted in the judgement of the Permanent Court of International Justice (PCIJ) in the well-known case of the *Legal Status of Eastern Greenland*. In that case, a public statement by M. Ihlen, the Norwegian foreign minister, purporting to enunciate the position of Eastern Greenland, was held by the PCIJ to bind Norway. See *Permanent Court of International Justice* (1933) Series A/B No. 53. The vital sections are reprinted in Green, 1978, pp. 160–171 and the cases cited therein.
23. See reference to the Attorney-General's address to the Australian Senate on September 26, 1974, as discussed in the Judgement; *ICJ Reports*, 1974, pp. 261–262.
24. The UNGA Res. 3456 (XXX) 1975; UNEP Governing Council Decision 24 (III) of 1975 and Decision 66 (IV), 1976 requested UNEP to keep the two respective bodies informed of any new international convention concluded in the field of international environmental law. See Kiss, 1983; Rummel-Bulska and Osafo, 1991, pp. X, 473–482; IUCN, 1991.
25. For a detailed profile of treaties on international drainage basins, see FAO, 1978; for consumption of waters on the River Nile, see Okidi, 1982, pp. 161–199 and Okidi, 1994.
26. UN; 1962; Bilder, 1972, pp. 294–380; Meyers, 1967, pp. 486–607.
27. Lester, 1967, pp. 89, 105–106.
28. Reprinted in *International Legal Materials*, vol. 8, p. 905, but see historical background in Hayton, 1967, pp. 298–442. See *International Legal Materials*, 1978, vol. 17, p. 1045 and 1989, vol. 28, p. 1303.
29. See the treaty in 419 *UNTS* 126; for background see Baxter, 1967, pp. 443–485; reprints in *International Legal Materials*, 1978, vol. 17, pp. 103–106.
30. For a detailed discussion see Okidi, 1982, pp. 161, 181–185; 1987; 1994. See text in Rummel-Bulska and Osafo, 1982, p. 112. The Niger treaty supersedes the 1963 Agreement; for other details see Enwemnwa, 1988, pp. 251–279. See also, Rummel-Bulska and Osafo, 1991, p. 389.
31. The Draft Principles were developed by an intergovernmental group of experts under the aegis of UNEP. It was issued as part of a report in UNEP/IG 12/2 of February 8, 1978.
32. For a comprehensive, article by article analysis of the Draft Articles by various experts in the field, see Stephen C. McCaffrey, in the *Colorado Journal of International Environmental Law and Policy*, vol. 3, no.1, Winter, 1992, p. 428.
33. For details on this and subsequent developments see Okidi, 1978, p. 30 ff.
34. Note that by 1962 the Inter-Governmental Maritime Consultative Committee had been created with the mandate over all matters relating to sea-going vehicles: safety of and on vessels at sea, carriage of goods and ship-borne pollution.
35. See discussions with illustrative incidents in Okidi, 1978, pp. 17–28.
36. For detailed discussion, see Okidi, 1978, pp. 49–55.
37. See text in Kiss, 1983, pp. 44, 405, 430.
38. Okidi, 1977, pp. 1–25; Kiss, pp. 46, 448–459; Rummel-Bulska and Osafo, 1991, pp. 8, 81–85.

39. See Articles 192–237 of the Convention on the Law of the Sea.
40. See wide ranging discussions in Flinterman *et al.*, 1985; also see, *New Scientist*, vol. 48, October 20, 1990, p. 209 and *Science*, vol. 170, October 16, 1970, pp. 318–320.
41. See Johnston, 1981, Chapter One.
42. This is the Dissenting Opinion of Judge Tanaka in *ICJ Reports* 1966, p. 292 and also by Judge Jessup, p. 441. The important point is that it is the position of the dissenting judges which eventually prevailed as South Africa was pressurized to leave Namibia and the Committee on Namibia was set up.
43. IUCN/CEL,1991, pp. 447–473.

3

National sovereignty and genetic resources

HANNE SVARSTAD

This chapter analyses the Convention on Biological Diversity from the perspective of an exchange between governments of the North and the South. The North has emphasized the conservation of biodiversity in the South. The governments of the South have taken the opportunity to put up three demands in exchange for their co-operation in such conservation efforts. These demands comprise the transfer of finances and technology from the North as well as the recognition of national sovereignty over genetic resources. The latter demand has been seen as a prerequisite to secure technological and financial transfers. Furthermore, during the negotiations the South stated that allowing the North access to its genetic resources depended on certain demands being met. The negotiators stated the objectives of the Convention as:

> [T]he 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, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.[1]

What are the opportunities of countries and people in the South to benefit from the Convention's elements of national sovereignty over genetic resources and technology transfer? This chapter reveals that few of the developing countries meet the conditions necessary to enable them to benefit from these two important aspects of the Convention. The impacts may also be negative for local providers of knowledge, development and conservation of genetic resources. Acknowledging this, the chapter suggests

remedial actions for the implementation process that could mitigate the negative distributional pattern.

The North–South exchange of biodiversity

Models are often used in social and political sciences in order to clarify complex social processes and to generate questions. One can view the exchange between the North and the South in accordance with the model of a social action system advanced by sociologist James A. Coleman.[2] In his model, Coleman proposes a minimum of two actors and a variety of things that the actors have control over and interests in. Interaction develops as a result of each of the actors having interests in the things that the other controls. A transaction takes place where the actors give up control over things that they are less interested in, in order to gain control over those that interest them more. The things for which control is transferred between the actors are called *transaction objects.*

A prerequisite for a transaction to occur is that 'Actors are not fully in control of the activities that can satisfy their interests, but find some of those activities partially or wholly under the control of other actors.'[3] Negotiations are a good example of cases where this prerequisite causes interaction.

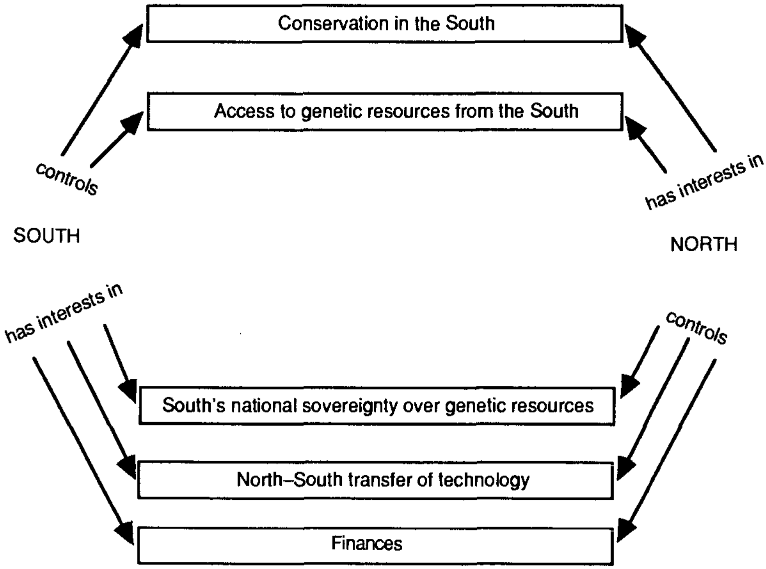
Transaction objects comprise events, goods and rights. What is transferred through the transaction is control or the right to control things.[4] For the latter, property rights are central. Actors attach interests to events, goods and rights. If they were totally rational, they would have clear preferences and full knowledge of different strategies to fulfill their wants. Rather than presuming full rationality, one can assume that the actors behave intentionally. They evaluate the control over certain things higher than others and with their restricted abilities they try to achieve goals they think are important. Negotiation resources are things that an actor controls but has little interest in. Other actors must have a strong interest in these things in order for them to be resources for the first actor.

Seen from the perspective of Coleman's model, countries of the South and countries of the North constitute two aggregated entities of actors. The Convention can be analysed as the outcome of the two groups' previous possession of interests in and control over major issues of the negotiations which are presented as five transaction objects. The relationships between the actors and the transaction objects can be seen in Figure 1.

In this chapter's description of the Convention from the perspective of an exchange model, the countries of the North and the South are treated as only two separate actors. This simplification can be justified by the block behaviour evident in the negotiations. Of the 101 countries[5] that took part, 77 were developing countries. They had their own strategy meetings under

the common label 'Group of 77', and they basically targeted the same objectives. The developed countries also shared objectives and strategies. The Convention often makes a distinction between developing and developed countries in clarifying obligations, rights and benefits.

Figure 1 The Convention on Biological Diversity: Exchanges between South and North



In a number of ways, the countries in each of the two groups differ with respect to interests and controls. Some of these differences were evident in the negotiations while others are not going to be manifested until the implementation of the Convention. The Contracting Parties consist of representatives for the governments of the participating countries. A government's interests in the outcome of the Convention are not necessarily consistent with those of the local communities that use, develop and conserve the genetic resources in question. Thus, the new national sovereignty over genetic resources demanded by the governments of the South may come into conflict with the interests of peasants and indigenous groups.

Transaction objects

The first transaction object consists of the efforts to conserve biodiversity[6] to be initiated as a result of the Convention. When comparing biodiversity in the South and the North, one sees a much larger variability both between

and within species in the South. This is due to natural historic factors. According to A.M. Sendaro, economic development has also caused considerable depletion of biodiversity in the North.[7] In the negotiations, governments of the North have shown great interest in the conservation of biodiversity in the South. This is largely due to environmental consciousness and pressure from environmentalists. The importance of maintaining wildlife in tropical countries has been given special emphasis. It has also been pointed out to be in the interest of the North, economically, to maintain the South's wild and domesticated genetic resources[8] for future use in industry as well as agriculture. Conservation in the South hinges on co-operation from the governments of the South. According to the Coleman model, hence, governments of the South control the conservation efforts. In the negotiations, the South utilizes this control as a negotiation resource in order to gain other objectives.

According to the exchange model, the South does not have considerable interest in the conservation of its biodiversity. The negotiations also reflected this. Developing countries emphasized the fact that conservation conflicts with the development of their economies. Nevertheless, conservation efforts are very valuable economically, both in the short term and in the long run. Within the short term, a country's biodiversity continuously provides people with material for survival. Although this may not often rank high on the list of priorities of governments which are more interested in large-scale development schemes, its importance should not be underplayed. 'Eco-tourism' may yield more income from the natural resources in an area than most development schemes based on extensive extractions of material from nature. In the long term, a country's maintenance of its biodiversity, including genetic resources, is crucial for its very survival and prosperity. A country's diversity of germplasm in agriculture is adapted to its specific conditions and is therefore an invaluable resource. Furthermore, wild flora and fauna have plenty of latent potential.

In spite of the clear advantages to be gained from conservation, governments of the South have not put much emphasis on their interests in these matters. This can be explained as a strategy often employed in exchange situations where actors play down their own interests so as to gain more from the exchange.

In the negotiations, the South emphasized that transfers of germplasm from the South are important for the economies in the North. Therefore, they claimed, the North has a high interest in maintaining access to these materials. Genetic resources from the South are important for the agriculture as well as pharmaceutical and biotechnological industries in the North. Prior to the Convention, the North has had free access to germplasm from the South. The North hence would have preferred that the Convention

concentrate entirely on conservation aspects and leave out the issues of access and rights over genetic resources. However, the North had to agree to discuss these elements of the Convention.

The South succeeded in acquiring national sovereignty over genetic resources. A national sovereignty regime was seen as necessary in order to gather money and technology as payment for the use of genetic resources from the South. The North can be considered to control this aspect because it has no interest in the new regime and could refuse to respect it. Respect for national sovereignty over genetic resources is borne of the North's interests in other aspects of the Convention. Questions that arise from this are whether countries and people in the South will be able to benefit from the new regime.

The South demanded transfer of finances from the North, to carry out conservation efforts and as payment for the transfer of genetic resources. This brought in the issue of money as a negotiation resource for the rich countries of the North.

The South used the negotiations as an opportunity to demand technology. Their interests have basically been to gain as much technology transfer as possible from the North. All kinds of technology related to utilization of biological resources, with a special emphasis on biotechnology, have been under consideration. The developed countries, on the other hand, have been reluctant to accept these demands. New technology gives an important advantage in international trade competition which the countries in the North do not want to give up. However, quite early in the negotiations, the North realized that in order to reach any agreement on the Convention, it was necessary to include a transfer of technology.

The drift towards national sovereignty

This analysis takes as a point of departure the following definition of property rights for genetic resources: Firstly, it implies that an actor has the right to decide over other actors' access to and utilization of specific genetic resources. Secondly, the owner has the right to payment from the actors who gain access to or utilize these genetic resources.

In contrast to other kinds of natural as well as man-made means of production, genetic resources have only recently been subject to property rights. Genetic resources have been open access resources, meaning that everyone has the right to use them free of charge. In the International Undertaking of the United Nations Food and Agriculture Organization (FAO) from 1983, plant genetic resources were labelled a common heritage of humankind.

Today, new patents on biotechnological inventions have introduced private property rights to some genetic resources. These rights are applied to

genetic resources which have been scientifically bred by companies and research institutions, mainly in industrialized countries. Earlier, a number of countries had established plant breeders' rights—private property rights to breed germplasm—which afford a more limited control than patents in regard to access, utilization and payment.

Community property rights on genetic material give particular communities the right to restrict utilization and collect payment for the utilization of germplasm from their territories. Such a property right has been proposed to be given indigenous people who often possess knowledge of local plants which is tapped and used by pharmaceutical and other companies.

A similar right has also been proposed for traditional farmers as a remuneration for their maintenance and development of plant genetic resources. Their conservation of a diversity of plants is an important input into breeding activities of the modern agricultural sector. FAO endorsed the concept of *farmers' rights* in 1989. The concept recognizes the contribution of traditional seed selectors and reflects a commitment to reward them for it. However, farmers' rights are not property rights as such. They do not accord farmers the right to decide upon access and utilization of genetic material. In the FAO discussions, a free exchange of germplasm has been considered a major objective. Furthermore, farmers cannot demand payment for the use of specific germplasm. Instead, the concept indicates a commitment of the participating governments to fund projects that will benefit farmers who develop and maintain germplasm. Although FAO has established a fund for this purpose, it has received hardly any finances.

National sovereignty over genetic resources implies that governments have the right to decide over foreign actors' access and utilization of genetic material from their territories as well as the right to collect payment when they permit utilization. The Convention provides such rights. Therefore, today's situation is characterized by a transition of genetic material from an open access resource to one governed by the rules of private property and national sovereignty. Genetic material which is systematically bred in laboratories becomes privatized, while germplasm from forests and traditional farmers' fields becomes national property. Systematic breeding of germplasm mainly takes place in industrialized countries, whereas developing countries possess the bulk of genetic material subject to national sovereignty.

In all the negotiations at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, the South emphasized the issue of national sovereignty. The governments of the South refused to submit themselves to conservation efforts from the North without their own control. The Convention limits conservation efforts by obligating the Contracting Parties only 'as far as possible and as appropriate'.

Article 3 says: 'States have in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies.' The only restriction on the states, which is made in the continuation of Article 3, is on activities with a negative impact on the environment of other states.

While the Convention confers that each country's government has the sovereign right to decide on conservation efforts of its territory, it affirms in the Preamble that the conservation of biodiversity is a common concern of humankind. The concept of 'common heritage of mankind' was refused in the negotiations. The new concept of 'common concern' refers vaguely to the obligations of developed countries to assist conservation efforts in the South with economical and technological contributions.

From an international regime of common heritage of mankind on genetic resources, governments have now got the international acceptance to decide over access and utilization of genetic material from their territories. Article 15(1) says that: '. . . the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.' This paragraph's clear statement of the national sovereignty over genetic resources is, however, modified by paragraph two of the same article which states, 'Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention.'

In Article 15(5), the Convention introduces the concept of *prior informed consent* which puts an emphasis on the right of governments to decide on the access to genetic resources from its territories. Payment, on the other hand, is to be on 'mutually agreed terms' and subject to the provisions of the Convention; as stated in Article 15(4). The country providing genetic resources (CPGR) has the right to remuneration, although this must be on terms agreed upon by both parties prior to any actual exchange of germplasm. Articles 16 and 19 provide the CPGR with rights of access to technology. Other aspects of the agreement may be created by the two parties.

Genetic resources with transaction value

In order to benefit from the Convention's provision of national sovereignty over genetic resources, a country must possess vast genetic resources, and these must have transaction value. The germplasm must be of interest to actors from other countries and not have been transferred to other countries prior to the Convention.

The Convention defines a CPGR as '[T]he country supplying genetic resources collected from *in situ* sources, including populations of both wild

and domesticated species, or taken from *ex situ* sources, which may or may not have originated in that country.'[9] The 'country of origin of genetic resources' is defined as 'the country which possesses those genetic resources in *in situ* conditions' (Article 2). Two or more countries may be the countries of origin of particular germplasm. Such countries will not benefit from the national sovereignty regime unless they supply actors abroad with the germplasm.

Every country in the world possesses a diversity of germplasm. It is crucial that this be maintained for the country's local communities. In order to benefit as a CPGR, however, a country must have a large quantity of genetic resources that are of interest to actors in other countries.

The countries of the South, as a group, possess a large portion of the world's genetic resources—both domesticated crops and germplasm in natural biotopes. This is, for instance, crucial to the world's agricultural production. According to an assessment made by sociologists Jack Kloppenburg and Lee Kleinman,[10] 95.7 per cent of the global production of the 20 most important food crops is based on genetic material from developing countries. The data collected also shows that these resources are not evenly distributed over the various regions of the South. While the Latin American and west central Asiatic regions have contributed 35.6 and 30 per cent of the germplasm for the major food crops respectively, the African region has contributed only 4 per cent. The distribution of germplasm also differs substantially within the same region. Ethiopia, for instance, in comparison to other African countries, possesses much diversity in globally-demanded food crops such as barley and wheat. Thus, while some countries of the South are 'gene-rich' in food crops of interest to the rest of the world, others are 'gene-poor' in this respect.

A similar picture can be drawn for the distribution of genetic resources in natural biotopes. Wild germplasm is important for the pharmaceutical and biotechnological industry as well as the agricultural sector. The diversity is particularly high in the tropical rainforests which contain more than half the species in the world biota.[11] The tropical rainforests are found in only a small portion of the developing countries. Brazil possesses the world's largest 'natural genebank' with about 30 per cent of the existing tropical rainforests. Other Latin American countries—Peru, Ecuador, Venezuela, Colombia and Costa Rica—also have rainforests. Of the Asian countries, Indonesia and Malaysia have the largest areas of tropical rainforest. Only two African countries have considerable areas under tropical rainforests, namely Madagascar and Zaire.

The Convention follows the principle of non-retroactivity in law. The effect of this is that national sovereignty is not to be enforced on genetic resources already stored in international genebanks or those that have

otherwise been transferred to actors outside their country of origin. Countries from which a large quantity of genetic material has been collected for international genebanks or actors outside the country will therefore have their opportunity to benefit from the Convention greatly reduced. Also, the Convention does not enter into force before the ninetieth day after 30 countries have ratified it.[12] Germplasm collected before this will also go unprotected by the Convention.

A considerable amount of domesticated germplasm has already been collected from 'gene-rich' developing countries. These materials do not have transaction value in accordance with the Convention. Nevertheless, agricultural experts hold that the present *ex situ* collections are by no means sufficient.[13] When it comes to the wild genetic material, only about 1.4 million living species of all kinds of organisms have been described out of a total amount of approximately 5–30 million.[14] This leaves a considerable amount of wild as well as domesticated germplasm with transaction value for countries in the South.

Why not include the previously collected material in the new regime of national sovereignty through a protocol to the Convention? Opponents of this have argued that it would contravene the principle of non-retroactivity in law because these resources have already been subject to access across national borders.[15] One could, on the other hand, emphasize the utilization aspect of national sovereignty. That way, an inclusion of the collected material will not imply retroactivity because the Convention will cover *new utilizations* of these genetic resources. This would considerably increase the amount of germplasm that countries in the South could gain economic and technical benefits from. Furthermore, a transaction value on the collected material would act as an incentive to the countries of origin to maintain these resources *in situ* as they can be subject to future contracts of utilization.

Transfer of germplasm

The Convention's acknowledgement of national sovereignty creates an international framework for the transfer of germplasm. Prior to the Convention, a number of contracts on transfers of germplasm had been set up between governments of the South and companies in the North. The most famous deal of this kind was made in 1991 between the pharmaceutical company Merck from the USA and the National Biodiversity Institute of Costa Rica (INBio). This arrangement illustrates the conditions that must be met by countries in order to benefit from the national sovereignty regime.

INBio helps Merck collect and chemically prospect genetic resources from Costa Rica's rainforest. Merck is given exclusive rights to screen these materials for pharmaceutical and agricultural applications. The payment

from Merck to INBio is US$1 million for two years and 5 per cent of any royalties arising from the sale of such products. INBio then spends 10 per cent of the initial payment and half of any royalties on conservation activities in Costa Rica.[16] The deal is, therefore, seen as a new way of financing conservation. A controversial aspect of the deal in Costa Rica is that the private organization, INBio, acts as the owner of genetic resources in the country.[17] Instead of treating the genetic material as national property, INBio treats it as private property to be sold as utilization rights. The deal exemplifies how governments of the South—in accordance with the Convention—could be paid to provide companies with access to genetic resources. The INBio /Merck arrangement could serve as a model which governments of the South can emulate to generate income from their genetic resources.

Legislation

The new regime of national sovereignty over genetic resources requires the establishment of legislation in each country, in addition to the Convention, that points out rights and obligations connected to the contracts and gives a framework for the administration and enforcement of national sovereignty. Model legislation must be developed to ease the international implementation of the Convention. Developing countries can then use this as a point of departure for enacting law in this field. The model legislation should particularly elucidate how the participation of local actors can be made an element of any contract. Ways to require incorporation of conservation elements should also be enunciated. The model legislation should also explain how to handle the transfer of germplasm to international genebanks. One possible comparison is the bank box system. A CPGR can put as a precedent condition that material be untransferable to any other actors without the permission of the owners. In that way, anybody wanting to utilize the germplasm would have to ask the country to provide them with access, conditional or otherwise. Another possibility for the CPGR may be to draft standard contracts for any transfer of material from the genebank.

Administrative capacity

Competent personnel are needed in the CPGR to make the arrangements for the sale of the genetic resources. Few developing countries possess the expertise to negotiate, design and administer such arrangements. Companies, on the other hand, have highly competent personnel. Arrangements for access and utilization of genetic material are similar to the issuing of patents. Private industry takes patenting very seriously and does not engage in negotiations or the drafting of contracts without lawyers who specialize in this.

The INBio arrangement shows that it is possible to build up such administrative capacity. However, INBio started off from a favourable position, with ample finances and technical assistance. This is not likely to be the case for many others. This problem can be circumvented by financial transfers to governments of the South to enable them to build administrative capacity to handle the germplasm transfers. This could include funds to train lawyers and other personnel to administer the transfers. An expert group of specialist lawyers, as a subsidiary body to the Convention, could be assigned the role of assisting governments in the initial stages of establishing contracts. Standard contracts could be drafted for both companies and genebanks. An analysis of past experiences with contracts made for the transfer of germplasm would be useful. Research into administration of national sovereignty over genetic resources can be effectively integrated with existing administration of similar matters. Two possible connection points are the approval of research permits for foreign scientists and the plant quarantine services.

Technological and scientific capacity

A country that aspires to be a significant provider of germplasm needs technological and scientific capacity to be efficient. Selling genetic resources requires competence on what these materials consist of. Most developing countries lack such competence. According to Oteng-Yeboah, there is one taxonomist per country in Africa south of the Sahara.[18]

The Convention at Article 15(6) says, 'Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties.' Thus, according to the Convention, the selling arrangements are supposed to facilitate participation in research and competence-building. In order to come even so far as the arrangements, a base of scientific and technical capacity is necessary. Article 18(2), on technical and scientific co-operation, states *inter alia* that '. . . special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building.'

INBio has, within a short period of time, managed to build a considerable technical and scientific capacity. The institute's strategy is based on three groups of staff: parataxonomists, apprentice curators and guest researchers. Parataxonomists are local lay persons trained to collect plants and insects. Apprentice curators are university graduates in biology who are trained as curators and taxonomists at INBio. Guest researchers, mainly taxonomists, work together with the apprentice curators on short terms and are paid by the institutes they come from.[19] This model is an example of an effective

and relatively inexpensive way of building capacity that other countries can learn from. Further, funds from the Convention could be prioritized for purposes of building technological and scientific capacity in this area.

Enforcement capacity

In order to benefit effectively from national sovereignty, a CPGR must be able to ensure that rights are not infringed. Currently, it is relatively easy for corrupt and criminal elements to smuggle seeds across the borders of most countries. Furthermore, it is impossible to imagine that a country can maintain total control of the use of its germplasm globally and prevent any company from jeopardizing its rights. This would require extensive bureaucracy, many technical experts and heavy expenses.

A company can easily claim that the germplasm in question is derived from a source which is not governed by the national sovereignty concept. Monitoring companies with which legal contracts have been made is probably too extensive a task for any CPGR. A company which purchases genetic material legally and develops a drug may later synthesize it and deny that it was derived from some particular genetic material.

When it comes to the INBio/Merck arrangement, it is most likely that Merck will keep its obligations and pay INBio for eventual commercial findings. The contract has given Merck much positive media attention by being described as an inventive conservation deal. If Merck finds something it can use from the INBio material, it can even gain additional positive public attention for which the price is relatively low compared to the marketing effects. If similar kinds of arrangements become common, however, the spotlights will be turned off.

The establishment of enforcement capacity poses one of the most difficult problems for implementing the Convention's new regime. The solution proposed here is connected to the utilization component of national sovereignty as opposed to efforts to prevent illegitimate access to the germplasm. A requirement of information about the germplasm's origin and the agreements made with the CPGR should be put on all marketing of biologically-based products. In the absence of this, the companies must state how they have acquired the germplasm.

A similar proposal is to connect such a duty to relay information on any applications for patents and patent descriptions.[20] However, since companies do not apply for patents on all products, attaching the information requirement to marketing would be much more effective. A protocol to the Convention could impose a duty on the Contracting Parties to ensure that companies in their territories conform with the requirement.

For each CPGR it would be virtually impossible to control internationally that the national sovereignty over their germplasm is not abused. To curb

abuse, the Contracting Parties could establish a germplasm identification service connected to the FAO, for instance.[21] Application of genetic fingerprinting and other relevant techniques would provide a certain control of the enforcement of national sovereignty for the CPGR. Infringements could be revealed by spot checks. There would also be a need for policy and legislation to sanction infringements.

Developing countries must meet all the described conditions in order to benefit from the new regime of national sovereignty over genetic resources. It is the most advanced countries that have the best chance of utilizing the new income opportunities. The least developed countries (LDCs) would probably have the greatest difficulties in building the required capacities so as to benefit from germplasm sales. As suggested above, however, a number of remedial actions in the implementation of the Convention could mitigate this conclusion.

South–South exchange of genetic resources

If a number of 'gene-rich' countries of the South manage to impose the new regime successfully, the situation for other countries of the South may deteriorate considerably. Access to genetic resources from other countries is as crucial for countries in the South as it is for countries in the North. The Convention may result in restricted accessibility as well as expensive and time-consuming processes for germplasm exchange. LDCs may be confronted with new problems and costs rather than benefits. According to Article 15(2), Contracting Parties should not impose restrictions on access to genetic resources that run counter to the objectives of the Convention. Such a negative impact on developing countries, especially the LDCs, is clearly counter to the objectives of the Convention.

A free exchange of germplasm within the South can be maintained if the countries of the South make an agreement on this in the implementation of the Convention. They can decide to refrain from demanding payment for germplasm which is transferred from one developing country to another. That way, only the North's appropriation of germplasm from the South would be subject to payment. In accordance with the Convention, the country receiving the germplasm would still be restricted from passing it on to a country in the North without permission from the country of origin.

Communal property rights

Another question is whether the new regime of national sovereignty over genetic resources established by the Convention is in accordance with or in contrast to communal property rights. Community property rights first and foremost confer on a defined group of local peoples the right to decide access and utilization of genetic material based on their knowledge or

territories. Neither the common heritage of mankind nor farmers' rights concepts give anybody the right to forbid access to genetic resources. The Convention, however, gives such a right to national governments. The international community does not recognize communal property rights in the Convention. National governments, however, may establish such rights.

Secondly, community property rights include the right of the community to receive payment from those allowed access to and use of the germplasm. In the international debate, a global levy or tax for commercial companies is sometimes proposed in order to generate income to the providers of germplasm.[22] A one per cent tax on the seed companies' turnover has been suggested to provide income which can be used to finance projects benefiting traditional farmers as payment for their contributions through the centuries in the supply and maintenance of plant genetic resources. A similar tax has been proposed to pay native peoples who provide companies with knowledge and genetic material from the rainforests. Since governments prefer to make sovereign decisions on regulations of their private industry, a global tax or levy is not very feasible politically.

The Convention does not recognize rights of payment for local providers of germplasm. It states clearly that the national governments are the actors with the right to be paid for the use of germplasm derived from their territories. A country's government can therefore generate income from provision of genetic material based on farmers' development, maintenance and knowledge. Likewise, a state may receive payment for germplasm with pharmaceutical value based on knowledge from its indigenous peoples. The local providers of the genetic material may not be paid for their contributions.

The Convention gives a CPGR the right to payment in the form of access to technology based on the particular germplasm provided. This may result in income from the traditional sector being used to develop modern sectors of agriculture and industry. The local providers are not likely to benefit from this. Such development may ultimately pose a threat to the culture and existence of the local providers.

There is some recognition of the contributions from indigenous and local communities to conservation and sustainable use of biodiversity. The Preamble to the Convention recognizes '. . . the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biodiversity and the sustainable use of its components . . .' In Article 8(j), it is said that:

> Each Contracting Party shall, . . .Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of in-

> digenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

Many indigenous and local communities are important actors, not only in the provision of genetic resources and knowledge, but also, in the conservation of biodiversity. Such communities may benefit from conservation efforts initiated either by their governments or the international community through financial mechanisms. Article 10 is about the sustainable use of components of biodiversity. Paragraph (c) states that 'Each Contracting Party shall, as far as possible and as appropriate . . .Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.' Although the Convention recognizes contributions from indigenous and local peoples, governments are only bound to support these systems 'as far as possible and as appropriate.'

Besides adopting the Convention in Nairobi in May 1992, the contracting parties also passed various resolutions. The last article, Resolution 3 'The Interrelationship between the Convention on Biological Diversity and the Promotion of Sustainable Agriculture,' recognizes '. . . the need to seek solutions to outstanding matters concerning plant genetic resources within the Global System for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Sustainable Agriculture, in particular . . . farmers' rights.' If benefits are emphasized in the implementation of the Convention, indigenous and local communities could benefit from it. Although the Convention recognizes contributions from local communities in the development and conservation of genetic resources, it does not recognize community property rights. The emphasis on national sovereignty not only indicates the efforts of governments in developing countries to control their resources against foreign actors. The control at the state level is also strengthened in contrast to the local and indigenous level. To counter this, participation of local actors should be required as an element of any contract on access and utilization of genetic resources. Reid proposes that: '. . . collectors negotiate equitable arrangements with the local communities, wildland administrators, private landowners, farmers, healers who were the custodians of the biodiversity collected or who contributed to the development or discovery of valuable genetic or biochemical resources.'[23] In each country, non-governmental organizations can play an important role in the implementation of this element.

Technology transfer

Transfer of technology from the North to the South was one of the major demands from the South in the negotiations leading to the Convention.[24] The Convention allows transfer of technology in two situations—to the providers of germplasm for technology developed from the germplasm provided (Article 16(3)) and the transfer of technology relevant to the conservation and sustainable use of biodiversity (Article 16(1)). Both types are directly linked to the South's transaction objects. The first type is related to the South's disposition of much of the world's gene pool. The second is related to the ultimate goal of the Convention which is the maintenance of biodiversity, the bulk of which the South controls.

In the negotiations, the G-77 group demanded a general transfer of technology in exchange for the transfer of germplasm and conservation of biodiversity. In yielding to this demand, however, the North insisted that the transfer be restricted to technology relevant to conservation. Although the Convention does not open for a general transfer of technology, the two bases for technology transfer, in their own different ways, cover much more than technology for conservation purposes. Firstly, a CPGR is given rights to technology which makes use of the particular genetic resources regardless of the purpose. Secondly, Article 16(1) could be interpreted to include a broad range of technology related to the use of biodiversity and genetic resources. The limits here will depend on how strict environmental requirements will be put into the interpretations of the phrases 'sustainable use of biodiversity' and use of genetic resources that 'do not cause significant damage to the environment'. Developing countries, and in particular those with a certain degree of technological capacity such as Brazil and India, have placed an emphasis on biotechnology.[25] It is clearly stated in the Convention that biotechnology is included in the two kinds of transfer of technology.

The extent of the transfer of technology as a result of the Convention hinges on its ability to tear down three barriers—formal, economic and internal. Formal barriers include legislation which restricts the transfer of technology.

Intellectual property rights (IPRs) such as patents may increase the transfer of technology to developing countries because the patent descriptions reveal the technology. Nevertheless, a patent gives the holder of technology the right for a certain period of time (usually about 15–20 years) to exclude others from access to and utilization of the technology. The holder decides whether he will allow others to use the technology in exchange for payment. Exclusivity and accessibility are two opposites, therefore, it is no surprise that the North and the South have taken different positions on the

issue of IPRs during the General Agreement on Tariffs and Trade (GATT) and UNCED negotiations.

Developing countries have tried to get the Convention to allow them access to technology from developed countries which is restricted by patents. They have also wanted the Convention to ban the patenting of genetic material from developing countries. Developed countries, and especially the USA have strongly opposed such attempts.[26]

The Convention recognizes IPRs, although it also gives developing countries some opportunities to access patented technology. Article 16(2) states, '. . . In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights . . .' In Article 16(3), the Convention opens for access to patented technology for: 'Contracting Parties, in particular those that are developing countries, which provide genetic resources.'

Article 19(2) says: 'Each Contracting Party shall take all practicable measures to promote and advance priority access on a fair and equitable basis by Contracting parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting parties. Such access shall be on mutually agreed terms.'

American industry has expressed fear that the Convention would coerce companies to turn over patented technology by compulsory licensing. However, these paragraphs cannot be interpreted that widely. Firstly, only a CPGR can benefit from these paragraphs, and such countries only get access to technology based on particular transfer of germplasm. The Convention does not give a general right to the developing countries to access patented technology. Neither are such rights linked to the purpose of conservation and sustainable use of biodiversity.

Secondly, the Convention does not provide legal means for coercing companies to transfer patented technology. The provisions are purely voluntary and based on 'mutually agreed terms' between a company and a CPGR in a deal previous to any transfer of genetic material and eventual patenting based on these materials. Article 16(5) states: 'The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.' In the USA, the biotechnological and pharmaceutical industries have expressed fear that this paragraph could be used to restrict IPRs.[27] Such restrictions could happen within each country as well as in the proposals of the Trade Related Intellectual Property Rights (TRIPs) in the GATT.

However, proponents of IPRs may argue that IPRs are supportive of the objectives of the Convention. IPRs are said to make genetic resources of the South more attractive for companies. Therefore, companies would be more eager to make deals for germplasm transfer which would result in technology transfers.[28] Although the text is vague, it may also be used to argue against IPRs. However, '. . . if Southern countries can maintain pressure for its suitable interpretation, and clearly show that IPRs work against the interests of biological conservation, then this clause could well work to their advantage.[29] Industries have little reason to fear from the Convention's stance on IPRs, and developing countries are likely to gain only small reductions of formal barriers against transfer of technology.

Economic barriers are the costs connected to IPRs and the purchase of equipment. The Convention could reduce the economic barriers in two ways. Firstly, it states (in Article 16(2)) that the transfer of technology to developing countries 'shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed . . .' This can be interpreted to be a recommendation that the price on technology should be kept below the market price. The phrase may mean that a worthy technology buyer from the South should be offered a better price than any other buyer. The terms must, however, be agreed on by both parties. The Convention encourages countries with technology to choose appropriate legislative, administrative or policy measures to facilitate favourable terms (Article 16(3)). Governments of developed countries could therefore make arrangements to compensate companies for any losses incurred in selling technology. Secondly, the transfer of technology may be provided in accordance with the financial mechanism established by Articles 20 and 21 (Article 16(2) and (3)). This implies that part of the funds contributed to enable the implementation of the Convention may be used for buying technology in the market for the South, for example, by financing royalties. Both ways of reducing the economic barriers are directed to all developing countries, the concern being with technology for the purposes of conservation and sustainable use of biodiversity. The second method also specifically refers to CPGR.

Internal barriers comprise the lack of important resources to introduce and utilize new technology. This includes a lack of qualified scientists and technologists as well as private and public organizational capacity in the field. This goes hand in hand with the lack of human and institutional resources to monitor and estimate the type and amount of technology that is applicable and useful.

Articles 17, 18 and 19 deal with efforts that may tear down internal barriers. The first two are oriented towards conservation and sustainable use of biodiversity. Article 17 deals with exchange of information and scientific

results, including information on training and surveying programmes, and recognizes the special needs of developing countries. Technical and scientific co-operation is dealt with in Article 18. Paragraph (2) states that '. . . In promoting such co-operation, special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building.' Further, paragraph 3 says that 'The Conference of the Parties, at its first meeting, shall determine how to establish a clearing-house mechanism to promote and facilitate technical and scientific co-operation.'

Article 19 deals with special rights of Contracting Parties which provide genetic resources for biotechnology research. Paragraph (1) gives the CPGR the right to participate effectively in the biotechnology research on their germplasm. The paragraph requires that each Contracting Party shall take legislative, administrative or policy measures, as appropriate, to provide for such participation. Where feasible this is to be carried out in the CPGR.

The Convention clearly addresses questions concerning internal barriers. Though research may not necessarily yield much in terms of relevance for the CPGR, these countries could benefit from the capacity-building that results.

The reduction of formal barriers is restricted to the provision of genetic resources for specific material on mutually agreed terms. Both reductions of economic and internal barriers are addressed in the Convention in such a way that all developing countries can use them for purposes of conservation and sustainable use of biodiversity. Also for these matters, CPGR are especially emphasized for arrangements of mutually agreed terms. Countries that do not possess the necessary conditions to benefit from providing access to genetic resources would hence have less to gain. The final results, however, will depend on specifications in the implementation phase.

Various remedies could be applied in the implementation of the Convention to increase the transfer of technology. Much of the technology transfer of the Convention is connected to the transfer of genetic resources. As such, the remedial action to establish the conditions precedent to the South benefiting from the application of national sovereignty will also improve the ability of the developing countries to gain technology.

The formal barriers can be reduced if agreements regarding access and utilization of germplasm emphasize technology transfer. Although patents give the holders the right to exclude others from utilizing technology, the patents may be an important source of information on technological development that could be used by the South. IPRs restricting the transfer of technology for the purposes of conservation and sustainable use of biodiversity can be considered to run counter to the objectives of the Convention as expounded in Article 16(5). Developing countries could ap-

proach Contracting Parties holding such patents and request a transfer of this technology. In contracts on germplasm transfer, economic requirements for the concomitant technology transfer can be emphasized. Furthermore, governments of the North could be requested to create legislative, administrative or policy measures to ensure that their companies provide technology transfer on fair and most favourable terms. Special projects for technology transfer could be designed as part of the financial mechanism of the Convention. Such projects can target the tearing down of internal barriers to technology transfer.

Notes

1. Article 1, Convention on Biological Diversity.
2. Coleman, 1990.
3. Coleman, 1990, p. 29.
4. Coleman, 1990, p. 35.
5. This was the number of countries participating in the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity at UNEP Headquarters, Nairobi on May 22, 1992.
6. The Convention on Biological Diversity in Article 2 (Use of Terms) defines *biological diversity* as 'the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.'
7. Sendaro, 1993.
8. The Convention on Biological Diversity in Article 2 (Use of Terms) defines *genetic resources* as 'genetic material of actual or potential value.' Genetic material 'means any material of plant, animal, microbial or other origin containing functional units of heredity.'
9. Article 2 (Use of Terms).
10. Kloppenburg Jr. and Kleinman, 1987b.
11. Wilson, 1988, p. 8.
12. Article 36, Entry into Force, Convention on Biological Diversity.
13. Keystone Center, 1991.
14. Wilson, 1988, pp. 3–5.
15. SAREC, 1992.
16. Reid *et al.*, 1993a.
17. Kloppenburg Jr. and Rodriguez, 1992.
18. Oteng-Yeboah, 1993.
19. Sandlund, 1991.
20. Koester and Prip, 1993.
21. Wood, 1993.
22. Friis-Hansen and Kronik, 1993.
23. Reid *et al.*, 1993a, p. 19.
24. A condition for transfer of technology is that the technology is accessible. The use of the expression *transfer of technology* in this chapter therefore includes access to technology.
25. The Convention gives a very wide definition of *biotechnology* in Article 2 (Use of Terms), as 'any technological application that uses biological

systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.'

26. Porter, 1992.
27. Porter, 1992.
28. Duesing, 1992.
29. Kothari, 1992.

4

Beyond the Biodiversity Convention: A view from India

ASHISH KOTHARI

Biodiversity has certainly been centre stage in world environmental politics in the last few years. This is not surprising, for the conservation and wise management of biodiversity is critical to the survival of humanity. Control over a resource as basic to survival as biodiversity automatically translates into control over people's lives, and consequently control over communities and nations.

It is widely recognized that the majority of the world's biological wealth is contained in the tropical regions, under the jurisdiction of southern countries. Yet in recent history, access to this wealth has been cornered by the industrial nations of the North, by processes of colonization, and by other weapons of economic and military dominance. To add insult to injury, the benefits accruing to the northern countries and companies from the use of biological resources, including those from biotechnology, have not been accessible to the South. In addition, the decision-making elites in the South have been more than eager to follow in the footsteps of their northern counterparts, forcing their countries down paths of development which are fundamentally unsustainable and inequitable.

In a situation like this, what chance for success does the Convention on Biological Diversity have? Can it help to change the power relations between and within nations which create and foster the destruction of biological diversity? Can it help in any way to empower those nations and communities which have been systematically disempowered over the last few generations?

It is the contention here that *the Convention does not explicitly address the global and national roots of biodiversity destruction, and pays mostly lip-service to the genuine needs of disprivileged people everywhere. Yet, even with its weak and inadequate terminology, it provides some basis for action, some possibilities of reversing many historical inequities between and within countries*. For this possibility to become manifest, however, a considerable effort at re-interpreting and looking beyond the Convention is necessary.

Biodiversity in India

India's biodiversity is one of the most significant in the world. Some 45,000 wild species of plants and micro-organisms and over 77,000 wild species of animals have so far been recorded.[1] These comprise about 6.5 per cent of the world's known wildlife. Given that a number of biologically-rich areas in the north-east are not yet fully explored and studied, the recorded wild biodiversity is likely to be only a part of what actually exists.

It is not only the sheer diversity which is significant, but also its uniqueness. As much as 33 per cent of the flowering plants and 18 per cent of all plants are believed to be endemic only to India. Exceptional diversity is found in taxa such as ferns with 900 recorded species and orchids with 1,082 species. In the case of amphibia, 62 per cent of the species are believed to be found only in India. High diversity is found among butterflies and moths, with about 13,000 species already recorded, and birds of over 1,200 species.[2]

Equally impressive is the range of domesticated biodiversity. The Indian subcontinent was called the 'Hindustan Centre of Origin of Crops and Plant Diversity' by Russian scientist N.I. Vavilov.[3] At least 166 species of crops and 320 species of wild relatives of crops are known. Within each of these species, the diversity of varieties is astounding. Until recently, there were an estimated 50,000–60,000 varieties of rice grown in India. Other crops with rich diversity include wheat, sugarcane, legumes, sesame, eggplant, okra, citrus species, banana, mango, jamun (*Syzygium* spp.), jute, ginger, turmeric, pepper, cinnamon and cardamom. Similarly significant is the indigenous livestock diversity, with 27 breeds of cattle, 40 breeds of sheep and 22 breeds of goats.[4]

At least 10 per cent of India's recorded wild flora and possibly a larger fraction of its wild fauna are on the threatened list, many of them on the verge of extinction. This is not surprising, for in the last few decades India has lost at least 50 per cent of its forests, polluted over 70 per cent of its waterbodies, built or cultivated over much of its grasslands and degraded most of its coasts. To this habitat destruction have been added hunting,

over-exploitation, poisoning by pesticides, excessive botanical and zoological collection, displacement by exotic species and a host of other activities.

No-one can say for sure how many species have already disappeared. The cheetah (*Acinonyx jubatus*) and the pink-headed duck (*Rhodonessa caryophyllace*) are amongst the few conspicuous losses. There are hundreds, perhaps thousands, of species which are gone forever, unsung and unrecorded, because they were not glamorous enough or were simply unknown. One example, an evergreen tree (*Madhuca insignis*), has not been seen for over a hundred years. Its typical locality in south-west India was once covered by dense evergreen vegetation, but severe deforestation and selective felling have resulted in its extinction.[5] The process continues for thousands of other species and subspecies, as unexplored habitats continue to be destroyed. The Silent Valley rainforest in the southern state of Kerala revealed several species never recorded before in the world. Plans to build a hydro-electric dam there were shelved following strong public protest; most other areas earmarked for development have not been as fortunate.

India's domesticated flora and fauna have had a similar fate. Hundreds, possibly thousands, of crop varieties have disappeared from the field, and not all of them are stored in genebanks. No one in India, unfortunately, knows clearly how much has been lost, or indeed, is still being lost. Genetic erosion has occurred due to the spread of modern agriculture. Since the advent of the dwarf varieties of wheat, imported from Mexico in the 1960s, a handful of seeds generated in the laboratory have replaced countless indigenous varieties. This is most evident in crops like rice, the broad genetic base of which provided insurance against pests, diseases and drought and which was a bank for desired characteristics like productivity, nutritional value and residue fodder potential. Perhaps equally important, these varieties were culturally valuable: there were rice varieties which would be grown for their scent, taste or colour (red or black is considered sacred).

India's efforts at countering the rapid erosion of biodiversity have been significant and varied, ranging from one of the world's largest networks of protected areas (almost 500 national parks and sanctuaries) providing *in situ* conservation, to an ambitious project to document and preserve germplasm of domesticated plants, livestock and fish in *ex situ* conditions. Yet, the slide continues because much of the conservation has been done in disregard of the real needs of the Indian population.

Global and national roots of biodiversity destruction

It is becoming increasingly evident that the roots of biodiversity destruction lie in the relations between communities within nations, and between

the nations of the world. These relations corner and manage the majority of biological resources for the benefit of a minority elite in poor nations and for the wasteful consumption patterns of the North. In a large number of southern countries the seeds of this destruction were laid during the colonial era; in India, for instance, large-scale commercial forestry started in British colonial times. Neo-colonial exploitation continues: over 18 million hectares of Amazonian forest have been cleared in Brazil to satisfy the European and American coffee demand; Germany's timber consumption causes degradation of 200,000 hectares of rainforest each year; Japan has laid a huge chunk of Goa bare to meet its demands for iron ore. The examples are legion.[6] Adverse terms of trade, protectionist policies of the North, dumping of hazardous and environmentally-destructive technologies and materials by the North into the South and other factors continue to cause severe and widespread biodiversity destruction. The same goes for the exploitative policies followed by the elite in southern countries. Vast areas have been plundered to meet the ever-growing consumption needs of this minority, aided by laws which legitimize urban-industrial control over resources.[7] The poor are forced to strain the meagre resources that are left in their control; they are then portrayed as ecological culprits. In countries like India, development policies and projects have rarely been sensitive to the need for biodiversity conservation, and to the interests of local communities. The government's failure to remove poverty has enhanced conditions in which sensible natural resource management assumes low priority.

The Convention on Biological Diversity only touches some of these issues and completely ignores others. Article 6 commits countries to 'integrate, as far as possible and as appropriate, the conservation and sustainable use of biodiversity into relevant sectoral or cross-sectoral plans, programmes and policies'; Article 10 commits them to 'integrate consideration of the conservation and sustainable use of biological resources into national decision making'; while Article 14 requires that they 'introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biodiversity with a view to avoiding or minimizing such effects.' Countries are, however, required to do all this only 'as far as possible and as appropriate', which gives them the freedom to do nothing at all.

In India, citizens' groups have started mounting pressure on the government for a thorough review of national development policies to make them sensitive to biodiversity conservation concerns. The Central Ministry of Environment and Forests appears willing to facilitate such an exercise, but it will require an uphill and drawn-out struggle to get other sectors of the government to change. Indeed, the recent economic changes in India, par-

ticularly the World Bank-inspired liberalization and structural adjustment process, may make this task virtually impossible.[8]

The precise impacts of development policies and projects on biodiversity are not well-studied in India; this would become necessary if the country was committed to following Article 14 of the Convention. India already has in place a system of Environmental Impact Assessment (EIA) for development projects, but this is restricted to public sector (governmental) projects and does not as yet cover the private sector. EIA criteria do not have biodiversity as a specific concern, although the impact on wildlife is supposed to be considered. A comprehensive EIA notification—making environmental clearances for most kinds of development projects legally mandatory under the Indian Environment Protection Act of 1986—has been pending with the government for over a year. Strong resistance has come from industrialists and politicians, but citizens groups are pressuring the government to incorporate biodiversity criteria in the EIA notification.

While elements of the Convention can be used for integrating biodiversity concerns into national planning, *there is in the Convention no mention whatsoever of global consumption patterns, terms of trade or other international roots of the biodiversity crisis.* A clause in an earlier draft which committed countries to 'take into account the effect of . . . international trade policies' was dropped in the last round of negotiations.

Countries of the South and people all over the world must demand a commitment from the North towards drastic restructuring of the world economy and far-reaching structural adjustments within northern economies. In the absence of global restructuring, critical aspects of the Convention are likely to exist only on paper.

There should be a review of the role of international aid agencies regarding the worldwide destruction of biodiversity. In this context it is alarming that the Earth Summit in Rio de Janeiro in 1992 endorsed the World Bank's claim to being the planet's environmental guardian. Within India, several citizens' groups have expressed concern over the increasing incursion of the Bank into conservation, education and health sectors.

Access to genetic resources

A victim of the North-South conflict during the run-up to the signing of the Convention at the Earth Summit was the ethically superior position of biodiversity as a global heritage. Throughout history, biological species and varieties, technologies and knowledge related to them have been openly exchanged between societies and individuals, resulting in all-round enrichment. This was also the spirit within which the International Undertaking on Plant Genetic Resources was formulated under the aegis of the Food and Agriculture Organization (FAO). However, in an unequal world, a

common heritage has every chance of being misused. Thus, the last two centuries have seen the countries of the North, themselves poor in biodiversity, literally looting the resources of the biologically-rich nations of the South while creating protectionist systems to monopolize the technologies and benefits arising out of these resources. A common heritage has been turned into a colony for the North. No wonder that in the negotiations for the Convention, countries of the South fought for the deletion of the terms *common heritage* and for the acceptance of the principle of national sovereignty over biological resources. Apart from the supreme arrogance of imposing political boundaries on nature, this is a sad diluting of the morally stronger position of common heritage but one which seems inescapable in a politically and economically unequal world. It has been argued by some[9] that the concept of biodiversity as a global commons must not be abandoned, even if it has been compromised in the Convention. Common heritage should include not just genetic resources but also biodiversity-related knowledge and biotechnologies.

In this respect, the Convention has been disappointingly silent on the question of access to international genebanks. It is well-known that a considerable part of the South's genetic variability is present in genebanks in the North, including species and varieties which are now impossible or very difficult to find at their original locations.[10] The Convention must be amended, or a protocol developed under it, to *make open access to these genebanks mandatory, and to encourage the repatriation of not just the resources but also the benefits derived from them.* It is interesting, in this respect, that Indian citizens have open access to the active genebank collections (such as the National Bureau of Plant Genetic Resources—NBPGR) maintained by the Indian government.[11]

Unfortunately, recent developments within India appear to be going further down the one-way street of open access to the South's biodiversity without concomitant access to the North's breeder lines or biotechnologies. The United States Agency for International Development (USAID) has agreed to provide a sum of US$13 million to India for setting up a genebank and related facilities. The NBPGR is to maintain these facilities, such that by 1995 a comprehensive inventory will have been completed of almost 120 germplasm collection units so that a computerized database management system and plant germplasm will be readily available for research purposes to scientists in the public and the private sector in India and worldwide. However, no concomitant commitment has been made by the USA to provide access to genetic materials or other benefits derived from the germplasm collected within India.[12] In future, American scientists or companies might patent such genetic material and withhold it from Indians or others.

Life forms, biotechnology and property rights

Indian officials have consistently stated that they would oppose the signing of the Convention if northern countries continued to deny or restrict access to biotechnologies arising out of the resources and knowledge obtained from the South. One of the most insidious ways in which industrialized countries have been doing this is in the form of patents or other forms of monopolistic intellectual property rights (IPRs). It is not surprising that this was hotly debated in the Convention negotiations.

For the last few centuries, colonial and neo-colonial powers have been freely taking resources and knowledge from the societies of the South, working on them in their laboratories, and presenting new biological materials to the world. Using the argument that these materials are the outcome of millions of dollars worth of experiments, they want to establish patents, ostensibly to guarantee suitable returns for the producers but more obviously to maintain monopolies for maximum profit. The problem is that it is not only pharmaceutical products, but also seeds, genetically-modified organisms and germplasm that are coming under the widening net of patents. US patents on genetically-altered mice[13] are amongst the first animal patents in the world. Species discovered in the wild are now open for plant patenting or plant breeders' rights, which also confer some monopolistic rights to their owners. In the USA, a plant patent has reportedly been given to a plant 'discovered' in Guatemala, even though it had apparently been known to people in that country, because in the USA, anything which has not been previously patented or described in a printed publication is considered novel and therefore capable of being patented.[14] It may not be long before even naturally-occuring organisms will be patentable.

From the point of view of a considerable number of people in the South, one issue is critical: humans do not, and should not, have the right to monopolize another life form. This is a natural corollary of a world-view, prevalent even now in many parts of India, that other creatures are fellow beings, *not* items of commerce. It is unfortunate that the Convention was unable to take a firm position on this. Future development of the Convention must come to grips with this, amending the text or putting into place a protocol to prohibit the extension of IPRs to life forms. It will be very difficult, but it is not impossible, to imagine a situation in which many nations and citizens' groups manage to raise this demand and force the reversal of recent patenting trends in the USA and other countries. India has so far resisted pressure to amend its Patent Act to allow for patenting of life forms due to the stand taken by some sensitive officials, a large number of members of parliament and citizens' groups. It will hopefully continue to take this stand.

The Convention gives some (rather remote) hope of reversing the trend towards patenting biotechnologies. Article 16 commits countries to 'provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biodiversity or make use of genetic resources and do not cause significant damage to the environment.' Moreover, such access/transfer is to be 'under fair and most favourable terms, including on concessional and preferential terms where mutually agreed.' Article 16(2) attempts to dilute this by stating: 'In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights.' This insertion, made at the insistence of the USA and some other countries at the last stage of the negotiations, is most unfortunate. But perhaps it can be countered by Article 16(5), which states: 'The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of the present Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to the objectives of this Convention.'

The formulation is weakly and unclearly worded, especially because of the caveat 'subject to national legislation'. Nevertheless, if southern countries and citizens' groups worldwide can maintain pressure for its suitable interpretation and clearly show that IPRs work against the interests of biodiversity conservation, then this clause could well work to their advantage. In that sense, one demand that should continue to be made is to subject the relevant negotiations under the General Agreement on Tariffs and Trade (GATT) and other fora to the overall objectives of the Convention. Clause 3(b) of Section 5 of the Dunkel Draft, on the patentability of plants, should then stand revoked. Perhaps Article 22(1) of the Convention, which appears to disallow 'serious damage or threat to biodiversity' caused by the 'exercise of rights and obligations', could be used to advantage here.

Disciplining the powerful private corporate sector is critical. Just as southern nations are being asked to negotiate resources over which local communities have traditional rights, northern countries should be able to negotiate on behalf of their private sectors. Northern governments repeatedly state that a number of formulations relating to patents and technology transfer are not negotiable since these are in the hands of the private sector. This is unacceptable, particularly since there is little that private companies can do in this field without governmental support, especially in terms of gaining access to southern countries and pursuing protectionist policies. The Convention, Article 16(4), states that: 'Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the

aim that the private sector facilitates access to joint development and transfer of technology . . . for the benefit of both governmental institutions and the private sector of developing countries.' Again, this weak formulation provides a base on which to build.

The Convention could become one of the South's few effective weapons against the increasingly monopolistic and North-dominated international trade regime which economically-indebted nations such as India are finding hard to resist. The South's biological resources are great assets and can be used as bargaining power. This requires an unprecedented show of solidarity amongst the gene-rich nations of the world.

Rewards and incentives for traditional innovators

While resources and information, which are for the benefit of humanity as a whole, should not be shackled by private monopolistic restrictions such as patents, those who work towards gaining these resources and information should be suitably rewarded, but why reward only formal sector scientists and corporations? Rewards should also be given to the countless indigenous and traditional communities which have for centuries been conserving biodiversity and finding new uses for it. Why not also reward farmers who for generations have been discovering wild plants worthy of cultivation and engaging in their own cross-breeding and selection methods to continuously refine agriculture? Almost all of the 'miracle discoveries' of modern technology are based on this traditional wealth of knowledge and resources. Looked at this way, the North and the elite of the South have an incalculable, continuing debt to traditional communities all over the world.

The Preamble to the Convention recognizes 'the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components.' Further, Article 8(j) states that each signatory country will,

> subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

Such a formulation was obtained after a great deal of debate in the negotiating sessions. Attempts were made to water it down considerably,

perhaps because official delegates realized that indigenous and other traditional communities within their countries stand to gain by it. One way of diluting it was to place it in Article (8) on '*In situ* Conservation', thus leaving wide open the question of rewarding local communities in other areas, including in *ex situ* commercial operations (although this could possibly be covered by the formulation in the Preamble). In addition, the words 'subject to its national legislation' were added to accommodate the interests of the USA, although many other delegations felt this was unnecessary and undesirable.

The weakened formulation notwithstanding, these parts of the Convention must be used by indigenous and other traditional peoples and by the groups that work with/for them. National policies on forests, wildlife and agriculture must be modified to incorporate these concerns. Then only will traditional communities whose knowledge base and resources are under constant threat of elimination by the forces of modernization be able to use the Convention's provisions guaranteeing them protection, much like the Universal Declaration of Human Rights has been used by communities whose basic rights are threatened.

The issue of 'equitable sharing of benefits' is of course, a thorny one, especially since genetic resources are not easily 'costed'. The price of a wild plant, for instance, can reflect only the collection and preservation costs or the foreseeable potential commercial benefits which might accrue. Other problems include the difficulty in deciding *who* the beneficiaries are and *how* the benefits should be disbursed. The much-publicized Merck-INBio agreement suffers from several of these problems: the royalties go to a recently-created private organization (INBio) which is negotiating resources that are in the public domain; the deal involves a great amount of secrecy; there is little public participation in it; Merck is under no obligation to make products (including genetic materials) derived from the germplasm collected accessible; and instead of developing local capacity to utilize the genetic wealth of the forests, the deal only ensures certain monetary inflows. As has been pointed out, 'the Merck deal is within the classical colonial division of labour with genetic resources taking the place of natural resources such as oil or copper.'[15]

Citizens' groups and sensitive government officials need to urgently evolve principles and strategies which can achieve some degree of fair and equitable sharing of benefits, not merely to government agencies but more critically to local communities, while not falling for the pitfalls of the Merck deal.

The rights of local communities

The greatest anomaly in the position of southern nations during the negotiations was that even while they stridently asserted national sovereignty

over biological resources, they tried to underplay the rights of their own local communities. Indeed, in its current form Article (8) on '*In situ* Conservation' may end up strengthening Western notions of biodiversity (read: wildlife) conservation, wherein local communities have been thrown out of protected areas or have had their rights and activities severely curtailed. Such an approach, adapted in India as in many other southern countries, has succeeded in protecting species and habitats in the short run, but done incalculable harm in the long run by alienating local people. Several observers have noted that national parks and sanctuaries have been set up in independent India much as reserved forests were set up by the British colonialists, the essential common element being the exclusion of the people who reside in the area.[16] In many instances, areas have been closed off to local communities, only to be opened up to massive tourist traffic. It is not surprising that local people have often turned hostile to wildlife conservation attempts or at the very best become passive onlookers while officials struggle to conserve the area. It is now recognized that this 'guns and guards' approach is not in the interests of biodiversity conservation or a genuine democracy. Yet it remains the prevalent practice, and the Convention only weakly attempts to modify it.

The final draft of the Convention has a qualified recognition of the interests of local communities in areas of significant biodiversity. There is a commitment, in Article 10(c), to 'protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.' There is also the formulation in the Preamble quoted above. These provisions are weak and inadequate: there is, for instance, no explicit and unambiguous guarantee of the *rights* of local people in areas to be conserved for biodiversity. This has generated considerable criticism from citizens' groups in India, especially those working with traditional communities. The fear that the anti-people approach to wildlife conservation may be reinforced by the Convention is further strengthened by the entry of agencies such as the World Bank into the field of biodiversity, since such agencies have little previous record of respecting the rights of local communities. If the Convention is to generate public support for its objectives, domestic and international pressure for future amendments to the Convention, or for specific protocols under the Convention, must tackle the issue of community rights.

Agricultural biodiversity

The Convention provides some faint hope of bringing attention to a long-neglected aspect of biodiversity: the erosion of cultivated and domesticated animals and plants. The worldwide spread of modern intensive

agriculture and animal husbandry has displaced thousands of varieties of cultivated crops and domesticated animals, making way for a handful of laboratory-generated varieties. This genetic erosion has proved disastrous for the food security of many nations and local communities and could prove so for humanity as a whole.

Under Agenda 21, the chapter on sustainable agriculture contains some of these points. However, since Agenda 21 is non-binding on countries and could remain only a statement of pious intent, there is a need to incorporate these concerns into something more substantial.

Unfortunately, these issues find only a weak mention in the Convention. In fact, whether the Convention deals with domesticated living beings at all or not was unclear till the February 1992 negotiations, when some delegates and some NGOs had to push for explicit recognition of this. However, the Convention remains heavily biased in favour of wildlife, with little elaboration of the steps needed to save domesticated life forms. For instance, it defines '*in situ* conservation' as including 'in the case of domesticated or cultivated species, the surroundings where they have developed their distinctive properties'. This would presumably include farmers' fields in areas where indigenous crop or livestock varieties have been used or developed. In the article on '*in situ* conservation', however, the text only mentions 'natural habitats' and 'natural surroundings' (Article 8(d)), and appears to leave out domesticated biodiversity.

In a country like India it is vital to guarantee some kind of protection and encouragement to farmers growing traditional varieties and to ensure that new laboratory-generated varieties do not indiscriminately displace traditional ones. In this regard India, for instance, would have to completely change the environmentally and socially-destructive Green Revolution strategies.[17] The Convention only vaguely commits countries to do so and provides plenty of loopholes. The following clauses, apart from Article 8(j), are relevant in this respect:

- 'Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology . . .'(Article 8(g));
- 'Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats, or species' (Article 8(h)) (providing species here includes varieties);
- 'Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements' (Article 10(c));
- 'Adopt economically and socially-sound measures that act as incentives for the conservation and sustainable use of components of biological diversity' (Article 11).

The last clause is important, for financial and economic incentives will certainly be necessary to encourage farmers to retain their traditional crop and livestock varieties, thus foregoing the greater short-term gains of modern 'improved' varieties.

It is critical that *in situ* conservation of crops and livestock on farmers' fields, the acceptance of farmers' rights and farmers' participation in biodiversity conservation are guaranteed in the Convention itself. The seeds of these are already in the text; it is now up to citizens' groups to ensure a wider interpretation and expansion into appropriate protocols.

The hazards of biotechnology

Increasing evidence is surfacing to show that the picture of biotechnology as humanity's saviour is seriously flawed, its exciting potential being tempered by its capacity to induce biodiversity erosion, environmental and health damage and greater economic and social inequality within and among nations.[18] The Convention is weak in this respect. During the Convention negotiations, there were several attempts by people's groups to get delegates to propose a separate article on safety in the development and use of biotechnologies. These moves were resisted by most delegations. The result is that the Convention comes out sounding extremely positive about biotechnology, with little caution built in.

Article 8(g) commits countries to 'establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental effects that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health.' Article 19(3) suggests that 'the Parties shall consider the need for and modalities of a protocol setting out appropriate procedures including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity.' It is imperative that citizens' groups use these clauses to pursue a protocol which covers genetically modified organisms (GMOs) and ensures biotechnology development and use which do not result in ecological and social havoc.

In this context, India has recently set out regulations regarding genetically manipulated organisms, under its Environment Protection Act of 1986.[19] These rules lay down procedures for environmental impact clearances, and for periodic checking of premises and processes handling GMOs. Central authorities have been set up under these regulations, including the Review Committee on Genetic Manipulation under the Department of Biotechnology, which is supposed to 'monitor the safety-related aspect

in respect of on-going research projects and activities involving genetically engineered organisms/hazardous micro-organisms, GMOs or cells.' A Genetic Engineering Approval Committee is to function under the Ministry of Environment and Forests 'for approval of activities involving large-scale use involving over 20 litres of hazardous micro-organisms, GMOs or cells in research and industrial production from the environmental angle' and 'for environmental clearance of proposals relating to release of GMOs and products into the environment including experimental field trials involving more than 10 litres culture volume.'

The Indian regulations are too new for their effectiveness to be assessed, but they could become a basis for similar regulations in other countries. Citizens' groups are urging the Indian government to formulate a draft protocol to be placed before the Conference of Parties or other appropriate body, immediately after the Convention is ratified. This is necessary to forestall possible attempts by some industrialized nations to scuttle any checks on GMOs and biotechnology.

Financial mechanisms and technology transfer

The two most contentious parts of the Convention, relating to financial mechanisms and technology transfers, were finally sorted out at the last negotiating round in May. With regard to funding, the final text of the Convention must be considered to have scored a victory of sorts for the southern countries. Article 20 commits 'developed country Parties (to) provide new and additional financial resources to enable developing country Parties to meet the agreed full incremental costs to them of implementing measures which fulfill the obligations of this Convention . . .' Article 21 states categorically that any mechanism to administer funds for the Convention must be under the authority of the Conference of Parties, which is a one-country, one-vote body. This mechanism must also 'operate within a democratic and transparent system of governance'. The Global Environment Facility (GEF) has been accepted as an interim mechanism only 'provided it has been fully restructured in accordance with the requirements of Article 21'. Since there are little chances of this donor-dominated, World-Bank-controlled fund becoming 'democratic and transparent' and accepting the authority of the Conference of Parties, it is more than likely that a new mechanism will have to be formulated at the first meeting of the Conference of Parties after ratification of the Convention. This reformed text is reported to be another main reason why the USA, so used to having its say in bodies like the World Bank, backed out of the Convention.

The claim of the South to the finances and technologies of the North is strategically important and morally justified considering the overwhelming

global damage that northern countries have caused. Also important are the nature and quantum of this transfer, for *the flow of finances and technologies to the South in the prevailing set-up will not necessarily enhance biodiversity conservation.* Such flows could in fact reinforce domestic plans and programmes which only pay lip-service to biodiversity. A global biodiversity fund can become helpful only when it is democratically managed (unlike the donor-dominated, World Bank-controlled international fund, the GEF), open and transparent to public scrutiny, flexible in its scale so as to allow for very small grants and sensitive to the environmental and cultural context of the recipient country. A proposal for an alternative fund to the GEF has recently been made by the World Wide Fund for Nature–India.[20] It has suggested a Southern Green Fund (SGF), which functions on a one-country, one-vote system, is sensitive to every country's priority needs and makes NGO/community participation mandatory in the process of project preparation and implementation.

A current example of the importance of making sure funds reach the right place is India's eco-development project. In 1991, the Indian government asked for a substantial sum (US$10–12 million) from the GEF biodiversity funds for eco-development to divert human pressure away from biodiversity-rich areas. However, the proposal was formulated in an *ad hoc* manner, without consultations with even major citizens' groups, leave alone the local communities.[21] Eventually, the GEF funds did not come through, and the Ministry of Environment and Forests now proposes to involve a large number of citizens and community groups in the development of the plans. Hopefully, future funds will be utilized with much greater public participation, transparency and openness.

A whole set of alternative funding mechanisms is needed to achieve the objectives of the Convention. Bilateral funding between countries, private funding and aid arrangements between citizens' groups will have to be worked out. Non-governmental initiatives assume critical importance in view of the concern to put incoming money to good use.

The commitment of the North to provide technologies to the South has already been discussed. It must be recognized that if what is needed is technology appropriate to biodiversity conservation, then the South may have a lot to teach the North. A considerable variety of traditional skills and techniques, especially those related to agriculture, is ecologically sustainable; these need to be encouraged and revived, rather than displaced by modern technologies just because of their availability. *The talk of 'technology transfer' assumes a one-way, North to South transfer, which is not only narrow-minded, but also self-demeaning for countries with a rich tradition of relevant technologies.*

National conservation strategy and laws

Article 6 commits countries to 'develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity or adapt for this purpose existing strategies, plans or programmes . . .' Even prior to the Earth Summit, the Indian government had formulated the *National Conservation Strategy and Policy Statement on Environment and Development*.[22] While most of this document is directly or indirectly relevant to biodiversity, the specific action points on biodiversity are very brief. There is obviously a need to build up a much more detailed strategy. One step towards this is the recent commissioning of a comprehensive status report on Indian biodiversity by the Ministry of Environment and Forests, an exercise which is currently underway at the Indian Institute of Public Administration.

As part of the review of India's state of preparedness regarding biodiversity conservation, an extensive survey was recently conducted of relevant national legislation.[23] In an assessment of over forty acts, it was found that while aspects such as *in situ* conservation of and trade in wild flora and fauna were well covered, serious legal gaps existed with respect to conservation of domesticated biodiversity, restrictions on introduction of exotics and appropriate sharing of benefits of biodiversity use. Subsequent to the signing of the Convention, a review was also done of the status of legal instruments available in India to enforce its various clauses. This analysis shows that of the 80 action points emanating from the Convention, about 45 would require appropriate legal measures. Of these 45, as many as 28 have no legal backing, including the following:

- ensuring fair and equitable sharing of the benefits of genetic resources (Article 1);
- integration of biodiversity conservation into sectoral and cross-sectoral plans, programmes and policies (Article 6(b));
- respecting and preserving relevant traditional knowledge, practices, and uses (Articles 8(j) and 10(c));
- regulating activities having significant adverse effects on biodiversity (Article 8(l));
- introducing EIAs of projects with possible impacts on biodiversity (Article 14(1)(a));
- notifying other countries of activities having potential impacts on their biodiversity (Articles 14(1)(c) and 14(1)(d));
- ensuring appropriate access to biological resources and biotechnologies (Articles 15(2) and 16);
- providing information to countries where GMOS are proposed to be introduced (Article 19(4)).

The Government of India has now been urged by several research and activist groups to identify ways and means of plugging some of the major legal gaps identified, both to ensure biodiversity conservation within India and to fulfill the obligations under the Convention. The Ministry of Environment and Forests is actively considering a separate, overall legislation on biodiversity. There are obvious difficulties and dilemmas involved: how does one deal with both wild and domesticated biodiversity in a single act? How does one legislate meaningful measures in the absence of even basic knowledge on biodiversity among the concerned personnel, including the judiciary? What happens to the existing Indian Wildlife (Protection) Act of 1972? These and many other questions will have to be dealt with before a separate act can be decided on; meanwhile, the major thrust is likely to be on plugging gaps in existing legislation.

Initiating a consultative, democratic process

One of the worst aspects of the Convention, from the point of view of most citizens, is the thoroughly undemocratic way in which it has been pushed through. It should be incumbent upon any government which is going to negotiate an international treaty, to conduct a process of wide-ranging consultation with its citizenry. In India, most of those who are involved in scientific, environmental and developmental work were not involved at the preparatory stages. Neither the government nor any other agency has made a systematic attempt to feed information to the media and to citizens' groups, or to have hearings and consultations with a wide range of people whose lives will be affected by the Convention.

The Convention negotiations were, like most United Nations processes, almost purely an inter-governmental matter. Two or three government officials were representing the entire nation of 800 million.

What is equally surprising and disturbing is the almost total silence of the Convention text on the need to involve the non-governmental sector in biodiversity conservation. Even the subsidiary Body on Scientific, Technical and Technological Advice (Article 25) is to consist only of government representatives. This is an extraordinary and glaring lapse, given the increasing international realization of the role of citizens in environmental protection.

Issues of biodiversity and biotechnology are complex, especially in their relation to social, political and economic processes. The people of the world have a right to take part in any process of formulating and implementing international agreements. Even now it is not too late. Each government should immediately start a dialogue, with its citizenry, on the issues relating to the Convention. The dialogue should include academics, environmentalists, scientists, social activists, and most important, repre-

sentatives of traditional communities which are closest to the biodiversity to be conserved. Only when such a process is carried through, and a broad understanding and consensus reached, will the Convention be implemented to the benefit of biodiversity and people at large.

Some tentative steps have been taken in India in this direction. National level consultations have been held on the follow-up to the Convention, and a committee was set up by the Ministry of Environment and Forests to suggest relevant actions. The goal of making biodiversity conservation an effective movement, however, needs much more than some meetings and committees. One very important factor in biodiversity destruction is the growing alienation of people from the natural resource base on which their lives depend.[24] In India's rural areas, this alienation is a result of State policies which cordon off natural resource areas and usurp the role of managing and protecting them, and which encourage the displacement of conservation-oriented traditional cultures and technologies. In urban areas, alienation is a result of the physical and psychological distance between natural resources and their consumers. In such a situation, neither the rural nor the urban population has any incentive to conserve biodiversity.

If this is the case, the conservation of biodiversity can only come from a number of steps involving people's participation: giving back greater control over natural resources to local communities, reviving relevant tradtional systems, channelling benefits of biodiversity conservation to local people, formally involving people at all levels of decision-making, encouraging partnerships between formal sector scientists and local communities and encouraging mass public awareness and education. This last point is a commitment under the Convention (Article 13). In India, government and citizens started acting on these fronts even before the Convention. For example, Forest Departments and local communities are experimenting with joint management and control over forest areas, though the element of biodiversity has still to be injected. An experiment with Village Wildlife Sanctuaries is being proposed in the north-east. Local ethnobiological knowledge is being documented (under the Ministry of Environment and Forests' All-India Coordinated Research Project on Ethnobiology).[25] In 1992, a mass public awareness project, the National Environmental Awareness Campaign, had as its central theme 'Biodiversity', no doubt influenced by the Convention negotiations. Further actions have been suggested, such as translation of the Convention text into all major Indian languages, placing copies of the text in libraries and documentation centres all over the country, using popular folk media and popular science methods to spread the message of conservation and incorporating biodiversity concepts into relevant educational curricula.

Notes

1. NBRI, in press; ZSI, 1991.
2. NBRI, in press; Inger and Dutta, 1987; ZSI, 1991.
3. Vavilov, 1951.
4. Rana, n.d.; Sharma, pers. comm., 1992; Balain, in press; Singh, 1988.
5. Nayar and Sastry, 1990.
6. Tucker, 1988; Gadgil and Guha, 1992; Schucking and Anderson, 1991.
7. Singh, 1985; IIPA, 1992.
8. Kothari and Kothari, 1992.
9. Menon, 1992.
10. Querol, 1988.
11. Rana, pers. comm., 1992.
12. Menon, 1992.
13. Sahai, 1992.
14. Menon, 1991.
15. Menon, 1992.
16. Kothari *et al.*, 1989; Gadgil and Guha, 1992.
17. Shiva, 1991.
18. Hobbelink, 1991; Fowler and Mooney, 1990.
19. Government of India, 1989.
20. Chakraborty *et al.*, 1992.
21. Braatz, 1992; Chakraborty *et al.*, 1992.
22. Government of India, 1992.
23. Kothari and Singh, 1992.
24. Kothari, 1992.
25. SPWD, 1992; Poffenberger, 1990; Zeliang, n.d.; Kothari and Singh, 1992.

5 Implications of the US 'No' in Rio

KRISTIN ROSENDAL

This chapter examines the situation for global exchange and conservation of genetic resources in the aftermath of the Earth Summit in Rio in 1992, from a political science perspective. It takes as its point of departure the refusal of the US delegation to sign the Convention on Biological Diversity The Bush administration quoted scientific uncertainty, doubts about the financial arrangements and displeasure with the provisions for intellectual property rights (IPRs) as their reasons for turning down the Treaty. This case basically concerns the understanding of foreign policy decision-making and the more general enquiry about what makes states choose to opt out from international collaboration. This chapter considers the reasons given by the US authorities and explores possible, additional explanations. It is important to study the potential implications of a removal of US support, funding and technology on the Convention.

An important element is whether the US stand is likely to carry weight with other parties, both as a precedent for other developed countries and with regard to reactions from developing countries. Of particular interest is the view taken on IPRs to genetic resources. In order to assess the US view, the articles concerning the patent issue in the Biodiversity Convention must also be seen in connection with developments in the 'international patent regime' in other international fora. The question of IPRs has been a controversial one in fora like the General Agreement on Tariffs and Trade (GATT) and the Consultative Group for International Agricultural Research (CGIAR). Another important factor pertains to the prospects of the interim funding mechanism, the Global Environment Facility (GEF), to deal successfully with the challenges of conservation and use of biodiversity. The GEF portfolio of and criteria for biodiversity projects are briefly presented and

discussed. The summary reviews the possible implications of the US decision for the future implementation of the Convention, focusing on its impact on arrangements aiming at a more equal distribution of benefits derived from the utilization of genetic resources.

A brief history

The Convention sets out obligations and objectives for nations to combat the destruction of plant and animal species and ecosystems.[1] It also deals with a number of underlying controversial items, though for perhaps the most controversial one—on regulating 'modified organisms'—it was left to the parties to consider later the need for such a protocol.

The international debate on plant genetic resources started in the UN Food and Agricultural Organization (FAO) in the early 1980s, when the developing countries demanded that the issue of the one-way, free-of-charge flow of genes from the South to the North must be addressed.[2] They were concerned that genetic resources from the South were considered 'a common heritage of mankind', while elaborated genetic material in the North, albeit often originating in the South, was seen as a commercial product. The North's systematically bred material is subject to protection by plant breeders' rights or patents.

The question of access and property rights in relation to various types of genetic resources has been a crucial element throughout the negotiations for the Convention. The developing countries have insisted on technology transfers as well as financial mechanisms as compensation for conserving biodiversity and as payment for the North's use of their genetic material. In the Convention the controversial issue of property rights to genetic resources found its preliminary solution in abandoning the common heritage principle, in affirming that genetic resources belong to the sovereign authority of the state.

The Convention obliges industrialized countries to share the financial burden of funding national conservation programmes in developing countries. It also calls on such donor nations to share relevant technology and research (with 'countries providing genetic resources'). The North-South controversy over funding was barely resolved by the compromise that the GEF of the World Bank, the UN Development Programme (UNDP) and the UN Environment Programme (UNEP) should be used for an interim period and on condition that it become more democratic. The latter condition was a concession to the developing countries, who preferred a new funding mechanism over which they could have more control. This reflects a fundamental conflict regarding the South's concern about national sovereignty over their own natural resources and the North's interest in getting their money's worth from spending on global environmental projects. The Convention will

be managed by an interim secretariat under UNEP and will become effective 90 days after ratification by 30 nations.

Official US explanations

The Americans themselves were reported to have given three reasons for not signing the Convention in Rio.[3] The US objected to the language of the provision on patenting of products made from natural biological resources; secondly, the article on funding of conservation projects in developing countries would not leave sufficient control in the hands of donors; thirdly, there is scientific uncertainty surrounding loss of biodiversity. The third explanation, that of scientific uncertainty, was later refuted by an official from the US Environmental Protection Agency (USEPA).[4] Still, the 'scientific uncertainty' argument did arise time and again during the negotiations, so it will nevertheless be discussed among the other objections to the Convention.

In a situation with *uncertainty* or *discord* regarding the scientific evaluation of a problem area, international negotiations may be hampered.[5] The argument goes that scientific uncertainty as well as a high degree of complexity regarding causes and effects in a problem area may hamper negotiations in that it reduces the chance of finding focal points (simple solutions) on which to concentrate action. There is, of course, also the possibility that discord about problem understanding may serve as an excuse, legitimate or not, for those whose objective it is to postpone decisions on an issue. Estimating species extinction is clearly hampered by uncertainty with regard to the number of species as a whole. This is not to say, however, that the scope of extinction is insignificant. It is estimated that extinction, due to destruction of habitats in one way or another, is taking place at a speed several thousand times as rapid as what is 'normal' under 'natural' conditions.[6] Of the three US explanations, the one regarding scientific uncertainty is probably the least important. After two years of continuous international negotiations on an initiative that the US actually helped place on the UNEP agenda, the argument that scientific uncertainty should be an insurmountable obstacle seems most of all like an anachronism. Even though scientists are obviously at a loss in estimating the exact number of species and the exact rates of species extinction on the planet, the fact that extinction is taking place at an alarming pace is hardly controversial. Moreover, the recourse to scientific uncertainty did not prevent the Bush Administration from once again trying to advocate the establishment of a forest convention. Coming from the US at that stage—after rejecting the Convention—this probably helped bury the idea of a forest convention indefinitely with the group of developing countries (G-77).

It is also clear that the US authorities intend to come up with their own suggestions for biodiversity conservation projects, further undermining the credibility of the uncertainty argument. The United States Agency for International Development (USAID) has increased spending on biodiversity projects by 400 per cent since 1989; to a sum of US$79 million in 1991.[7] This leads to the assumption that to the extent that the US used the uncertainty argument, it was mainly as a way of strengthening their reason for turning down the Treaty.

The second US explanation represents a classical concern for high-contributing donor countries. Two elements weigh against this being a sufficient reason to block the Biodiversity Convention, the main point being that the GEF will be the *de facto* funding mechanism for the interim follow-up of the UNCED arrangements. Although it is agreed that GEF must become more democratic, this process is likely to be kept under tight control by the donor countries, and at present there are few signs that the World Bank is going to lose its grip on GEF. Furthermore, for donors there is always the option of withholding funds until they are satisfied with the way things are running. That would certainly not be a new policy as far as the US is concerned. However, donor reluctance is hardly a convincing reason for opting out of an agreement altogether. The US could have improved their environmental image by conceding to sign the Convention and would not have lost face if they had later shown some hesitation about contributing financially. This may to some extent explain why Bush's negotiators agreed to the draft Biodiversity Convention at the last negotiation round in Nairobi, a mere two weeks before the Earth Summit. At that point Eleanor Savage, chief of the US delegation, declared, 'The US is willing to make available new and additional resources through the GEF. But we won't commit money to any other funding mechanism.'[8]

The first US reason for not accepting the Treaty on biodiversity is of a more complex nature than the others. The argument is primarily tied to Articles 15, 16, 18 and 19 of the Convention, dealing with the controversial issues of access to genetic resources, technology transfer and sharing of benefits from utilization of genetic resources.

Without sophisticated biotechnological tools, trained scientists and adequate infrastructure, patenting is, as yet, hardly a viable solution for the majority of developing countries. On account of the patent criteria, only the systematically-bred material may be thus protected, and this is rarely the case with germplasm in the South. With the ever-widening scope of patent protection following the developments in biotechnology, there is also a trend towards patenting naturally occurring genetic material. The process of isolating and describing genes or gene-sequences may now be considered a sufficient scientific effort to fulfil the patent criteria of 'novelty' and

'inventive step'. Gene-rich developing countries fear that these developments in patent legislation may pave the way for increased northern control over Third World natural resources.[9] Some countries, like Ethiopia, have embarked on a policy of denying exports of their genetic resources, because developing countries at present are not getting any benefits from the technological utilization of their genetic material. The Convention goes some way in making amends to this situation.

Article 15 states that each country has the *sovereign authority* to determine access to its genetic resources (paragraph one), that access to genetic resources requires *prior informed consent* and must be on *mutually agreed terms* (paragraphs three and four), and that a *country providing genetic resources* is entitled to benefit from the commercial use of its resources (paragraphs six and seven). Three basic mechanisms are envisaged by the Convention by which a country may benefit from use of its genetic resources: *participation* in the research using the resources (15.6), receiving *technology* which embodies or utilizes the resources (16, 18 and 19) and sharing the *financial benefits* realized from commercial exploitation of the genetic material or resource (15.7 and 19.2).

As far as patenting is concerned, paragraphs two and five of Article 16 are the most important. In Article 16.2, which deals with technology transfer, it is stated that: 'In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights.' This is all very much in line with the interests of the US, until 16.2 goes on to declare that: 'The application of this paragraph shall be consistent with paragraphs three, four, and five.' It is the content of paragraph five that has so alienated the Bush administration, as it states: 'The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that *such rights do not run counter to its objectives*' (emphasis added).

The US has for the last four or five years been instrumental in pushing for a wider international acceptance of patent legislation, most notably through the Trade Related Aspects of Intellectual Property Rights (TRIPs) negotiations within the framework of the GATT.[10] Fierce competition with Europe and Japan in the biotechnology race and the view that US firms are losing billions of dollars due to pirate copying of American inventions, are the main motives behind this move.

How real are American fears that Article 16.5 may constitute a constraint on the development of their biotechnological companies and industries? To what extent is the US alone in viewing the world in this particular manner?

There are several implications and alternative explanations regarding the US decision.

Alternative explanations

Other explanations for the US reluctance to sign in Rio may be found at the national decision-making level, or it may be linked to the traditional role played by the US in multilateral negotiations. There may also be factors in the negotiation process, but those would be harder to tie solely to the activity of the American delegation.

Firstly, the critics may have a point that the whole negotiation process preceding the Convention was simply not good enough, as the A-team was sent to negotiate the Framework Convention on Climate Change.[11] In the study of international regimes and co-operation, recent work emphasizes the importance of the concept of 'political engineering' or of entrepreneurs in determining negotiation outputs.[12] Political entrepreneurs can increase flexibility by helping to redefine the negotiating situation and the choice of negotiating strategies. Still, it would seem that negotiating the Convention would require quite different knowledge and capacities among the delegates than that of climate change. Hence, the biodiversity negotiations would hardly have benefitted from political negotiations on climate change. A related point is that the biodiversity issue received less public attention, and thus probably less public spending, than did the issue of the greenhouse effect. This may have worked in both directions: less attention may have given the negotiating parties more leeway, but less money might have reduced important inputs in the process. Still, these are not really credible explanations for the US action, as this was the situation for the majority of the delegations to the biodiversity negotiations.

On the other hand, there was actually one rather serious bargaining slip-up on the part of the American delegation. The case involved the leak of a memo from William Reilly, head of the US delegation in Rio, to Clayton Yeutter, head of the domestic policy staff in the White House. The memo suggested ways of 'fixing' the treaty so that the administration might be persuaded to sign it after all. The apparent slip has been put down to intra-administrative opposition to the Biodiversity Treaty, however. The leak is believed to have taken place within the office of US Vice-President Dan Quayle, and his Council on Competitiveness, which were anxious to defend the biotechnology industry.[13] Said Curtis Bohlen, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, who co-operated with Reilly on the memo, 'We would have liked very much to sign this Convention. But clearly it was leaked by people who didn't want it signed. I think it's very unfortunate that people within the administration would embarrass their president this way.'[14]

From a different viewpoint, that of the people who didn't want to see the Convention signed, the leak may have been regarded as a necessary step to protect the US biotechnology industry in a time of fierce competition from Japan and Europe. The perceived need to boost American export products in world trade is likely to have been enhanced by the approaching presidential election, in which campaign Bush was struggling hard to improve his domestic image.

Another subnational explanation may be connected to the US fundamentally preferring bilateral arrangements in biodiversity conservation as well as in many other fields, without the impediment of international regulations, whatever their content. In a presidential election year, Bush is likely to have been particularly observant about expenses. This may have worked to strengthen his bias towards bilateral deals. Most popularly quoted is the case of Merck Pharmaceuticals and the Costa Rican National Institute of Biodiversity (INBio). The latter provides plant and animal species for drug research which Merck gets exclusive rights to develop, and in return Merck pays US$1 million as well as royalties for any drug developed. While Bush feared that the Biodiversity Treaty might hamper future arrangements along these lines, biologist Thomas Eisner, who brokered the Merck-INBio deal, regards it as a prime example of why Bush should have signed.[15]

Eisner's view may seem to be incoherent, as the Merck-INBio deal had already been concluded, successfully from the US point of view, *without* a Convention to guide it. A more favourable interpretation of Eisner's point, however, may be that as soon as the Convention has been concluded and agreed to by a large number of parties, those who refuse to abide by its rules and standards may find it hard to attract new partners. This point is supported by the statement from Venezuela.

The US worry about control over the funding mechanisms of the Convention seems loosely founded, as they would probably keep a high degree of control through the GEF. In a wider perspective 'donor reluctance' may give a better explanation of US behaviour. Looking at the traditional international role played by the US in multilateral negotiations, scepticism about a New International Economic Order (NIEO) and literally any concessions to the developing world has been much stronger than that of the European Community and Japan.

Finally, the whole idea of rationality in (foreign or indeed any kind of) policy-making may in itself be questioned.[16] A policy-making process may involve a large number of actors with conflicting interests or different priorities, none of whom has complete knowledge about all alternative choices nor about what consequences may follow from these choices. The task in this case, however, is not primarily to give a rational explanation of the US action but rather to discuss its possible implications. In order to discuss im-

pacts, there is, of course, a need to increase understanding about what caused the US rejection. In this case, the idea that US biotechnology industries needed special protection and were endangered by the formulations about IPRs in the Treaty, does not seem to have had a proper basis in rationality. According to Porter, the fears may not be based on an adequate understanding of the Convention text.[17] He points out that Americans had a major concession in the formulation of Article 16.2, which calls for '*adequate and effective protection of IPRs*, and secondly, that the officials of the Industrial Biotechnology Association (IBA) only had access to the text after the Bush administration announced its decision to turn down the Treaty. Thus, little time was left for analysis of the text before the IBA announced its position on the case.

Implications of the Bush decision

An important concern is whether the US stand is likely to carry weight with other parties, both as a precedent for other developed countries, and with regard to reactions from developing countries. The concept of *implementation* demands some clarification. The implementation of an international convention refers to the parties' activities in relation to what is spelled out in the convention text. In this discussion the Convention is regarded primarily as a contract, regulating transactions between countries providing genetic resources and countries utilizing genetic resources commercially. Several steps of action are needed in order to provide a basis for successful implementation of this contract. First, there is the ratification of the deal and then the fulfilment of the respective obligations. The obligations consist on the one hand of providing financial and technological transfers and on the other of making genetic resources available on mutually agreed terms. The main focus here is on whether the parties are likely to execute their respective duties in accord with the contract.

Biologists have mapped only a tiny fragment of the intricate web of species and ecosystems in the world. This certainly complicates efforts to protect the world's biodiversity, as it becomes more difficult to make a selection of 'worthy cases'. There is a growing consensus, however, encompassed in the 'precautionary principle', that *scientific uncertainty* should not be allowed to hamper vital, remedial action. The fact that almost all other countries (a total of 155) apart from the US, gave their assent to the Convention in Rio implies that the uncertainty argument is hardly taken seriously among the majority of parties. As far as scientific uncertainty is concerned, it is hardly likely to prevent the Convention from receiving the 30 necessary ratifications.

The US refusal to contribute to the funding of the Convention may have serious precedents in the international community. An international agree-

ment can seldom be better than its budget, a situation which is still illustrated by the FAO International Undertaking for plant genetic resources and the Fund accompanying it.[18] The FAO Undertaking, in spite of a great number of signatories, is still without any practical significance, based as it is on voluntary funding.

One of the main reasons why GEF was chosen, in spite of certain shortcomings in its democratic structure, was its assumed ability to attract major funding. In its pilot stage, GEF has already been active in financing a number of global environmental projects, and with large contributions from France and Germany it is not dependent on American money. Furthermore, regarding 'donor reluctance', the EC and Japan traditionally are less uneasy about financial precedents than is the US. As GEF covers several global environmental problems—climate change, oceans and possibly deforestation and desertification besides biodiversity—the US has already pledged to make substantial contributions to GEF as a whole.

With or without US funding, a more important question is whether GEF will turn out to be a suitable tool for conservation of biodiversity. This question goes outside the main scope of this chapter, but its importance demands some attention. It was already argued that donor countries are unlikely to forgo control of GEF. A related question is to what extent GEF activities may be hampered by the political struggle between recipients and donors, in the tug-of-war between 'democratization' and 'conditionality'. What is the situation for biodiversity conservation, in terms of criteria and funding of projects in the GEF portfolio? As opposed to traditional World Bank programmes, will GEF be adjusted to reach the small-scale farmers who admittedly play the most important part in growing and maintaining a diversity of food crops in the fields? How will the Small Grants Programme of the UNDP work out?

GEF has already been active in funding three-year biodiversity projects, and the Scientific and Technical Advisory Panel (STAP) has been active in developing criteria for selection of these projects. These criteria are in line with the guidelines set out in the Convention. In a recent report on the review of the GEF biodiversity portfolio, a group of fourteen reviewers agreed on a number of shortcomings:[19]

- Projects take little consideration of local people, their expertise and priorities;
- There is too little innovation in environmental conservation;
- Establishing more protected areas is a limited strategy for protecting biodiversity;
- NGO involvement is inadequate;
- There is a need to integrate local and national priorities and concerns;

• There is little or no indication of post-GEF financial support and hence no long-term perspective.

The reviewers are, of course, not consistent in all their statements: On the one hand the danger of little variety in the types of areas and proposals in the projects is pointed out ('Little consideration is given to areas where a single species may be of crucial importance to the survival of ecosystems and social structures. Arid and Semi-Arid areas are especially neglected.'). On the other hand, the experts suggest that the criteria for project eligibility may be too general ('It may be necessary to reduce or rank generic criteria.'). Nevertheless, the developments of the GEF-mechanism seem to be followed closely, with the intent of staying in line with the objectives of the Convention.[20]

As far as the reactions from developing countries are concerned, the funding question must be seen in relation to the question of property rights. Some developing countries are themselves looking for systems of IPRs in order to effectively control and benefit from the use of their genetic resources. This solution may ultimately be preferable from a development perspective, leaving more motivation for self-sufficiency and more room for sovereignty over resources. However, it brings up problems of enforcement, infrastructure and reduced access to genetic resources for the less developed countries. Also, the revenue from such IPRs is itself hardly sufficient for conservation.[21] While the South still appears as a bloc in the questions of technology transfers and additional funding, it no longer has a common stand on IPRs. A major explanation lies in the different levels of technological development. Some countries thus have found it less costly to give in to the US patent pressure in GATT. Unlike Brazil, India and the newly industrialized countries, the majority of developing countries still lack the infrastructure to introduce effective patent systems. This breaking up of the *alliance* between Third World countries may not altogether be detrimental with a view to reaching effective ways of implementation for conservation of biodiversity. It may give way to less costly arrangements and thus curtail the industrialized world's fear of precedents. Some developing countries have already been reacting to the US rejection of the Convention. As a direct response Venezuela has stopped signing new agreements with the US scientific institutions who were collecting and screening biodiversity in the country.[22] Similar policies are emerging in several Central American countries.

The third objection to the Convention was the US conviction that their biotechnology industry will be hurt by the provisions on IPRs in the Convention. Is this a notion that will have broad support among the developed countries? In order to answer this question, one needs to look at some general trends in the international patent regime and at the actual formulations in the Convention.

Patenting is catching on in ever wider circles, and there are no indications that the Convention has had any prior diminishing effects on this practice. Most noteworthy, CGIAR, the main vehicle behind the Green Revolution, decided at their last mid-term meeting in Istanbul (May 22, 1992) to embark on 'defensive patenting'. Germplasm derived from the genebanks of the CGIAR's International Agricultural Research Centres (IARCs) will still be subject to the principle of free availability, following the policy of the CGIAR system. The Istanbul group concluded that a resort to IPRs should not take place unless it is 'absolutely necessary'—for example, in order to forestall pre-emptive protection by others of CGIAR-generated technology.[23]

The motivation behind the Istanbul decision can be found in the developments in biotechnology, the 'privatization' of agricultural research and the strengthening of national and international patent legislation.[24] The majority of the IARCs are already in the process of employing biotechnology programmes as are their national counterparts (national agricultural research centres) in developing countries. Furthermore, agricultural research is tending to move from the public sphere to private enterprise. This makes it increasingly necessary for developing countries to introduce IPR systems in order to attract funding of agricultural research. In addition, patent legislation is generally expanding not only geographically, but even more so functionally, thus giving even broader possibilities to issue patent protection for plants and seeds.

Following the Istanbul decision, the Norwegian Ministry of Environment issued a questionnaire to the IARCs, enquiring about their stand in the patent question. The answers so far (about two-thirds) indicate a variety of views among the IARCs concerning this question. The majority made it clear that they had not come to a final stand in the matter. A few stressed that this was not yet a relevant situation with them, while several displayed the view that they did not intend to introduce IPRs on their material at all. One IARC was less hesitant about IPRs and pointed out that the whole issue of patenting had become too emotional. Most of the IARCs made a clear distinction between 'raw' germplasm and products of biotechnology, however, and they contested the application of IPRs on the former.[25] So far the idea of 'defensive patenting' is an elusive concept, also with the IARCs, however, and hence its practical implementation in the CG-system remains to be seen.

It should be pointed out though, that the US National Institute of Health used a similar reasoning ('defensive patenting') when filing close to 3,000 patent applications for human genes from the Human Genome Project.[26] This action has caused turmoil in the biotechnology industry, causing the UK Medical Research Council to retaliate by filing US patent applications for more than 1,000 genes, and causing France, Germany and Italy to put a

stop to scientific information exchange within the international DNA database recently set up in London with EC funding. In the first round, the NIH application has been turned down, but this may not be the final verdict in the case.

Increased adoption and expanding of patent legislation may also be observed in both developing and developed countries. This is true even for some of those who most zealously fought the international patent quest in the TRIPs negotiations in the GATT Uruguay Round. Hence, most of those developing countries that can possibly sustain a patent system, like India, Brazil and Mexico, are well on their way to accepting it.[27] Likewise, Norway and the Nordic countries advocated the national right to exclude plant and animal varieties and also naturally occurring biological material from the TRIPs decision on patent protection. Still, a patent on a naturally occurring micro-organism (*Lactobacillus plantarum* DSM 3676 and DSM 3677) was recently granted to a German corporation seeking patent protection for their 'invention' in Norway (Patent no. 169573, 15.7.92). As a strengthened patent system reaches worldwide acceptance, it will be increasingly hard to argue that only one country will be harmed by restrictions on it.

There are several reasons why the Convention will probably not impose severe limitations on biotechnology companies. First of all, there is a certain limitation inherent in the Convention which restricts its application to *future* dealings with genetic resources. Hence, it does not induce any kind of payment for germplasm already existing in national and international genebanks. To some developing countries and NGOs,[28] this is regarded as a weakness of the Convention, but in fact the legal basis of an international convention requires that it cannot have a retroactive impact. This question remains one of the most controversial items in the Convention, however, and it must certainly be addressed in the future negotiations on protocols.

When it comes to the actual interpretation of the Convention, it is interesting to note that the British biotechnology industry has displayed a much more relaxed reaction to the patent-formulations than did the US. The BioIndustry Association (BIA), representing 160 British biotechnology companies, has been calling on Bush to back the Convention. Said Louis Da Gama, executive of the BIA: 'Having reviewed the convention, we do not share the concerns expressed by the US government.'[29] Moreover, the reaction from the European Parliament (EP) was actually to once again block the EC Commission's proposal for a directive on patents in biotechnology.[30] The EP's environment committee expressed concern that the text of the proposed directive would not be compatible with the Convention.[31] These reactions seem to exemplify both the first and the second of the three possible interpretations which were outlined at the beginning of this chapter: the

EP gives a similar interpretation as the US, and the BIA a slightly different interpretation from the US, but in *both cases they insist on backing the Convention*. Thus, rather than following the US example, countries party to the Convention may even come to accuse the US of subsidizing their own biotechnology industry by not adopting the Treaty.[32]

A third reason why industry should have little to fear is the provision in Article 15, which states that access to genetic resources should be according to 'mutually agreed terms'. This provision can at best pave the way for more orderly transactions of genetic resources—a situation which may in the end prove beneficial to both actors. At 'worst', implementation will rest on the mutual strengths of the transacting parties and is hardly likely to be harmful for the multinational seed and pharmaceutical corporations. This provision also works to provide the Convention with a bias in favour of bilateral arrangements; again, it is hard to see why the US or anyone else should object to this. As John Duesing from Ciba-Geigy Seeds points out, the expression *mutually agreed terms* also means that 'intellectual property rights issues and the commercial use of derivated technology will have been negotiated before that genetic resource is transferred and exploited by the requesting party'.[33] Duesing further argues that the formulation in paragraph 16.5 ('patents and IPR . . . not run counter to its [the Convention's] objectives') which so alienated the Americans, really depends on whether one believes IPRs to be supportive of the objectives in the Convention or not. Duesing believes patenting to be promoting these objectives, as it provides an incentive to evaluate and develop new genetic resources.

The Convention would hardly have achieved the consent of the majority of the developing countries, if it had been void of realistic provisions for more equitable distribution. To the extent that the Convention makes arrangements for a more equal distribution of benefits from the utilization of genetic resources, it will, of course, extract an equivalent revenue from the transacting parties.

There may be additional or different reasons why countries might choose not to ratify the Convention in the end. This would certainly not lack precedent in the international community: In spite of getting the signatures of nearly all developed countries, the UN Law of the Sea Convention has only been ratified by Iceland and the former Yugoslavia. This outlook is clearly imminent in the case of France and Malaysia, who were both ardently opposed to the Convention at the last negotiation round in Nairobi. Malaysia may still decide that they cannot live with GEF as the financial mechanism, and France may still be resentful that the Convention does not require the development of an international list of threatened species and areas of biological importance. Not too much comfort should be gleaned from the fact that the Convention needed only 30 ratifications to enter into force; this is a

very low number considering the objectives at stake. Moreover, it is not at all irrelevant which the first 30 these are. The self-imposed US isolation at UNCED is widely interpreted as real. Many signatories (among them the EC countries) have already decided to begin the follow-up and implementation work before the Convention enters into force.[34] Finally, there is the question of the environmental policy of the US administration of President Bill Clinton and Vice-President Al Gore. At present, there are few concrete indications, and predictions seem uncertain with regard to Clinton's ability to keep his campaign promises in real politics. While keeping the developments in the American economy firmly in mind, however, Clinton seems to profess a more mainstream environmental image than did Bush.

Although the Clinton Administration signed the Convention late in 1993, the US signature will in all likelihood be accompanied by a US interpretative statement concerning the provisions in the Convention regarding IPRs, financial mechanisms and technology transfers. The crucial questions arising from this new event are: Will the new interpretations shake the delicate balance of actor interests so far aligned in the Convention text? and Will the US succeed in gaining support for their interpretations from other industrialized countries?

It is obvious that the finely tuned international consensus behind the Biodiversity Convention cannot take many blows without disintegrating. Part of the balance is achieved by the very vagueness of Article 16.5: it does not say that IPRs are harmful to the Convention objectives, nor does it say that IPRs are not harmful. If the American interpretative statement were to involve a bias in any of these directions (most likely the latter), the fragile balance of the consensus in the Convention might well be severely shaken. The US seems intent on securing the support of the EC countries for their interpretative statement. So far, there has been no definite support for the US statement from these countries. As the ratification process proceeds, it remains to be seen whether other industrialized countries will follow their original intent to follow up the Convention as it is, or if they were really fence-sitting in Rio, waiting for the US to take the blow for obstructing international co-operation in conservation of biodiversity. At any rate, by making an interpretative statement, the US might bring about a delay in the process of making the Convention an effective instrument in international exchange of genetic resources. Financial transfers and technology exchange play major parts in such international deals, and they are crucial elements in achieving equitable sharing of the benefits from genetic resources. Equity is clearly a prerequisite to achieve effective international conservation and management of biodiversity.

Summing up

Both scientific uncertainty and donor reluctance were found lacking with regard to presenting major obstacles to further international activities in biodiversity conservation. Both arguments were maintained by the Bush administration as explanations for their dismissal of the Convention, but they were not found to carry much real weight even with the Americans. Internal administrative strife and traditional tight-fistedness, both amplified by the strains of a presidential election year, appear to be equally good explanations of American behaviour in Rio. Illustrative of the internal strife within the US Administration, is the US biotechnology industry and their political supporters whose influence won through in the final round. Their fears, however, appear to have been loosely founded. As the formal objections by the US were given so little adherence among the remaining parties, the US stand may actually have had the effect of strengthening public opinion of the Convention.

The question of IPRs was found to carry more weight, but its real importance in the implementation process is difficult to judge. On the one hand, there seems to be a number of reasons why the patent question may not constitute such a serious constraint after all. The international patent regime is expanding rapidly, and there are thus no indications that the Convention has had any prior diminishing effects on this process. As the patent-system reaches worldwide acceptance, it will be increasingly difficult to argue with the American biotechnology industry that only one country will be harmed by restrictions on it. This assumption seems to be supported by the European interpretations of the formulations in the Convention. Secondly, there are certain limitations inherent in the Convention itself which restrict its application to *future* dealings with genetic resources. Hence, germplasm in international genebanks (deposited prior to the entering into force of the Convention) may still be utilized without compensation.

The geographical expansion of the patent system thus seems to be bridging the traditional North-South controversy surrounding its functional expansion. The price for this broadening international consensus, however, is that it may leave the least developed, gene-poor countries increasingly at the losing end in two respects: limited funding for biodiversity conservation and reduced access to improved breeding material. As evaluation of the Scientific and Technical Advisory Panel of GEF demonstrated, there is a tendency to disregard the potential importance of genetic resources in arid and semi-arid areas. Regarding biodiversity conservation in a long-term perspective, this is not a good omen for the implementation of the Convention. In view of the varied responses from the IARCs, however, there is clearly some resistance left, most particularly with regard to the

functional expansion of the patent legislation. Most IARCs rebuked the patenting of 'raw' germplasm material.

In conclusion, the patent question seems to remain unresolved and may still be one of the most likely stumbling blocks for future ratifications and implementation of the Convention. This is amply illustrated by the uncertainties created by the announced US interpretative statement. The patent formulations do seem to constitute an inherent conflict in the Convention itself, and this is likely to put the practical ramifications of the Convention continuously to the test. Like most other international agreements, enforcement mechanisms are its weak side, and this remains one of the main challenges for the future progress of the Biodiversity Convention.

Notes

1. The Convention defines *biological diversity* as the variability among all living organisms, including diversity within species, between species and of ecosystems.
2. The Convention defines *genetic resources* as the hereditary material of plant, animal, microbial or other origin, which has actual or potential value.
3. Coghlan, 1992, p. 9.
4. Pers. comm., January 26, 1993.
5. Young, 1989.
6. Wilson, 1988.
7. USAID, 1992.
8. *International Environment Reporter*, 1992, June 3, p. 347.
9. Mooney *et al.*, 1988, pp. 1–2; Kloppenburg, 1988a; Hindar *et al.*, 1990.
10. Coghlan, 1992; GATT, 1989.
11. *Economist*, 1992, pp. 85–86.
12. Young, 1991.
13. *Economist*, 1992, pp. 85–86
14. *International Environment Reporter*, 1992, June 17, p. 414.
15. *International Environment Reporter*, 1992, June 17, p. 398.
16. March and Olsen, 1976.
17. Porter, 1993.
18. Resolution 8/83 of the Twenty-Second Session of the FAO Conference, Rome, 5–23 November, 1983, and Resolution 5/89 of the Twenty-Fifth Session of the FAO Conference, Rome, 11-29 November, 1989. Fridtjof Nansen Institute. 1992. *Green Global Yearbook*. London: Oxford University Press.
19. GEF. 1992a.
20. GEF, 1992a.
21. Barton, 1991.
22. Reid, 1992a; *International Environment Reporter*, 1992, November 4, p. 705.
23. CGIAR, 1992.
24. Barton and Siebeck, 1992.
25. A full analysis of the replies from the IARCs is forthcoming in a report about the Biodiversity Convention, by the author of this chapter.
26. *Financial Times*, 1992, p. 16.
27. van Wijk, 1991.

28. GRAIN, 1992.
29. Coghlan, 1992, p. 9.
30. Commission of the European Communities, Proposal for a Council Directive on the Legal Protection of Biotechnological Inventions (October 17, 1988).
31. *International Environment Reporter*, 1992, June 17, p. 398.
32. *Environmental Policy and Law*, 1992, p. 340.
33. Duesing, 1992, pp. 19–23.
34. Norwegian Ministry of Environment, 1992.

PART II

ACCESS TO GENETIC RESOURCES AND INDIGENOUS KNOWLEDGE

6 Farmers' rights and the Convention on Biological Diversity

VANDANA SHIVA

In biodiversity conservation, the most critical actors are local communities of farmers and forest dwellers who have for a long time conserved and utilized the diverse species of wild and domesticated plants and animals that the global community now wants to protect. The phrase 'national interests and global imperatives' ignores the rights of the original custodians of the world's biodiversity at the local level. This chapter focuses on the neglected rights of the most important actors of the conservation chain in relation to the Convention on Biological Diversity.

Indigenous rights and the Convention

Culture and biodiversity are inseparable. The co-evolution of cultures, life forms and habitats has conserved the biodiversity on this planet. Communities everywhere in the world have developed knowledge and found ways to derive their livelihood from the bounties of nature's diversity. Hunters and gatherers use thousands of plants and animals for food, medicine and shelter. Pastoral, peasant and fishing communities have also evolved knowledge and skills to derive sustainable livelihood from the biodiversity on the land and in rivers, lakes and seas.

The Convention acknowledges this contribution by local communities. The Preamble to the Convention states that Contracting Parties recognize 'the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitable benefits arising from the use of traditional knowledge, innovations and practices, relevant to the conservation of biodiversity and the sustainable use of its components.'

However, no article in the Convention directly addresses farmers' rights or mechanisms for the compensation of indigenous knowledge. Articles 10(c) and 18(4) refer to indigenous practices but not to rights of farmers or local communities. Article 10(c) states: 'Each Contracting Party shall as far as possible and as appropriate protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.' Article 18(4) states: 'The Contracting Parties shall in accordance with national legislation and policies, encourage and develop methods of cooperation for the development and use of technologies, including indigenous and traditional technologies in pursuance of the objective of this Convention.' As stated in these clauses, community rights do not exist as rights; they are privileges given by contracting parties. Local community rights are also tacitly implicated in other clauses where indigenous knowledge is not explicitly addressed.

The need to evolve and implement farmers' rights

The interest here is focussed on the rights of farming communities to continue to conserve and utilize the genetic resources that they have traditionally conserved and utilized. *Farmers' rights* is a concept that has been recognized in FAO discussions related to genetic resources, but it is not as yet fully operational on any global platform.

Farmers' rights are implicitly referred to in the operation and implementation of *in situ* conservation. However, Article 8 on *in situ* conservation fails to fully recognize the role of cultivated diversity. The focus is on protected area management. Biodiversity conservation in sites of production is neglected. This lacuna is not so serious in Agenda 21.[1] Chapter 14 in Agenda 21, on 'promoting sustainable agriculture and rural development' states in Section 6 (about conservation and sustainable utilization of plant genetic resources for food and sustainable agriculture): 'The primary objective is to safeguard the world's genetic resources while preserving them to use sustainably. This includes the development of measures to facilitate the conservation and use of plant genetic resources, networks of *in situ* conservation areas and use of tools such as *ex situ* collections and germplasm banks.' Chapter 15 of Agenda 21 states in Section 15(5)g that governments, co-operating with the relevant United Nations bodies, and with the support of indigenous people and their communities should: 'Take action where necessary for the conservation of biodiversity through the in situ conservation of ecosystems and natural habitats, as well as primitive cultivars and their wild relatives.' *In situ* conservation of cultivated biodiversity makes it imperative that the concept of *farmers' rights* be evolved and implemented to enable farming communities to effectively

conserve local biodiversity. However, intellectual property rights (IPRs) as defined in other instruments such as the General Agreement on Tariffs and Trade (GATT) deny farmers' rights and the intellectual and material contribution of Third World farmers to the global production and knowledge system.

The tension and contradiction between farmers' rights to ensure biodiversity conservation and IPRs for the seed industry to ensure market expansion for biotechnological commodities can be seen in the Convention in Article 16 on access to and transfer of technology. Article 17 draft of February 20, 1992 addressed the issue of transfer of technology on fair and concessional terms, with no commitment to patents and intellectual property protection. The final draft of the Convention dealt with this issue in Article 16 and introduced a clause in 16(2) which states that: 'In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights.' On the other hand, Article 16(5) states that 'Contracting Parties, recognizing that patents and other IPRs may have an influence on the implementation of this Convention, shall cooperate in this regard, subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.' Articulation of rights that support the objectives of biodiversity conservation includes the articulation of farmers' rights since *in situ* conservation cannot be effectively ensured without empowering local communities with rights to conserve local biodiversity. Farmers' rights provide the only effective instrument for protecting biodiversity while supporting people's livelihoods. They can provide a creative means to subject global trade negotiations to the global environmental imperative of biodiversity conservation. They are also needed to develop a more fair and just system for the exchange of biological resources and knowledge of the resources.

Compensation for indigenous knowledge

Who owns biodiversity? Can intellectual contributions that modify or record biodiversity be the instruments to establish rights to ownership over these resources? What are the modes for just and fair compensation to contributors of knowledge and genetic resources?

These are questions that are central to debates surrounding the conservation and use of biodiversity and genetic resources and are directly related to implementation of the Convention. These questions have also been raised at negotiations on IPRs taking place in GATT and FAO.

Most discussions about Trade Related Intellectual Property Rights (TRIPs) in GATT have focussed on the assumption that only the intellectual

contributions of corporate-sponsored scientists need protection and compensation. The only North–South debate then is how IPRs will restrict transfer of technology from the industrialized North to the industrializing South.

However, no attention has been paid to how IPRs will encourage the uncompensated free flow of resources and knowledge from the South to the North. A very significant issue that has been missing in these debates is how IPRs in GATT count as knowledge and innovation only when they generate profits. Knowledge and innovation for social ends such as health care and sustainable agriculture are not considered as intellectual contributions. Contributions of societies and communities which have not been motivated by profits are thus exploited but not recognized. For example, ethnobotanists transfer knowledge from traditional healers to pharmaceutical firms. The IPRs go to the firm, not to the healer. As Posey has stated, industry and business discovered many years ago that indigenous knowledge means money.[2] The phrase *intellectual property rights* therefore raises multiple questions. Whose intellect? What property? Whose rights? What rights?

In this wider framework, traditional farmers who have selected, improved and conserved biodiversity, or traditional healers who have used plant diversity for medicine also have prior IPRs which should be protected. When this knowledge and biodiversity is exploited for commercial ends, these contributors should have a say in deciding whether such exploitation should take place, and the terms of compensation. IPRs in the area of biodiversity are not merely a matter of transfer of technology but become ground for intercultural dialogue. For many communities, knowledge and biological resources are inalienable. No price is high enough to justify their appropriation. In the hill regions of Garhwal, for example, people value their seeds more than their lives. In times of devastating famine, people prefer starving to death to finishing their seed.

Negotiations related to biodiversity and biological innovations are complicated because different groups and actors involved give different meanings to basic concepts. For traditional societies, biodiversity is common property, and knowledge related to it is in the intellectual commons. For biotechnology corporations, biodiversity becomes private property through their investments, and IPRs are the means for such privatization.

Throughout history, biodiversity has been the common property of local communities—with both resources and knowledge being exchanged freely. The absence of a price has not, however, meant a lack of value. Biodiversity has, in fact, been highly valued in traditional societies through cultural and social mechanisms which have allowed its simultaneous conservation and utilization.

The emergence of genetic engineering as the new biotechnology has encouraged the emergence of patents and IPRs for products derived from biodiversity. However, the new regime of patent rights for biotechnology products is also rewriting the traditional rights to biodiversity. Instead of being treated as the common property of local communities or as the national property of sovereign states, the Third World's biodiversity has in recent years been treated as the common heritage of the world. In contrast, the modified biodiversity is patented and sold back to the Third World as high-priced and patented seeds and drugs. This unequal and asymmetric exchange has led to a wave of criticism from the Third World movements on indigenous peoples, environment and sustainable agriculture. A search began for a means to the ecologically sound exchange of biological knowledge and resources on fair, equitable terms.

The Indo-US programme

The Indo-US programme is the largest activity in the area of biodiversity undertaken by the US Agency for International Development (USAID). It involves payment of US$11 million by the US and counterpart funding of an equivalent amount by the Government of India for strengthening the National Bureau for Plant Genetic Resources (NBPGR) and for joint collections by Indian and US teams. The genetic resources are collected free of charge and can be passed on to both private and public agencies.

The collection is undertaken with a view that genetic resources are the 'common heritage of mankind'. However, the beneficiaries of these collections are not guided by the 'common heritage' approach but by the concept of private property. This aspect of the Indo-US relationship is expressed not through scientific exchange but through trade laws. Under Super and Special 301 clauses of the US Trade Act, and using threats of unilateral trade sanctions, the US has been putting pressure on India to pass patent laws consistent with US laws which patent plant and animal life forms. The Indian patent laws do not allow patents for living resources. The Indian Patent Act 1970 says that patents cannot be given for 'a method of agriculture or horticulture or for any process for the medicinal, surgical, curative, prophylactic or other treatment of human beings or any process for a similar treatment of animals or plants to render them free of disease or to increase their economic value or of their products.'[3]

The Indo-US exchange is riddled with double standards on rights related to biological resources and the values assigned to them. When genetic resources are taken from India to the US, they are treated as free and common; knowledge of their characteristics is treated as belonging to an intellectual commons. However, when the same genetic resources are modified, they are treated as private property, with high prices and royalties at-

tached to them. Knowledge related to the genetic resources is treated as 'intellectual property'. Rights are therefore interpreted as totally different depending on who is at the giving and receiving ends of the transaction. The Indo-US exchange therefore perpetuates the unequal biological order, with resources and knowledge flowing freely from the South to North, and their products being saddled with protection and payments in the reverse direction. The rights of the original donors of genetic resources, the farmers, do not figure anywhere in this exchange.

GATT can be viewed as a universalization of this unequal biological order in which the Third World gives resources and knowledge freely, without protection, but has to buy commodities protected by IPRs.

The Merck–INBio agreement

One of the most publicized efforts to 'compensate' the Third World for its contributions was the 1991 agreement between Merck Pharmaceuticals and INBio, the National Biodiversity Institute of Costa Rica. Merck agreed to pay US$1 million for the right to keep and analyse plant samples to be gathered from Costa Rican rainforest national parks by INBio employees. These unconditional rights, with US$4 billion per year in revenues claimed in exchange for US$1 million paid to a small conservation organization, do not respect the rights of local communities or the government of Costa Rica. The agreement is not between the people living in or near the national parks to be prospected. They had no say in the deal, nor are they guaranteed any benefits. Neither is the agreement between a transnational corporation (TNC) and a national government. The agreement is between a TNC and a conservation group, formed at the initiative of a leading conservation biologist from the US, Dan Janzen.

INBio views commercial prospecting by multinationals as a solution. However, the basic problems in this model are that those 'selling' prospecting rights never had the rights to the biodiversity in the first place. Those whose rights are being sold and abnegated through the transaction have not been consulted or given a chance to participate.

The intention of the Merck–INBio agreement is to stop the free flow of resources, from the South to North. However, many questions remain about whether this is a fair, equitable and ecologically sound exchange.

Farmers' rights at FAO

The unequal exchange of biological resources between the North and South was finally challenged in the FAO in the mid-1980s. FAO discussions led to two shifts. Firstly, *all* genetic resources were to be treated as a common heritage to be freely shared, including the 'improved' and 'elite' lines. Secondly, they introduced the concept of farmers' rights. In the

March 1987 meeting of FAO's Commission on Plant Genetic Resources, Third World delegates argued that if plant breeders had rights of ownership, control and compensation by virtue of labouring for a decade to develop a new variety from Third World genetic resources, then Third World farmers also had rights, since they had domesticated important agricultural crops, observed, developed and safeguarded the tremendous biodiversity that breeders and the seed industry use as 'raw material'.

Farmers' rights at FAO were observed through the creation of an international gene fund for the conservation and utilization of plant genetic resources. Such a fund would make these rights concrete. Administered by the Commission, and thus indirectly by the international community, it would 'reward' farmers with programmes beneficial to all. Farmers' rights are defined, in the text of the International Undertaking on Plant Genetic Resources of the FAO, as:

> rights arising from the past, present and future contributions of farmers in conserving, improving and making available plant genetic resources, particularly those in the centres of origin/diversity. Those rights are vested in the International Community, as trustee for present and future generations of farmers, and supporting the continuation of their contributions as well as the attainment of overall purposes of the International Undertaking.

The main problems with farmers' rights as construed by the FAO Commission is that farmers do not have a place for negotiating biodiversity rights and determining patterns of utilization. In addition, the contributions to the gene fund are voluntary, unlike royalty payments under IPRs.

While these models differ in many ways, they share the basic deficiency that farmers and local communities are not involved in decisions about biodiversity and transactions of knowledge about biological resources. Government and non-government agencies involved in collection receive the compensation for information and resource transfer while local communities are excluded. In principle the FAO model is more equitable, but in practice that equity has still to be realized by finding ways to reward farmers' innovations without discrimination just because they run farms and not multi-million-dollar labs.

The Keystone Dialogue

The Keystone Dialogue on Plant Genetic Resources has developed the notion of recognition as a means to further implement farmers' rights. It recognizes that informal innovations of farmers contribute to increased and sustainable production. However, these innovations are discriminated against by policy instruments that have been designed to support the diffusion of the formal innovation system, in the private and public sectors,

both under the Green Revolution phase as well as in the biotechnical phase. If innovations by farmers have to be recognized and rewarded, pluralism in agricultural development strategies becomes essential. Farmers' rights must become effective, and farmers must be able to influence decisions related to the use of biological resources which are their means of production. These decisions include basic questions of ownership and control over genetic resources, and patterns and criteria for their development and use.

As yet, no model exists which recognizes these rights of farmers and other producer communities who derive their livelihood from biodiversity. The rights of farmers, tribal people, pastoralists, herbalists and fisher folk to the biodiversity that they have conserved and used from time immemorial can be effectively granted only if they are allowed to participate actively in making decisions that have an impact on their rights and the status of biodiversity.

The dominant model of free, unprotected flow of knowledge and resources from the gene-rich South to the capital-rich North and the protected flow of knowledge and resources in the reverse direction is brazenly unjust and unsustainable. It needs to be changed. It can only change through a political process which recognizes the original contributors of knowledge and genetic resources and respects their value system. A world in which market values are the only values will impoverish all of nature, the Third World and the international community. Non-market, non-monetary systems require higher values. These are the real political tools for establishing rights to knowledge and biological resources.

The recently signed Convention is the highest level international treaty on the negotiation of these rights. These rights are also indirectly addressed in GATT under agriculture and TRIPs. All these models could be consistent with the interpretations of the Convention; none of them, however, gives effective rights to local communities. It is essential that these international instruments recognize and respect the prior rights of communities of producers and innovators and not just recognize the innovation and production of TNCs.

In the Convention, the rights over biodiversity are the rights of sovereign states.[4] These need to be built on the rights of communities who have conserved and protected biodiversity within national territories. Governments of the South can only be strengthened by standing behind their people and biodiversity and supporting and protecting the democratic rights of diverse species and communities to co-exist. If states in the South join the global move to deny rights and to take away control over biodiversity from local communities, they too will be weakened. They could subsequently lose their sovereign rights over biodiversity to economic

powers in the North, whose global empires in the biotechnology era will be built on the destruction and colonization of the South's biodiversity.

Impact of patents on Third World research

Intellectual property rights and patents are enclosures of the intellectual commons in life forms and living processes. Unlike mechanical artefacts, innovation and knowledge related to utilization of living resources has been a highly evolved tradition in all cultures. Innovation for which patents are being given often only builds on prior knowledge and use of biological systems for food and medicine. Instead of stimulating research and knowledge generation, patents stifle creativity and communication. In the Third World, where privatization is not the norm, most knowledge generation takes place in the public domain, either in the formal or informal sector. The formal sector includes all public sector research institutions. The informal sector includes all communities which maintain and generate knowledge related to biodiversity. IPRs undermine knowledge generation and creativity in both these sectors. IPRs, particularly those imposed worldwide through GATT, are restricting at three levels: The first is the shift from common rights to private rights. As the Preamble of the TRIPs agreement states, IPRs are only recognized as private rights. This excludes all kinds of knowledge, ideas and innovations that take place in the 'intellectual commons'—in villages among farmers, in forests among tribal people and even in universities among scientists. TRIPs are therefore a mechanism for the privatization of the intellectual commons, and a de-intellectualization of civil society, so that the mind becomes a corporate monopoly.

The second restriction of IPRs is that they are recognized only when knowledge and innovation generate profits, not when they meet social needs. Article 27(1) of TRIPs refers to the condition that to be recognized as an IPR, an innovation has to be capable of industrial application. This immediately excludes all sectors that produce and innovate outside the industrial mode of production. Profits and capital accumulation through industrialization are recognized as the only ends to which creativity should be put. The social good is totally ignored. TRIPs therefore become a mechanism for industrialization of all aspects of life under corporate control and a 'de-industrialization' of production in the small-scale and informal sectors of society.

The most significant reduction is achieved by the prefix 'trade related'. Since most innovation in the public domain is for domestic, local and public use and not international trade, only multinational corporations innovate for the sole purpose of increasing their share in global markets and international trade. TRIPs will only be an enforcement of the rights of multina-

tional corporations to monopolize all production, distribution and profits at the cost of all citizens and small producers worldwide, and particularly in Third World countries.

Both the informal and the formal sectors are affected negatively through the intellectual enclosures engendered by patents. The informal sector innovation is destroyed as it receives no recognition. For example, when ethnobotanists transfer knowledge from traditional healers to pharmaceutical firms and when genetic resource conservationists transfer knowledge from farmers to seed corporations, the IPRs go to the corporations, not to the farmers and healers. Over time, this appropriation of knowledge kills the original, socio-cultural context of knowledge generation.

The formal sector of innovation and knowledge is destroyed by restricting free access to scientific knowledge due to patent restrictions. The broad patents on scientific processes and life forms block free exchange of ideas and materials, which have in the first place been taken freely and from the informal sector in the biodiversity-rich Third World. Patents thus block a free flow of knowledge from the formal sector of the North to the formal sector of the South while maintaining a free flow from the informal sector of the South to the formal sector of the North. Patents also block a free flow of knowledge between the formal and informal sectors of the South, since research is systematically privatized and transnationalized, breaking the vital link between science and society, the only thing that nurtures creativity. Biodiversity, and knowledge about its utilization, therefore, gets steadily eroded in the public domain, causing both ecological and economic impoverishment in the Third World.

Just and sustainable use of biodiversity

The most important issue to recognize in biodiversity utilization is that the new biotechnologies based on genetic engineering are only one among diverse scientific and technological options. The second significant issue is that these technologies have to be assessed and not just blindly accepted as superior. The world cannot assume that either the indigenous plants and animals or the methods of their utilization by indigenous communities are intrinsically inferior. They have merely been defined as inferior and then been replaced by more powerful interests and systems.

Indigenous seed varieties or landraces are called 'primitive' not because they yield less or are more vulnerable to drought and pests. They are called 'primitive' because they do not respond as favourably to chemical inputs as do the so-called 'miracle seeds' of the Green Revolution, which are inaccurately called 'high-yielding' but are merely high-response varieties.

Twenty-five years after the introduction of chemicals, users are aware of the high ecological and health costs associated with them. Seeds that re-

spond to chemicals and native seeds which do not require chemical input should be scientifically reassessed for their respective performance in chemical-free agriculture. This creates a new opportunity to build alternatives on the basis of local diversity and the local knowledge of that diversity. In such an alternative, there is room for scientist/farmer collaborations, not on the old destructive relationship of the all-knowing scientist and the ignorant farmer, but in a new partnership of scientists and farmers as knowledgeable and creative actors.

Public sector research institutions which were set up in the Green Revolution period therefore need to be democratized to serve local communities. In the absence of such democratization, these institutes are either being globalized and privatized to serve transnationals or they are closing down. The debate on patenting in the Consultative Group on International Agricultural Research (CGIAR) system portends these trends towards privatization of public sector research systems.

The democratization of research involves the recognition of certain principles. Research systems in the Third World are dynamic only in so far as they are integrated with the needs of society (especially the poor and powerless) and work for social objectives as opposed to profit. In research for sustainable agriculture, Third World farmers must be recognized as major sources of knowledge of biodiversity and its sustainable use. Epistemologically, the Third World farmer, the Third World scientist and the industrialized country scientist working for a corporation have to be recognized as having equal capacities and rights to maintain the principles of democracy in knowledge generation. The dichotomy between conservation and production is a false one induced by the system of industrial capitalism. Production can only be sustainable when based on conservation. Conservation itself can become unsustainable if it is separated from production. Thus *in situ* conservation by farmers can only be sustained if it is recognized as a production system. The democratization of knowledge is therefore linked to the democratization of production so that different producers are recognized for their contributions to feeding and healing the world. Policy options need to support these different sectors and actors, rather than supporting only one, such as genetic engineering under corporate control. A narrowing of options makes for non-sustainability, high vulnerability and high levels of social and ecological waste.

Not until diversity is viewed in terms of production can it be conserved. If production continues to be based on uniformity and homogenization, uniformity will continue to displace diversity. Improvement from the corporate viewpoint, or from the viewpoint of western agricultural or forestry research, is often a loss for the Third World, especially the poor. It is therefore not inevitable that production should act against diversity. Uniformity

as a pattern of production becomes inevitable only in a context of control and profitability. Such *in situ* conservation-cum-production also provides an alternative to patent monopoly on life forms.

The utility of farmers' and tribal peoples' seeds has high social and ecological value, even if it has no market value attached to it. The limits of the market system in assigning value can hardly be a reason for denying value to farmers' and nature's seeds. It points more to the deficiency of the market system than to the status of the seed or farmer intellect.

There is no epistemological justification for treating some germplasm as valueless and common heritage and other germplasm as a valuable commodity and private property. This distinction is not based on the nature of the germplasm but on the nature of political and economic power.

In India, Navdanya, a programme of the Research Foundation for Science, Technology and Natural Resource Policy, has built up a farmer-run network for seed conservation, regeneration, production and distribution as an alternative to the centralized control of the seed industry and as a further alternative to patent-controlled resources and research. Navdanya is an alternative that aims to protect biodiversity, local knowledge and rights to that biodiversity.

Alternative principles should be supported for governing the conservation and utilization of biodiversity. Both resources and knowledge need to remain in the public domain in areas critical to human survival, such as food production and health care. Farmers' rights, as the rights of indigenous communities to conserve their resources and regenerate their knowledge of resources, should be respected and effected in development planning. Support should be given to public sector research institutions to ensure that they are democratized and serve local and national needs, and are not dismantled or privatized to serve the needs of transnational corporations. *In situ* conservation and production need to become one to ensure that diversity enters the logic of production.

Notes

1. Agenda 21 is the global agenda for action from the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992.
2. See Posey's further comments in the next chapter.
3. Article 3(h) and 3(i), Indian Patent Act 1970.
4. Article 3, Convention on Biological Diversity.

7

International agreements for protecting indigenous knowledge

DARRELL POSEY

The links between biological and cultural diversity are inherent in the Convention on Biological Diversity that was signed by 126 Heads of State during the Earth Summit in June, 1992. Although many people feel that the language of the Convention is weak, most agree that progress was made. Certainly for indigenous peoples there was at least recognition of their important role in the new environment and development order—and a call for them to benefit through equitable sharing from sustainable development. The Rio Declaration on Environment and Development signed at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro clearly establishes the relevance of indigenous peoples and the central importance of their protection in order to attain sustainable development. Given the squeamishness of nation-states regarding indigenous peoples' rights in the past, the tone of the Rio Declaration can be considered progressive and welcome. Principle 22 states: 'Indigenous people and their communities, and other local communities, have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.'

Article 1 of the Convention states:

> The objectives of this Convention . . . 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, including by appropriate access to genetic resources and appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

The underlying logic behind these objectives is that biological diversity can only be conserved if it is sustainably utilized, particularly by the biotechnology industries, and the economic benefits of such utilization flow back to conservation activities, particularly in developing countries. States retain sovereign rights to their biological and cultural resources, and are responsible for ensuring that the benefits flowing from the utilization of biological resources reach their citizens.

Indigenous peoples, who have largely been marginalized (if not totally eliminated) by such processes in the past, are understandably sceptical. For the first time, indigenous and local communities embodying traditional lifestyles are expressly mentioned in the Convention and their invaluable contribution to biological diversity conservation recognized. Signatories to the Convention have pledged, in Article 8(j), to:

> . . . respect, preserve and maintain knowledge, innovations, and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

The real 'outline for action' of the Earth Summit is Agenda 21. Chapter 26 deals specifically with indigenous peoples, traditional knowledge and sustainable development. This list of 'priorities for action' is more than adequate to direct major global resources into the use, application and protection of indigenous peoples, their cultures, physical and intellectual resources.

The language of the Rio Declaration, the Convention and Agenda 21 is sufficiently vague to be moulded into future political and economic actions by the international pressures that are applied. Given that indigenous and traditional peoples are recognized as having special rights and benefits, and that economic livelihood is linked to development and conservation of natural resources, it is definitely worthwhile that energies and efforts be directed towards pushing the relevant sections in the direction of indigenous rights, including the recognition and protection of, as well as compensation for, intellectual property.

The Global Environment Facility (GEF)[1] became the major implementing facility for action that results from Agenda 21 and the Convention. Thus, it stands to become a significant agent of change (or non-change) in the future. GEF projects are determined and controlled by the World Bank, to-

gether with the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP).

In the most recent 'Criteria for Eligibility and Priorities for Selection of Global Environment Facility Projects', priority is to be given to 'economic, ethical and cultural value estimation of areas of biological diversity.'[2] Although not explicitly spelled out in the draft version of the guidelines, the final version will supposedly include protection of intellectual property of traditional and indigenous peoples as a criterion for project evaluation.

Indigenous groups doubt that existing international and national laws will adequately recognize and protect their knowledge, innovations and practices. They are even more sceptical that 'trickle-down benefits' will occur, since historically they have rarely benefited from the goodwill of nation-states. It seems that intellectual property rights (IPRs) may be one of the most useful mechanisms for securing the 'equitable sharing' promised in Rio.

Intellectual property rights

During informal hearings held in Geneva during Prep-Com III of the United Nations Conference on Environment and Development (UNCED), August, 1992, indigenous representatives discussed their concerns and scepticism regarding the use of IPR regimes to protect their cultural heritage. It was clear that under *some circumstances* commercialization of knowledge and plant genetic resources might be desirable, but the prime desire for indigenous peoples was an IPR regime that gave them the right to reject privatization and commercialization.

Several other basic problems were specifically pointed out. The categories between cultural, intellectual and physical property are not as distinct and mutually exclusive for indigenous peoples as in the Western legal system. 'Sacred sites', for example, are frequently types of ecological reserves that are the result of human knowledge in management and conservation, as well as cultural centres that have physical and spiritual significance. Secondly, knowledge is generally communally held, and, although some specialized knowledge may be held by certain ritual or society specialists (such as shamans), this does not give that specialist the right to privatize communal heritage. Thirdly, even if legal IPR regimes were to be implemented, most indigenous communities would not have the financial means to implement, enforce or litigate.

IPRs can be accepted as currently defined, or the entire concept can be purposefully moulded, expanded and re-designed. The former is said by most IPR lawyers to be impossible, given the industrial property connotations, individual property bias and inequality of access to legal structures

faced by local communities. The latter, therefore, seems to be the only option—albeit a very challenging and difficult one.

Essentially established to protect individual, technological and industrial inventions, it seems that IPR is a very unlikely tool to protect the collective, trans-historical and intangible qualities of indigenous cultures. Many hold that IPR is the completely *wrong* way to go about strengthening and empowering local communities, traditional and indigenous peoples. Perhaps they are correct, but the pursuit of the nebulous and incorrigibly difficult precepts upon which IPR is based is justifiable because IPR is a subject that excites, incenses and challenges thinkers from most disciplines and cultures. IPR is one of the 'hottest subjects going' in most political and business circles because biological diversity and knowledge are now seen as being very valuable.

Valuing biological diversity and setting out the ground rules for biotechnology (biogenetic resource acquisition and 'sharing of benefits' from their genetic manipulation) were the essence of the Earth Summit. There is no question that genetic resources and the knowledge of traditional and indigenous peoples about those resources are the new gold, silver and diamond mines and petroleum-derived polymer factories of the future. They are the newest 'last frontier' that will draw explorations and underpin future economies.

Indigenous peoples will be a part of this process since their knowledge has unabatedly been shown to offer the keys to understanding sources for new medicines, fertilizers, foods, oils, repellents, insecticides, building materials and dyes. The lands and territories they have defended, occupied and moulded over the millennia are the major sources for this new wealth. Will they benefit from this process, or will they become yet again the victims of an expanding frontier?

Sceptics doubt that anybody will benefit in the long run. The real issues that face the planet—poverty, social injustice, human rights violations and environmental degradation—were only peripheral at UNCED. Sadly, much of what went on was a political game to re-divide the world's resources between key global players, or would-be players. Environmentally rich countries want to be given as much power as technologically rich countries. One has to admit that 'bio-culturally rich' *vs* 'industrially rich' is at least more pleasant to the ear than 'developed' *vs* 'un- or under-developed countries', 'northern' *vs* 'southern', or 'first' *vs* 'third world'. No matter the dichotomy in vogue, the consumer society will eat its way to the collapse of the global environment and economy.

Given this grim scenario, the best strategy seems to be to support, protect, strengthen and empower those indigenous and traditional societies that are still relatively out of the destructive system. IPR may not do that, but it

will probably buy them some time—and may even help. Demanding that knowledge of non-literate peoples should be held on a par with knowledge of the industrialized world will stimulate new debates on concepts of wealth and property based upon conservation of biological and cultural resources. Undoubtedly there are other channels to effect this dialogue, but IPR goes beyond other proposals made to date. A number of overlapping areas of international law and agreement can be identified in order to build upon the results of the Earth Summit in order to provide the synthetic and ideological basis for a newly designed IPR (which will surely also have to be renamed).

Indigenous perspectives and non-Western models

IPR is a foreign concept to indigenous peoples. Until very recently, the subject was not on their agenda. Within the past two years, however, that has changed. For example, in the Charter of the Indigenous-Tribal Peoples of the Tropical Forests (Article 44), IPR concerns are explicitly stated: 'Since we highly value our traditional knowledge and believe that our biotechnologies can make an important contribution to humanity, including "developed" countries, we demand guaranteed rights to our intellectual property, and control over the development and manipulation of this knowledge.'[3] In the current Draft of the Declaration on the Rights of Indigenous Peoples, such concerns are also clearly stated in paragraph 19: 'Indigenous peoples have the right to special measures for protection, as intellectual property, of their traditional cultural manifestations, such as literature, designs, visual and performing arts, medicines and knowledge of the useful properties of fauna and flora.' The 'Kari-Oca Declaration' from the indigenous peoples' meetings prior to UNCED, demands that: 'Our health rights must include the recognition and respect of traditional knowledge held by indigenous healers. This knowledge, including our traditional medicines and their preventive and spiritual healing power, must be recognized and protected against exploitation' (Article 26).[4] Furthermore, in Article 38, the Declaration states that: 'Indigenous peoples maintain the right to be compensated for the use of their lands and resources.' Even more explicitly, the 'Kari-Oca Declaration' devotes an entire section to 'Culture, Science and Intellectual Property' (Articles 84–109). Article 99 emphatically states that: 'The usurping of traditional medicines and knowledge from indigenous peoples should be considered a crime against peoples.' Article 102 most elegantly summarizes the basic concerns for IPRs:

> As creators and carriers of civilizations which have given and continue to share knowledge, experience and values with humanity, we require that our right to intellectual and cultural properties be guaranteed and that the

> mechanisms for each implementation be in favor of our peoples and studied in depth and implemented. This respect must include the right over genetic resources, gene banks, biotechnology and knowledge of biodiversity programs.

One of the areas of IPR research that is most lacking is that of non-Western IPR regimes. Up to now, the debate has centred around United Nations and Western concepts of intellectual and genetic property. There are, of course, ancient systems of property utilized by Muslim, Hindu, Chinese and many other civilizations, but what about the property regimes of indigenous peoples themselves? Cunningham[5] mentions a few African examples, and numerous other examples are to be found in many places. A synthesis and analysis of non-Western systems would be very helpful in finding creative solutions for the 'new IPR' category.

The International Labour Organization

The International Labour Organization (ILO) was the first UN organization to deal with indigenous issues. A Committee of Experts on Native Labor was established in 1926 to develop international standards for the protection of native workers. The ILO has traditionally been seen by indigenous peoples, however, as an institution interested more in their 'integration' into national work forces than their collective rights as distinct societies. The original Convention 107, Convention Concerning the Protection and Integration of Indigenous and Other Tribal and Semi-Tribal Populations in Independent Countries (June 5, 1957), by its very name gave credence to those concerns.

The Convention was revised in June, 1989 as Convention 169, the Convention Concerning Indigenous Peoples in Independent Countries, and much of the integrationist language was removed. Its seventh preambular paragraph refers to 'the distinctive contributions of indigenous and tribal peoples to . . . ecological harmony of humankind.' Article 7 guarantees the right of indigenous peoples to decide their own development priorities and to control their own economic, social and cultural development.

Article 13(1) states that governments 'shall respect the special importance of the cultures and spiritual values of the peoples concerned of their relationship with the lands or territories, or both as applicable,.which they occupy or otherwise use, and in particular the collective aspects of this relationship.' The recognition of *collective aspects* is a critical aspect of the Convention and is important in IPR issues, since collectivity is fundamental to transmission, use and protection of traditional knowledge.

ILO Convention 169 is the only United Nations Convention that specifically deals with indigenous peoples. Although the Convention does not specify IPR, its language is conducive to protection of these rights.

Interestingly, the Convention is not even mentioned in the Secretary-General's concise report on 'Intellectual Property of Indigenous Peoples'.

Conventions, such as ILO 169, have a presumed legal basis but no effective mechanisms for enforcement, although they do serve as general agreements upon which legal and ethical positions can be argued. The International Court of Justice, for example, could be of assistance to indigenous peoples in IPR cases. The UN General Assembly, or member states, would have to initiate any action, however, which makes such action extremely difficult—given current levels of apathy for indigenous issues in general and vested interests of influential national and international economic forces.

Human rights

The 1948 Universal Declaration of Human Rights (UDHR) and subsequent International Covenant on Economic, Social and Cultural Rights (ICESCR, 1966) guarantee fundamental freedoms of personal integrity and action, political rights, social and economic rights and cultural rights. The principle problem with the 'human rights approach' to cultural protection is that action (or inaction) is directed toward nation-states and does not easily 'provide a basis for claims against multinational companies or individuals who profit from traditional knowledge. Any remedies would be against either the state where the indigens are located (for failure to protect them) or against the state or the company profiting from the knowledge (if there are transnational obligations or if the state is part owner of the enterprise).'[6]

Nonetheless, IPRs are consistently seen as basic human rights and are implicit in the Universal Declaration. For example, Article 1 (ICESCR, art. 1; ICCPR) establishes the right of self-determination, including the right to dispose of natural wealth and resources. This also implies the right to protect and conserve resources, including intellectual property. Article 7 (UDHR) allows for equal protection under the law, thereby implying that IPR protection should be available to indigenous peoples as well. Article 17 provides for the right to own collective property and not to be arbitrarily deprived of that property. And Article 23 (UDHR) guarantees the right to just and favourable remuneration for work, which could undoubtedly be interpreted as work related to traditional knowledge. Finally, Article 27 (UDHR) provides for the right to culture and recognition of interest in scientific production, including the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production.

This language is echoed in the Draft Declaration on the Rights of Indigenous Peoples, which states in paragraph 18, 'Indigenous peoples have the right to the protection and, where appropriate, the rehabilitation of the total environment and productive capacity of their lands and territories, and

the right to adequate assistance including international cooperation to this end.'

It is clear that IPRs should be seen as manifestations of basic human rights. Furthermore, it is clear that human rights organizations should take up the cause of IPRs, and appropriate international legislation should be used to defend indigenous and traditional knowledge and biogenetic resources from unjustified exploitation.

Working Group on Indigenous Populations

In 1972, the United Nations Economic and Social Council (ECOSOC) authorized the Commission on Human Rights to form a special sub-commission 'to conduct a broad study of the problem of discrimination against indigenous peoples.' After a lengthy delay, a voluminous report found that present international instruments are not 'wholly adequate for the recognition and promotion of the specific rights of indigenous populations as such within the overall societies of the countries in which they now live.'[7]

In 1982 ECOSOC created the Working Group on Indigenous Populations. Since that time, the Working Group has prepared a Declaration on the Rights of Indigenous Peoples and has become the most open international forum for indigenous representatives and advocates of indigenous rights.

Resolution 1990/27 of the sub-commission recommended that any UNCED convention 'Provide explicitly for the role of indigenous peoples as resource users and managers, and for the protection of indigenous peoples' right to control of their own traditional knowledge of ecosystems.' Resolution 1991/31 called for a study on the applicability of collective rights regarding property, including intellectual property.

In 1991, the Sub-Commission on Prevention of Discrimination and Protection of Minorities requested the secretary-general to prepare a concise report on the extent to which indigenous peoples can utilize existing international standards and mechanisms for the protection of their intellectual property, drawing attention to any gaps or obstacles and to possible measures for addressing them. In the Concise Report of the secretary-general of the United Nations directed to the Commission on Human Rights (Sub-Commission on Prevention of Discrimination and Protection of Minorities) Forty-fourth session, intellectual property has been divided into three groups: folklore and crafts (oral literature, music, dance, artistic motifs and designs, basketry, beading, quillwork, carving, weaving and painting); biological diversity (plant varieties, medicine, materials for house, boat or other kinds of construction or use); and indigenous knowledge (knowledge of plants and animals, ecosystems and other techniques and skills for survival).

Beyond the commercial and environmental interests in conserving traditional knowledge, the Secretary-General says that there is an overriding and 'largely unpaid moral debt to indigenous peoples for their contribution to the arts, sciences, technology and other areas of human knowledge and endeavour.' Furthermore, 'While ethically it may be appropriate to recognize the historical debt of modern society to the knowledge and "discoveries" of indigenous peoples, it may also be appropriate to consider ways of protecting and compensating the present-day knowledge of indigenous peoples'.

In May 1992 the United Nations held a Technical Conference on Indigenous Peoples and the Environment in Santiago, Chile. The conference established some basic principles that include: 'recognition, protection and respect for indigenous knowledge and practices that are essential contributions to the sustainable management of the environment.' It was also recommended that the UN system take effective measures to protect property rights, including intellectual property of indigenous peoples.

These declarations and recommendations, together with the Draft Declaration from the Human Rights Commission, have been a clear call for protection of and just compensation for the IPRs of indigenous and tribal peoples. The progressive language of the Convention has, likewise, set the bureaucratic wheels of the UN in motion towards some very interesting issues that depend upon the recognition of minority participation, equitable sharing and collective rights.

Folklore and plant variety protection

The United Nations Educational, Scientific and Cultural Organization (UNESCO) is perhaps the most logical place to deal with questions of IPRs as fundamental rights of native peoples. Although UNESCO has heard 'petitions' of complaints by native peoples related to the fields of education, science, culture and information, indigenous questions are still only marginal to the agenda of UNESCO's Executive Board. There is at least some tacit interest in IPRs by UNESCO representatives, however, and some action might follow if sufficient pressure is applied from member states.

The World Intellectual Property Organization (WIPO) in Geneva has 123 member states that have already reached broad agreements on industrial property and copyright. *Industrial property* deals chiefly with inventions, trademarks, industrial designs and appellations of origin. *Copyright* deals chiefly in literary, musical, artistic, photographic and cinematographic works. The application of industrial property agreements has never been related to indigenous knowledge or handicrafts. Copyright laws have proven ineffective because they depend upon the identification of individuals who produced the work to be copyrighted. Folklore represents tradi-

tions that transcend the life span of individuals and, therefore, are collective property and not protectable.

In 1984, WIPO, together with UNESCO developed 'Model Provisions for National Laws on the Protection of Expressions of Folklore Against Illicit Exploitation and Other Prejudicial Actions.' The Model Provisions were stimulated by the multiple abuses, distortions and mutilation of folklore traditions being provoked by the development of technology in audiovisual productions, phonograms, broadcasting and cable television. The Model Provisions specifically refer to the problem that communities do not benefit from the folklore which they develop and maintain.

The International Board of WIPO that prepared the *sui generis* Model Provisions sought to maintain a balance between protection against abuses of expressions of folklore and the freedom and encouragement of their further development, as well as adaptations inspired by folklore. The Board emphasized folklore as a living body of human culture which should not be stifled by too rigid a protection. Both individual and collective folklore traditions are recognized. The words *expressions* and *productions* are used instead of *work* to emphasize that the provisions are *sui generis* and that copyright laws have not proven effective in the protection of folk traditions. Under the Model Provisions, folklore need not be 'reduced to material form' (that is, written down) to be protected.

The Model Provisions avoid dealing with the concept of *ownership*, since the owners of folkloric traditions in some countries is legally the state. Emphasis is given to authorization of use by the 'competent authority' or 'community concerned'. Compensation for authorized use would, therefore, be negotiated during the authorization process. Unauthorized use or willful distortion of folklore prejudicial to the cultural interests of the community would be considered a punishable offence. Fines, seizure and imprisonment are foreseen as enforcement measures. It is important to remember that the Model Provisions are nothing more than proposals for member states. No country to date has adopted the Model Provisions. Furthermore, members of the Group of Experts from WIPO and UNESCO that reviewed the Model Provisions in 1984 recognized the urgent need for international protection of expressions of folklore but concluded that an international treaty would be premature. Reasons for such a conclusion were that appropriate sources for the identification of the expressions of folklore to be protected were lacking, and no workable mechanisms for settling disputes could be found.

Although no further developments have occurred since 1984, the WIPO Model Provisions did propose the recognition of collective and individual expressions and productions that remove folk expressions from the necessity of having the personality of a creator/artist as required by copyright

law. Establishment of the principle that unwritten or oral expressions can be protected and that fees for such expressions should be paid, with criminal penalties for those who disrespect the necessity of authorization, was (in the bureaucratic ways of international politics) something of a triumph.

Perhaps the only concrete development generated by the Model Provisions was the application of neighbouring rights to protect native performers. Using this principle, folkloric expressions could be considered the same as the performance of a work and, therefore, protected under international copyright agreements as set out in the 1961 Rome Convention for the Protection of Performers.

The Model Provisions did not specifically refer to scientific views of native peoples. In part this is because of the bureaucratic functioning of WIPO and other UN organizations. They were not specifically instructed to provide Model Provisions for this area and felt obliged not to do so. It would require specific requests to WIPO from the UN General Assembly and/or member countries in order to effect similar Model Provisions for scientific IPR issues.

In 1991, however, the Sub-Commission on Prevention of Discrimination and Protection of Minorities requested the Secretary-General of the Commission on Human Rights to prepare a concise report on the extent to which indigenous peoples can utilize existing international standards and mechanisms for the protection of their intellectual property, drawing attention to any gaps or obstacles and to possible measures for addressing them. WIPO was also specifically requested to help in 'formulating recommendations for the effective protection of the intellectual property of indigenous peoples'.

One interesting question is whether neighbouring rights can be applied to expressions of agriculture. A critical point for indigenous peoples is that plant (and animal) genetic resources must be seen as unique to their cultural heritage. This approximation is not unusual, in as much as plant genetic resource protection falls under WIPO's jurisdiction within the UN.

The Union for the Protection of New Varieties of Plants (UPOV) is an independent, intergovernmental organization having legal personality. It is linked to WIPO in that its secretariat is located in the same building as WIPO and its Secretary-General is also the Director General of WIPO. WIPO established a Convention in 1961 (amended in 1972 and 1978) for the protection of breeders of new plant varieties. Under the international convention, natural or legal persons resident in member states can acquire protection for plant varieties that they have developed that are 'clearly distinguishable', 'sufficiently homogeneous' and 'stable in essential characteristics'. Breeders' authorization is not required for the use of the protected variety to create other varieties; in other words, new varieties can be freely developed from the protected variety.

The Convention calls for compensation of the breeder for use of the protected variety. No cases have appeared before UPOV in which native peoples are considered the breeders of distinctive varieties, although ethnobiologists, geneticists and botanists can now clearly show that the origins of hundreds of domesticated varieties lie with indigenous selection for and improvement of genetic traits. Even wild varieties may show extensive selection for millennia with resultant genetic improvements, although these varieties were never given domesticated status.

The critical factor here is to link folklore and plant genetic resources with intellectual property. It is this complicated legal linkage that allows for expansion of the concept of IPRs to include traditional knowledge not only about species use, but also about species management. Thus, ecosystems that are 'moulded' or modified by human presence are a product of indigenous intellectual property as well, and, consequently, are products themselves (or offer products) that are protectable. Furthermore, wild and semi-domesticated (or semi-wild), as well as domesticated plant and animal species, are products of human activity and should also be protectable.

Farmers' rights

The UN Food and Agriculture Organization (FAO) has tackled the issues of farmers' rights and breeders' rights. Major goals, in a series of conferences, were to find ways in which developing countries and Third World farmers could get a share of the huge seed market. Basic food crops, like rice, maize and wheat, were originally acquired from native peoples, and genetic material from wild stock is still essential to breed into existing varieties the resistance necessary to sustain economic production. Third World countries are in enviable positions, since they 'possess the greatest genetic wealth of edible plants at a time when plant genes are in greatest demand in the flourishing biotechnology industry'. Yet developing countries continue to be reluctant and timid in their demands of IPRs for their genetic resources.[8]

In 1987, FAO established a fund for plant genetic resources. The idea was to establish a fund to finance projects for sustainable use of plant genetic resources in the Third World. Contributions would be linked to the volume of total seed sales. Unfortunately, contributions were voluntary and the fund wholly inadequate. Major seed producers, like the USA, have opposed mandatory contributions to the fund. The USA has, in fact, even refused to participate in USA discussions on the matter. Instead, it has pushed for patent rights for all laboratory improved varieties.

Religious freedom

In a seminar on IPRs at the United Nations Human Rights Convention in Vienna, June 1993, Ray Apoaka, chairman of the North American Indian

Congress, suggested that IPRs is essentially a question of religious freedom for indigenous peoples. 'Much of what they want to commercialize is sacred to us. We see intellectual property as part of our culture—it cannot be separated into categories as [Western] lawyers would want.' Pauline Tangipoa, leader of the Maori, agrees: 'Indigenous peoples do not limit their religions to buildings, but rather see the sacred in all life.'

The Human Genome Project is an example of the dangers indigenous peoples see in the unbridled research and commercialization of genetic resources. In a brochure distributed by the World Council of Indigenous Peoples, a frantic alarm is raised over the genetic research that is taking place on indigenous peoples in the name of global health.[9] They are concerned that such research will not benefit them and that it may even be utilized to destroy or weaken them. They are concerned that someone else is going to commercially benefit (and in a big way) from their genetic material, and they have not even been consulted on the matter. Certainly no sharing of profits is mentioned, even in the fine print. The Human Genome Project clearly infringes on the human rights and religious freedom of indigenous groups. Most groups chosen to be surveyed (that is, have bits of their hair, skin, blood and other body materials analysed in laboratories) believe that taking of such material from an individual is against their religion. Yet science, as well as industry, does not recognize religion as a valid factor in professional activities.

Non-governmental and professional activities

The World Commission on Environment and Development (WCED) pointed out in 1987 that 'tribal and indigenous peoples' lifestyles can offer modern society many lessons in the management of resources in complex forest, mountain and dryland ecosystems.'[10] Scientists are increasingly documenting the complex nature of indigenous, scientific and ecological knowledge in order to emphasize the profound importance of such information in the development of alternative models of sustainable natural resource use, management and conservation.

In 1988, the International Society for Ethnobiology (ISE) in its first world congress in Belem, Brazil, established a set of principles for research and work with indigenous and local communities. The Declaration of Belem was the first to call attention to the 'inextricable link' between the conservation of biological diversity with the preservation of cultural diversity. It was the first international declaration to specifically call for the protection of and compensation for IPR that is treated as 'an inalienable right'. Principle 4 of the Declaration states that 'Procedures be developed to compensate native peoples for the utilization of their knowledge and their biological resources.' In 1990, the ISE established the Global Coalition for Biological and Cultural

Diversity that, in turn, started an International Working Group on IPRs that now has over 350 members worldwide. The Global Coalition has also worked to develop a model covenant on intellectual and cultural property that can be used as a template for negotiations by local communities with companies, researchers and institutions.

Codes of ethics and professional behaviour similar to the Declaration of Belem have been developed by the International Society of Chemical Ecology (1989), Society of Economic Botany (1991), US National Institute of Health/National Cancer Institute (1991), Global Biodiversity Strategy (WRI/IUCN/UNEP) and Asian Symposium for Medicinal Plants, Spices and other Natural Products (1992) and American Society of Pharmacognosy (1992).

During its Second International Congress in Kunming, China, ISE established the Global Coalition for Bio-Cultural Diversity, with one of its major goals being to put IPRs on the political agenda of as many NGOs, professional societies, businesses and governments, including the UN, as possible. The International Working Group on Intellectual Property Rights began to take on this task.

The World Wide Fund for Nature (WWF) is currently conducting IPR research from the community level and will eventually develop educational materials as well as model agreements for local and traditional peoples. The World Conservation Union (IUCN) began a Task Force on Indigenous Peoples in order to articulate more coherent and effective policies in the conservation of nature through the involvement of indigenous peoples and the use of traditional knowledge in effective conservation activities.[11] Likewise, major environmental groups, such as WWF, have taken on IPR issues as a key mechanism of the more just and equitable partnership necessary to conserve biological and cultural diversity.[12]

Technological developments in genetic engineering and biotechnology, combined with more effective screening procedures, have stimulated large companies to seek new industrial products from plants, animals, micro-organisms and marine organisms. Pharmaceutical products form one of the biggest categories, although health and body products, natural fertilizers, insecticides and repellents, colourings, dyes, oils and essences are providing booming research results. Genetic resources from crop plants also bring huge economic benefits to seed companies. Plant species of horticultural potential are yet another area of great economic potential.[13]

Since most of these materials come from the communal resources of local farmers and traditional and indigenous peoples, the knowledge, chemical structures and genes are seen 'as belonging to nobody, [so] there is little incentive to conserve either species or habitants.'[14] As the IUCN Task Force on Indigenous Peoples concluded in its May 1993 meeting: 'Local indige-

nous communities must be actively involved in developing strategies, regionally and nationally as well as locally, and in their implementation and monitoring.' To achieve this end, the Task Force developed the following basic principles:

- Indigenous peoples' participation is a fundamental ingredient in strategy planning.
- Locally-maintained technologies and knowledge are fundamental to the development and implementation of strategies that cover their territories.
- Initiatives must incorporate approaches that enable sharing of power and decision-making as well as the inclusion of input and information.

Basic to the implementation of these principles is the development of partnerships that rest in the securing of IPRs and just compensation for traditional knowledge and biogenetic resources.[15]

The most celebrated agreement to date is between INBio (Instituto Nacional de Biodiversidad) of Costa Rica and Merck Pharmaceuticals. In the agreement, Merck paid US$1 million 'up front' for collecting and screening privileges. If any new products are developed, Merck retains the patent rights but must share profits with INBio (to date the royalty figure is undisclosed but is thought to be 3 per cent), who, in turn, will invest the funds in conservation activities.[16]

The US National Institute of Health's (NIH) National Cancer Institute (NCI) has also developed a set of general principles to govern its vast collections across the globe. Compensation for traditional knowledge and biogenetic resources is central, with compensation including training, institution-building and information transfer. Similar arrangements have been set up with the New York Botanical Garden and Kew Royal Botanical Gardens, with beneficiaries being the state governments.

'Guidelines for Equitable Partnerships in New Natural Products Development' have also been developed by WWF, together with UNESCO, and the Kew Gardens 'People and Plants' initiative. The 'Code of Practice' considers the wide range of subjects related to equitable relationships between institutions and corporations with local communities and indigenous peoples. While recognizing that governments hold sovereignty over biogenetic resources, the code calls upon governments to 'accept the responsibility for establishing or implementing national policies for the conservation and use of biological diversity' (Section 1.1), while collectors are urged to 'respect local social values, traditional, and customary law' (Section 5.4). While encouraging 'ethno-directed' screening and collection, the Code leaves the IPR issue up to national governments who 'should be free to decide whether or not to adopt IPR protection for new natural products' (Section 8.3). There is very little in the Code to console, encourage or even orient local communities as to how to deal with IPR issues.

The obvious problems of these arrangements is that local communities in general, and indigenous peoples in particular, are benefited only if the governments or non-governmental organizations so desire. This very basic point has brought all agreements existing to date under much-deserved criticism, since indigenous and traditional peoples are no longer interested in intermediaries or patrons.

Indigenous peoples and developing countries have taken steps on their own to deal with misappropriation and misuse or unauthorized use of traditional knowledge. In 1979, the Organization of African Unity urged that herbal medicine research be carried out in secrecy to prevent multinational companies from developing new drugs and selling them back to developing countries at high prices.[17] The Kuna Indians of Panama developed a 26-page manual in 1988 to regulate scientific research in their area.[18] The Kayapo Indians of Brazil are currently negotiating an IPR code and contract with the Body Shop to regulate commercial activities in their region, especially regarding the development of new products based on traditional knowledge and local biogenetic resources.

Linking markets and conservation

As with the Rio Declaration and the Convention, there is an underlying premise that 'green consumerism' can stimulate biological and cultural diversity. Many feel, however, that markets are incompatible with conservation. Ecologists are justifiably concerned with the ecological impact of production of 'natural products' that become too successful. The tendency is always toward monocultures of cash crops. Many worry that international demands may spell the end of biodiversity rather than encourage conservation of natural resources as initially desired.

Anderson has drawn attention to the relatively low productivity of some traditional models of economic exploitation, including, most specifically, the 'extractive reserves'. He shows how reliance on Brazil nuts and rubber is not only economically impoverishing but decreases biodiversity as well. He argues:

> Before we can work to improve extractive reserves we need a critical vision of their limitations. While it is necessary to clear the air of some of the romantic myths associated with extraction, I would disagree with the contention that extractivists are marginal elements in the process of frontier expansion in Amazonia and that we should, therefore, concentrate our efforts in improving land-uses among the numerous colonists. In a practical sense, the forces struggling against deforestation in Amazonia are vanishingly small, and it is imperative that allies and battlegrounds be chosen carefully.[19]

Browder is yet another persistent voice in pointing out the over-rated productivity of traditional Amazonian models of exploitation. He expounds the somewhat politically unpopular position that Chico Mendes and 'his rubber tappers', for example, were a political movement and not an environmental one. According to him, rubber tappers also deplete their resource base, and too many funds have gone to help one small segment of the poor hold onto their cultural heritage and way of life.[20] Solutions are needed for all the poor inhabitants of tropical forests.

Likewise, Redford sharply warns that many traditional societies heavily exploit the fauna of their reserves and provoke reduction, even local extinction, of heavily-hunted species. This process of 'defaunation' can also lead to *ecological extinction*, defined as 'the reduction of a species' abundance, so although it is still present in the community, it no longer interacts significantly with other species.' Indigenous peoples are not 'ecological noble savages'. The degree of ecosystem destruction on the global level may mean that, in some cases, the only way to conserve biodiversity is to abolish all types of human behaviour—from road-building and timber extraction, to indigenous hunting and extractivism.[21]

Provocations of cultural changes can be equally concerning. Is not the establishment of mechanisms for just compensation of native peoples also the destruction of their societies through the subversion of materialism and consumerism? Historically, indigenous peoples and local communities have never fared well with the vastly more powerful outside economic system. The 'harvest ideology' is essentially an integrationist argument, a retrograde philosophy which could set the campaign for tribal peoples back 25 years or more by playing right into the hands of those who want to oppose the movement for land rights. The fact is that indigenous societies and their natural environments are being destroyed by the dramatic expansion of industrialized society now. Good or bad, pharmaceutical companies and 'natural products' companies have tasted success in their efforts: they will not go away. It is also fairly obvious that an ecosystem that has no value will be leveled for whatever has value.

Conclusion

IPR has become a very central issue to debates in many major fields of international politics and law, including human rights, labour law, environment, development, trade and religious freedom. Expansion of markets into local communities has stimulated the IPR debate, which, from the indigenous viewpoint at least, is more a concern for protection *from* commoditization of their knowledge and resources than interest in markets and development of new products. However, increasing needs for alternative sources of income based on traditional knowledge and sustainable development for

indigenous and traditional peoples also makes IPR an issue of equitable sharing from the mining of biodiversity.

Problems central to the implementation of existing IPR tools (copyright, patent, trade secret, appellation of origin, trademark) include the collective nature of traditional knowledge and the necessity for identifying the initiator or inventor of certain knowledge (inventions) and/or genetic resources. ILO Convention 169 has established an international precedent for the recognition of collective rights, as have the Universal Declaration of Human Rights and the Convention on Biodiversity. 'Neighbouring rights', as first described in the WIPO Model Provisions on folklore but subsequently recognized in a wide range of laws relating to expressions of artists, serve as a major advance in the protection of traditional knowledge. Indigenous/traditional knowledge as 'science', however, has only been marginally conceived but will hopefully be developed as a result of the Declaration of Rights of Indigenous Peoples and other developments called for by the secretary-general of the United Nations. Religious freedom guarantees have, to date, not been adequately utilized to defend IPRs, while the provisions of the Convention on Biodiversity (together with Agenda 21) are only now being analysed in order to develop effective strategies to empower local communities and indigenous peoples. Two major steps now need to be taken: (1) IPR debates need to be translated into practical tools for indigenous, traditional peoples and local communities so they can begin to experiment with on-the-ground methods of dealing with the problem of IPRs as *they* define it; and (2) non-Western models of intellectual/cultural property need to be analysed to redefine IPRs as an entirely new concept. Both of these steps must be led by indigenous peoples themselves. The role of scientist, scholar and lawyer should be to provide information and ideas, not to undertake the redefining of IPRs. That should occur as the result of practice and experimentation by local communities. One thing is certain: the concept is not defined, and indeed, should not be defined in the immediate future.

There is some consolation in knowing that IPRs are high on the agenda of governments, non-governmental groups, professional organizations and businesses. To date, however, indigenous rights groups and human rights groups, with some notable exceptions, have not taken up IPRs as a major focus of their activities. This is because of a very profound uncertainty that IPRs is the best mechanism for sustaining biological and cultural diversity. Even with an equitable legal structure, local communities will inherit an inherently unequal access to those structures. It seems unlikely that an indigenous community would ever have the financial means to hire property rights lawyers to defend their interests in a court of law. There is also a distrust of any system that dismembers intellectual from spiritual, cultural and

physical property. Indigenous peoples are not willing to trade their collective, traditional wealth, for privatized, individualized wealth. There is also concern that any mechanism that facilitates access to indigenous peoples and their resources will work not to strengthen the communities and the environment but merely to accelerate their destruction through uncontrollable market forces and unbridled consumerism.

Notes

1. GEF was originally established as a financing mechanism for the Montreal Protocol to reduce greenhouse gases and protect biodiversity, international waters and the ozone layer.
2. UNEP, 1992b, section 9.2.2.
3. Charter of Indigenous-Tribal Peoples of the Tropical Forests: Statement of the International Alliance of the Indigenous-Tribal Peoples of the Tropical Forest, Penang, Malaysia, February 15, 1992.
4. Kari-Oca Declaration and Indigenous Peoples Earth Charter (May 25–30, 1992), Rio de Janeiro, printed in 'IWGIA Newsletter', 1992, pp. 57–61; also see Aparicio, 1992, pp. 53–56.
5. Cunningham, 1993.
6. See Shelton, 1993.
7. UN Document No. E/CN.4/Sub.2/1986/7/Add.4. para. 625.
8. Kloppenburg and Kleinman, 1987b.
9. WCIP, 1993.
10. WCED, 1987, p. 12.
11. Indigenous Peoples and Strategies for Sustainability: Inter-Commission Task Force on Indigenous Peoples. IUCN, Gland, Switzerland, 1993.
12. Cunningham, 1993.
13. Cunningham, 1993, p. 4; see also, Juma, 1989; Yamin and Posey, 1993; Mooney, 1983; Kloppenburg, 1988b; Kloppenburg and Kleinman, 1987b.
14. Cunningham, 1993, p. 4.
15. IUCN, 1993, pp. 16–17.
16. See Stone, 1992.
17. Hanlon, 1979; Cunningham, 1993.
18. Chapin, 1991, p. 17.
19. Anderson, 1990, p. 220.
20. Browder, 1992.
21. Redford, 1992.

8

Access to genetic resources: A legal analysis

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VEIT KOESTER AND CHRISTIAN PRIP

The Convention on Biological Diversity has three main objectives as outlined in Article 1: The conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of its benefits. Of these objectives, the latter is the most controversial and the one which caused the harshest discussions during the negotiations on the Convention. This comes as no surprise since the provisions which implement this objective are supposed to have far-reaching consequences on access to and transfer of genetic resources.

This chapter analyses some aspects of the Convention regarding access to genetic resources from a legal perspective. It addresses how the provisions on access to genetic resources should be interpreted and how they should be implemented in order to make them function in accordance with the objectives.

Throughout this chapter, a number of terms to denominate categories of States are used. Although the genetic resources of interest are mostly found in developing countries, and those using these resources are, to a large extent, the developed countries, the distinction is not made along these lines. Rather, the authors refer to *providing* countries and to *importing* or *user* countries as mentioned in Article15 paragraph three.

From common heritage to national sovereignty

Until recently, genetic resources have not been subject to property rights. They were considered to be open access resources. This implied that they could be collected and utilized freely, though not necessarily free of

charge, by anyone. This principle was reaffirmed as recently as 1983 in the International Undertaking of the Food and Agriculture Organization (FAO) of the United Nations where it is stated in Article 1 that plant genetic resources are the 'heritage of mankind and consequently should be available without restriction.'[1]

Developing countries opposed the principle of common heritage to genetic resources and questioned the fairness of gene-poor developed countries obtaining genetic resources free of charge from the gene-rich developing countries, patenting the products and selling these patented products to the country where the material was collected at exorbitant prices. In the negotiations for the Convention, the developing countries therefore argued that the principle of common heritage should be replaced by the principle of national sovereignty over genetic resources. This argument was adopted.

It may seem that during these negotiations the other primary objective—the conservation of biodiversity—was somehow forgotten. This objective may, at first sight, seem incompatible with sovereign property rights over genetic resources. However, the use of these resources and their commercialization can be seen as a conservation device. Without pursuing this argument in depth here, it should be noted that sovereignty over genetic resources is not counterproductive to conservation. On the contrary, installing property rights over genetic resources creates an incentive for their protection. By giving genetic material a market value, the management and maintenance of the species will in many cases be assured.[2]

Both the Preamble and Article 3 of the Convention reflect the national sovereignty approach which is applied to other natural resources. As the principle implies, governments have the right to determine the utilization of resources within their territories, including demanding payment for the same.

Access to genetic resources

Article 15 of the Convention deals with access to genetic resources and reflects some of the sensitive issues raised, particularly by developing countries.

Nothing in the definitions of *genetic material* and *genetic resources* in Article 2 excludes material that has been modified by genetic engineering or other biotechnological techniques. The problem that this poses is whether provisions on access cover these as well. The provisions of the Convention apply equally to the flow of genetic resources in either direction. Hence the direct commercial use of those genetic resources that are the result of biotechnology by another Contracting Party, or by a private party under its jurisdiction requires compliance with the provisions in this

Article.[3] Access to resources thus includes access to technology, and the participation of providing countries in the results of biotechnology is in this way to some extent contained in Article 15. The Convention must, however, be interpreted in good faith and in accordance with its purposes.

Secondly, it has been suggested that *genetic resources* should be interpreted to include the *knowledge* of genetic resources. The wording of the term and its definition though do not seem to contain this widened application. However, nothing prohibits a State from including this notion in such a way that the access to traditional knowledge is also governed by these provisions.

The first paragraph of the Article recapitulates the fundamental principle of international law on sovereignty over national natural resources. According to this principle, States can exercise sovereign rights over their genetic resources through national legislation. The second paragraph then balances this new principle, indicating that these States shall endeavour to facilitate access and not impose restrictions contrary to the objective of the Convention. This leaves room for access on acceptable and not arbitrary terms.[4] In paragraph four, this issue is further stressed by providing that access is to be on mutually agreed terms, which means that the purchaser and supplier have to agree on the conditions that govern the export.

Paragraph three designates the countries to be considered as 'countries providing genetic resources'. Besides countries of origin and those countries that supply genetic resources from *in situ* sources, countries that acquired the genetic resources in accordance with this Convention are covered by this paragraph for the purpose of the entire Convention. Hereby, genetic resources that are stored in genebanks or kept under *ex situ* conditions in a State that is a contracting party to the Convention and those that were obtained prior to the Convention entering into force are excluded from these regulations.[5] It is because these provisions cannot be applied retroactively that material can still be exchanged without complying with any regulations regarding access or benefit distribution provided in the Convention.

Paragraphs four and five express how access is to be granted formally. It shall be on mutually agreed terms, with prior informed consent (PIC) and subject to the provisions of this Article. States can waive the need for PIC. The PIC procedure is the key issue in this Article. Paragraphs six and seven provide for participation of the countries providing genetic resources in scientific research and the sharing of results of research and benefits accruing from genetic resource utilization. The provisions are identical to those of Article 19 and similar to those in Article 16. The wording of paragraph four makes these provisions explicit prerequisites for the granting of access.

Prior informed consent

The use of genetic resources is, according to the terms of the Convention, related to and dependent on the exercise of sovereignty by the State owning these resources.[6] In order to ensure compliance with the principle of sovereignty, providing countries must design a means of enabling them to effectively determine the conditions on which access should depend. The countries must take further steps to ensure that their regulations are not flouted. To this end, Article 15 (paragraph five) provides for a PIC procedure, requiring that the potential purchaser of genetic resources applies for and receives the authorization of the providing country before acquiring any material from its territory.

The PIC principle was applied for the first time within the field of environmental instruments in the UNEP London Guidelines for the Exchange of Information on Chemicals in International Trade. It was thereafter incorporated in the 1989 Basel Convention on the Control of Transboundary Movements of Wastes and Their Disposal and in the FAO International Code of Conduct on the Distribution and Use of Pesticides. In these cases, the PIC procedure emphasizes the shared responsibility of importing and exporting countries. States are here to ensure that PIC is obtained before any export or potentially harmful activity, for instance the international trade of chemicals, transboundary movements of hazardous wastes or the distribution and use of pesticides, is undertaken. By making the import or transit of chemicals and hazardous waste dependent on their giving consent in advance, States emphasize their sovereignty over their territory.

In Article 15, paragraph five of the Convention on Biological Diversity, the PIC procedure is to serve a slightly different purpose from the implementation of the principle in the examples above. It is the export of a State's own genetic resources rather than the import of potentially dangerous goods which is subject to consent. The sovereignty concept here more clearly refers to the State's national resources, as a corollary to sovereignty over national territory.

As it underscores national sovereignty, PIC can easily contain provisions or conditions making access dependent on the sharing of benefits and know-how without impinging on any of the other provisions in Article 15 (i.e., not contrary to paragraphs two and four). The purchaser thus has to get permission from the providing country before the genetic material can be gathered and taken out of that country. In return for this permission, the providing country may demand compensation from the exporter. This compensation can be financial, or centred around the transfer of technology, participation in research activities and distribution of benefits.

Whether or not to grant permission is strictly a unilateral decision indicating the conditions under which access will be granted, although access may not be unreasonably restricted as is stated in paragraph two of Article 15. Paragraph four of Article 15 requires that access shall be on mutually agreed terms, thus implying negotiations resulting in an access-regulating contract agreeable to both parties.[7] This only makes sense when the PIC procedure is applied first. In disposing of all relevant information—which can be made a condition for granting access—the providing country will be aware of the quantity of genetic material to be acquired, its future possible value and the use it will be put to. The knowledge and information thus obtained will enable the providing country to enter the negotiations on more equal terms with the purchaser.

The PIC draws the contours of the possible permit. The agreement fills in the details that are different from case to case. Although the general conditions can be imposed unilaterally by the providing country, the entire permit will be the result of a trade agreement where the laws of give-and-take rule in a bargaining market. The risk remains of a providing country insisting on unacceptable conditions and thus losing a deal.

The implementation of PIC

There are a number of possible elements that both providing and user countries might want to consider when drafting national legislation on this issue. However, a general discussion of the PIC procedure is necessary first. The wording of paragraph five of Article 15 'unless otherwise determined' is somewhat equivocal. Contracting Parties that do not wish to establish any PIC procedure for the access to their genetic resources are supposed to formally state so. Otherwise, after the ratification of the Convention, they will be obliged by public international law to require PIC. By making PIC the rule and the non-application of any PIC provision the exception, the drafters of the Convention wanted to ensure that PIC becomes a standard procedure for the appropriation of genetic resources.

The rationale behind the present formulation is to avoid the situation where the absence of a negative reply after a specific amount of time is used to justify the collection of genetic material without the consent of the providing country. No inconsistencies with the spirit of the Convention occur as long as potential purchasers simply abstain from collecting genetic resources without consent.

This provision could, however, create a legal vacuum. Firstly, potential purchasers of genetic material will have to scrutinize the legislation of the country providing this material for a PIC procedure of some kind. In the event that there is neither a PIC procedure nor an official statement indicating that PIC is not required, they will still have to comply with paragraph

five of the Convention. Subsequently, those purchasers desiring to comply with this provision will not even know which authority in the providing country to turn to, what elements to include in their application, under which modalities to apply, how long to wait for the permission, or what happens if even after a considerable time no answer has been obtained.

However absurd this situation might seem juridically, the political grounds for it are clear. Attempts have already been made by providing countries using international instruments to limit access to genetic resources. However, no application thereof was ever made by those developing countries that were most upset by the use of their plant genetic resources.[8] The starting point for the Convention is to end the previous juridical situation. States, and particularly providing countries, are to implement PIC through their national legislation. They should also encourage each other to take legislative measures in this area.

Reality, though, presents a different image. As long as providing countries fail to enact provisions regulating access, the context will remain unchanged. Where no PIC is required, there is a substantial risk of uncontrolled and free access. In many states, a request cannot be turned down without reference to a legal provision. The providing country will not be able to deny access to its genetic resources, if it cannot invoke a regulation that justifies its decision. Where a potential user files an application to collect genetic resources with a providing country in which no legislative steps have been undertaken, the country can only authorize use.

The absence of PIC regulations will in many cases primarily be due to the fact that intended regulations have not yet been instituted, perhaps because the country lacks the necessary capacity to enact, administer and enforce such legislation. Therefore, it is essential that action be taken to encourage providing countries to enact the necessary provisions and to assist others who might have difficulties enacting a system on their own.

A PIC model

Although it is the responsibility of national governments to determine access to their genetic resources, it might be useful for countries providing these resources to be guided by a model which incorporates some useful elements for effective PIC. Individual states can then adapt the procedure to suit their requirements. This model distinguishes between the needs of the purchaser and provider, with particular reference to the perspective of the providing country.

Minimum elements for providing countries

A designated national authority. A competent national authority should be installed to serve as a focal point. Not only would it deal with all requests

for access, it would be responsible for the entire process—from providing further information, to interested parties, through the negotiations with purchasers, up to the granting of or licensing access. Having a single authority streamlines procedures and reduces opportunities to unfair practices due to lack of co-ordination. The authority should also be able to build comprehensive databases which will be able to give a picture of some of the useful genetic resources available in the country.

Scope of PIC. In order to effectively consider the peculiarities of every state, providing countries should be given the option to determine and delimit the genetic resources for which they will require PIC. States would mainly want to protect their most valuable genetic material and hence only require that applications be filed for those resources. By singling these out, they can concentrate their efforts and time on the most important and beneficial contracts, granting free access to other material.

Providing complete information. A central requirement is for a potential user to disclose the specific material wanted, the quantities required, the use to which the material will be put and potential implications of the granting of access under the requested conditions.

Fees. By giving indications of licence and fees (for access and/or collecting and/or use), the providing country will make it clear to potential purchasers that it is aware of its genetic richness and will grant access only in return for reasonable compensation.

The providing country could at this stage mark whether it will want a lump sum, compensation based on royalties, payment in kind or a combination. States will probably not want to restrict themselves to a system described in advance since the most beneficial compensation depends on the concrete terms of the application. Therefore, states will prefer royalties, especially where user industries still rely on samples harvested from their territory.[9]

The fee for processing the request must be stated. The cost of this process may be fairly substantial, and it is only fair that the party filing such a request pays for it. This is already common procedure in most developed countries.[10] It is the only way to avoid overloading the public administration which often lacks sufficient resources to handle applications efficiently.

General conditions. A number of general conditions governing every licence could prevent potential purchasers coming to the negotiation table with unrealistic expectations. Providing countries could indicate their min-

imum requirements, which will be standard and not debatable. Such provisions would be applied to all potential purchasers (in accordance with Article 15 paragraph two) to create some uniformity and curb arbitrary deals. The conditions could include the minimum requirements regarding Article 15, paragraphs six and seven. It is tempting for a providing country to include as much as possible in these minimum requirements since they are not open to debate. Good faith and the wording of paragraphs two and four of Article 15 guard against too stringent a list of prerequisites.

Provisions should also be enacted that require the collector to negotiate equitable arrangements with the local communities, wildland administrators, private landowners, farmers and healers, the custodians of the biodiversity collected or those who contributed to the development or discovery of valuable genetic or biochemical resources.[11]

In this regard, the providing country could include provisions in the agreement that the permit from the government will not be provided until the PIC of the local communities involved has been obtained. Although this is not expressly provided for in Article 15, Article 8(j) requests states to 'respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities (. . .) and [to] promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices (. . .). '

Provisions for the future. In order to maintain some control over the genetic resources a purchaser acquires, obligations regarding future dealings with the material should be included. A genebank paying for a huge amount of material cannot be allowed to provide it to others and hence compete with the country of origin once access is given. Therefore, the country providing the material should ensure, possibly through export restrictions, that access does not go counter to their future interests.

Provisions regarding the environmental implications of the agreement can also be included. Article 15 paragraph two states that conditions to facilitate access shall be created for environmentally sound uses of the genetic material. Article 16 links access to technology to the environmentally sound technologies as well. Providing countries can therefore determine that access will only be granted when both the present collection, the future use and the technology received in return for the material are environmentally sound.[12]

Miscellaneous provisions. The framework for a PIC procedure could allow for some provisions of a more general nature, not strictly related to the matter in question. It could include a provision obliging purchasers not to engage in any deals that do not comply with the terms of the Convention.

It could also urge states under whose jurisdiction potential purchasers operate to take steps to adopt similar PIC requirements. The common cause of regulated access will be served by including a clause requesting the purchaser to enact import-regulating legislation[13]—when it is the state itself. In the case of a private company, the home government could be encouraged to enact legislation prohibiting import of genetic material that has not been obtained in accordance with the Convention.

There are obvious limits in such a provision.[14] Private companies have limited impact on national legislation, and their willingness to lobby for access-complicating legislation should not be overrated. The private sector could, however, do this if such provisions were made a condition for the permit.

Elements for user countries

The user countries will mostly be developed countries that do not themselves have a great variety of useful genetic resources at their disposal. Therefore, they will generally not be inclined to impose PIC for the gathering of their own resources. In Denmark, for example, the proposal by the Minister of the Environment to the Parliament for the Danish ratification of the Convention indicated that Denmark will not require PIC for the time being by stating that ' . . . the PIC principle in general does not apply to the export of genetic resources in Denmark and that there—at least for the time being—does not seem to be a need for such provisions.'[15] Such countries may, however, enact provisions regulating the import of genetic material. Various options or different degrees to which access-regulating measures in the user country can be taken, are suggested below.

Unlawful collection. The Convention does not require countries to ensure that users within their territories comply with the PIC procedure.[16] Countries could, however, decline to allow into their territories any genetic material which has not been acquired in compliance with the PIC procedure in the country providing the material. This could be done by adopting legislation that makes any import not complying with the PIC provisions in the exporting country unlawful. A system could be organized in which illegal exports could be confiscated and returned to the providing country. Criminalizing such activity is another option.[17] However, the requirement for a licence in the importing country only makes sense if the country that provided the material has itself restricted other countries' access to its genetic resources by making it subject to PIC.

Record-keeping. By obliging companies, laboratories and other users to keep records of their stocks of genetic resources, it is easier to monitor

compliance with the PIC procedures. These records should be provided to the national authorities upon request. Thus, the government of the user country can be in a position to assist a providing country seeking to find out whether genetic resources have been illegally exported from it.[18] That information could help to prevent future illegal transfers.

National patenting legislation. A national patenting system can eventually be linked to the national patenting legislation of the user country in those cases where the collected genetic material is patentable. This could be done, for example, by making demands on application for patents and patent descriptions concerning the development of genetic resources dependent on the provision of certain information. In filing an application, the applicant would have to retrace the origin of the genetic material used, indicate to what extent it was used and state the conditions under which the material was acquired.

Genebank-oriented measures. A number of initiatives can be developed in the biotechnology sector to enhance the effective application of Article 15. Germplasm banks could implement a policy which would give the Convention wider application. Such a genebank could refrain from distributing a requested germplasm accession if the same or a similar accession is still readily available from the source country, as long as that country is a party to the Convention.[19] In such a case, the requesting party would have to get the material from that providing country directly, and thus in accordance with Article 15.

A broadening of this concept could include the elaboration of a code of conduct that germplasm banks themselves could adhere to. Not only would it facilitate their future access to *in situ* genetic resources in providing countries,[20] but it could preclude claims for compensation by the providing country for the material already collected. The terms of such a code would have to be negotiated at the relevant fora. It is doubtful whether a system that reimburses providing countries for the resources acquired prior to the Convention will be developed.

Scope of the requirements imposed by Article 15

Interpretive questions. Two main questions regarding the scope of the requirement of Article 15 deserve attention, namely if the obligations mentioned in paragraphs six and seven are incumbent on private companies, and whether providing countries can regulate access from private property within its territory.

Each Contracting Party. A possible controversy might arise in the interpretation of the words *each Contracting Party*. It has been argued that this

wording excludes nationals and private companies within the jurisdiction of a state and only encompasses the state with its institutions and affiliates. This argument is based upon an *a contrario* interpretation of Article 16 paragraph four. As no reference to the private sector is made, it is not to be included in the obligations imposed on states.

This interpretation seems untenable. Conventions, treaties and other acts of public international law in general by their very nature only oblige states. States in turn incorporate these obligations into their own national legislative system in order to transfer them to persons, both legal and physical, under their jurisdiction. Without the understanding that 'each Contracting Party' encompasses the nationals under its jurisdiction, the obligations to which a country subscribes would be reduced considerably. This is due to the fact that principal actors in biotechnology industries—genebanks, agricultural and pharmaceutical companies—are primarily within the private sector, and hence would be exempted from all obligations that they do not voluntarily endorse. It can be presumed that it was the clear understanding of developing countries in the negotiating process that every obligation incumbent on a state necessarily includes its industrial complex.

Private property in providing countries. The question arises as to whether a providing country can make access to genetic material from private property subject to PIC. Article 15 paragraph one says that states exercise sovereign rights over their natural resources. From the traditional viewpoint, this does not include the right to limit the individual property rights of citizens within a state. However, in environmental protection and energy issues, it has been common practice for states to restrict the exercise of these rights by individuals, subject to the protection of interests that are estimated as being of higher value.

In the Convention, Article 15 does not institute a property right as such over the genetic resources of a state but gives states the right and duty to govern their genetic resources in their relations with other states and their inhabitants. In addition, Article 15 legitimizes the institution of obligations and restraints on citizens and third parties, including other states and their inhabitants. As such, a providing country could formulate the prohibition, for all persons within its jurisdiction, to export without PIC or even to sell genetic material knowing that they might be exported without a PIC being obtained.

Recommendations

Certain action-oriented recommendations of a general nature can contribute to the effective implementation of PIC for access to genetic re-

sources. Some kind of international co-operation is desirable and necessary. In November 1992, UNEP established four Expert Panels for the Follow-up of the Convention. A fifth was later added. The issue of access to genetic resources was not included in the range of these interim follow-up activities as outlined in the second resolution to the Convention. Given the importance of the issue and the attention it has already received, the implementation of the provisions on access to genetic resources ought to be on the agenda for the first meeting of the Intergovernmental Committee on the Convention established by UNEP in accordance with the mandate given by the Governing Council at its 20th session in May 1993 or for one of the first meetings thereafter, that is, possibly in the framework of the meetings of the Conference of the Contracting Parties.

A protocol on PIC has been suggested.[21] Although this might be an effective way to ensure international participation and awareness, starting the heavy machinery of international consensus-building will be of no benefit to the cause. Article 15 paragraph five is clear enough. Giving the Contracting Parties the opportunity to renegotiate issues dealing with access in general, and PIC in particular, might open up old wounds and the concomitant problems in reconciling opposing positions of the past.

In international treaty law, the conference of the parties to a convention can make recommendations to the contracting parties at its meetings. This possibility may be expressly provided for in the terms of the Convention.[22] Many conventions that do not have such a provision state that the contracting parties shall consider and undertake any additional action to fulfill the objectives of the Convention.[23] The recommendations or resolutions that the conference adopts are not legally binding on the contracting parties, but as they generally result from a consensus there is considerable political pressure to obey their provisions.

The Convention provides in Article 23 paragraph four(i) that the Conference of the Parties shall '[c]onsider and undertake any additional action that may be required for the achievement of the purposes of this Convention in the light of the experience gained in its operation.'

A recommendation could be drafted holding that all states opting out of PIC should inform the secretariat to the Convention. The secretariat could then establish a list of such countries. Those states that adopt a PIC system should notify the secretariat of the institution that will serve as their national authority. Potential purchasers will only have to contact the Convention secretariat to get information on whether they would have to obtain a permit to acquire the material they are interested in, and to which national authority the application is to be directed. This could simplify the administrative procedure considerably.

Additionally, providing countries could be urged to notify the secretariat as soon as possible of the steps they have undertaken to require PIC, by

creating the presumption that access is free of charge if the secretariat has not been notified of their requirements within a certain amount of time.

Due to the limited ability of providing countries to enact the necessary provisions, there is a considerable risk that for a long time access to genetic resources will not be governed by Article 15. It is thus advisable that some model legislation be drafted. This legislation will be most useful if it is wide-ranging and flexible; it should also be easily implemented and adapted to the particular conditions of the state making use of it. In light of their extensive experience in drafting model environmental legislation, both UNEP's ELI/PAC (through the Montevideo Programme) and IUCN's Environmental Law Centre could be requested to undertake parts of the task. The developed countries could be requested to provide the financial means,[24] and the necessary funding could also be made available through the Global Environment Facility.

Once such model legislation has been drafted, the Conference of the Parties could in a resolution draw the attention of the Contracting Parties to this legislation and request them to take account of the provisions when enacting a PIC procedure at the national level.

The regulations governing access in the Convention build on the new approach of sovereignty over genetic resources. Many problems arise in implementing this new principle. The PIC procedure, as the centrepiece of the providing country friendly approach, requires considerable work at the national level. It is also necessary to co-ordinate the various activities on the international front. It is only when states providing and those using genetic resources co-operate that the providers can be compensated for their genetic material. This co-operation can take place at a bilateral level, when a providing country makes the availability of the genetic resources dependent on the enactment of import-regulating provisions by the user country. Not only is this a very time-consuming process, it contains many loopholes. Multilateral action should hence be combined with national efforts, possibly in the regular meetings of Contracting Parties, but eventually through, for example, a code of conduct for genebanks.

Taking into account the rapidly evolving activities in other organizations, future co-operation should not be excluded. Even though potential purchasers and providing countries might have different interests, both can be served by a common system in which only some elements vary.

Needless to say, establishing national bureaucratic systems which are represented internationally is an enormous hurdle. Lists and notifications, in view of the interests at stake, have worked in the past. This is, however, an extra burden to national administrations which in many cases do not possess the necessary infrastructure to keep up with initiatives in international law.[25]

The PIC, regardless of what form it is to take, will initially be difficult to enforce. The material subject to control comprises microscopic components of plants or animals extremely hard to identify as a 'genetic resource' and very easily smuggled out of its country of origin. In addition, numerous conflicts of law-related situations might arise once a PIC system has been put in place. Also, legal problems will occur when national (federal) governments have ratified the Convention but where the jurisdiction over biodiversity-related issues rests with federal authorities.[26] Consequently, compliance will to a large extent rely on good faith by the states and people involved.

Notes

1. The International Undertaking has since taken steps to protect the vested interests of providing countries. Annex III to the International Undertaking was adopted by the FAO Conference in 1991 as a resolution. Here it is stated that 'all natural resources are subject to the sovereign control of the State,' as an attempt to resolve the growing tension that arose in developing countries over the use of their genetic resources by developed countries.
2. See for example, OECD, 1993.
3. Duesing, 1992, p. 23.
4. The actual difference between the 'common heritage but not free of charge' concept on one side and the 'national sovereignty' concept on the other is more one of practical purpose and not very significant. The novel thing, however, is embodied in the political importance of stating national sovereignty and the explicit linking with the transfer of technology and the participation in research activities. See also Bragdon, 1992, p. 388.
5. Resolution 3 of the 1992 Nairobi Final Act of the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity recognizes the need to seek solutions to outstanding matters in other fora, and mentions in particular '[a]ccess to *ex-situ* collections not acquired in accordance with this Convention'.
6. The voluntary International Code of Conduct for Plant Germplasm Collecting and Transfer, elaborated under the International Undertaking (see footnote 1), takes this approach. It contains guidelines for the collection of plant germplasm and includes some general provisions on the balance between economic advantages for users and providers. Its terms on compensation to the provider of the collected material are unfortunately rather vague. Therefore the instrument as such is not very useful to guarantee sovereignty of States over their genetic resources.
7. See also Gollin, 1993b, p. 294.
8. See the 1961 International Convention for the Protection of Plant Varieties (UPOV Convention) as subsequently amended in 1972, 1978 and 1991.
9. Frye, 1992, p. 344.
10. All countries of the European Community, for example, require the payment of a lump sum for handling an application to disseminate genetically modified organisms (GMOs) within their territories, in accordance with EC Directive 220/90.
11. Reid *et al.*, 1993a, p. 19.

12. In the fourth revised draft (April, 1993) of the IUCN International Covenant on Environment and Development, Article 24 deals with biodiversity and its components. States are to endeavour to facilitate access to genetic resources for environmentally sound uses (Article 24(3)a).
13. See *infra*, 'unlawful collection'.
14. Such conditions can be directed to the past as well, by setting as a general condition that no user who previously acquired genetic material contrary to the provision of the Convention can be granted access. A black list of *mala fide* purchasers can be established. No respectable biotechnological company will want to see itself placed on such a list because of the serious consequences this could have on future access.
15. *Forslag til folketingsbeslutning om ratifikation af konventionen om den biologiske mangfoldighed (biodiversitetskonventionen)*, March 17, 1993. *Folketingstiden di 1992–93*, 2 Samling, tillaly A, sp. 8600.
16. Article 15(4) might be understood to require that user countries ensure that access be granted subject to PIC and thus that they take all necessary measures to ensure compliance with this obligation within their jurisdiction.
17. Burhenne, 1992, p. 325.
18. An exception has to be made with regard to confidential information and industrial secrets, though source disclosure could be made a part of the national patent application procedure.
19. Duesing, 1992, pp. 21–22.
20. See *supra* 'provisions for the future'.
21. See, *inter alia*, Svarstad, 1993.
22. See, for example, the 1979 Convention on the Conservation of Migratory Species of Wild Animals (CMS), Article VII(g): 'The Parties (. . .) may in particular: make recommendations to the Parties for improving the effectiveness of this Convention;' in the 1971 Convention on Wetlands of International Importance Especially as Waterfowl Habitat, an amendment was made in 1987 to include the possibility for the Conference of the Contracting Parties to 'adopt other recommendations, or resolutions, to promote the functioning of this Convention' (Article 6 paragraph two(f)).
23. As in the 1989 Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Article 15(5)c. See also Vienna Convention for the Protection of the Ozone Layer, Article 6 paragraph four(k).
24. In accordance with Resolution 2, paragraph two(i) of the Convention.
25. Hence, a global multilateral agreement has been suggested in the field of agrobiodiversity in a resolution to the last meeting of the FAO Commission on Plant Genetic Resources (Resolution CPGR 93/1, Revision of the International Undertaking on Plant Genetic Resources). Hereby a fund is established which will distribute money from the users to the providers. The former will in turn get free access to the resources in the providing countries. The amount taken from each country will be taken into account to enable a more just remuneration. Such an approach considerably reduces the bureaucratic efforts involved in bilateral agreements.
26. de Klemm, forthcoming, p. 33.

Part III

Access To and Transfer of Technology

9

Technology transfer and environment

AMRITA ACHANTA AND
PRODIPTO GHOSH

Multilateral regulation of the global environment is sought through conventions and protocols, for example, the Convention on Biological Diversity and the Framework Convention on Climate Change signed in Rio in June 1992, and the 1990 Montreal Protocol on Substances that Deplete the Ozone Layer. The Convention on Biological Diversity involves two broad classes of technology transfer issues for developing countries (DCs). Firstly, technology transfers are essential in order that DCs may meet their differentiated responsibilities (not necessarily mandatory) in abating environmental damage. For example, a less intensive growth path of greenhouse gases in the case of India and China may involve a switch from conventional pulverized coal thermal power technologies to more energy-efficient or advanced coal power technologies. Research and development (R&D) in respect of the latter have, for the most part, been carried out in industrialized countries (ICs), whose firms, accordingly, own the relevant intellectual property rights (IPRs). Technology transfer from the owners to the relevant agents in DCs will be necessary, and the important questions here relate to the terms, depth, payment and payers for such transfers. Secondly, in the case of biodiversity conservation, environmental protection (and perhaps traditional knowledge) will furnish important positive externalities to the process of technology generation (for example, pharmaceutical products and agricultural crops), and the question is how to enable the DCs to realize payments for these external benefits to technology producers. This issue is distinct from the question of paying the opportunity

costs of biodiversity conservation. Each of these broad issues is interspersed with considerations of equity between nations and across generations.

Theoretical bases

The standard justification for the granting of property rights over intellectual property is that such rights furnish incentives for creative work. Further, they are sought to be fine-tuned so that the incentives maximize the difference between the value of the resulting intellectual property and the social cost of its creation, including administration and transactions costs. In other words, the specifics of IPR regimes are designed to realize economic efficiency.[1]

IPR regimes are premised on the belief that prospective financial returns in fact drive private creators of intellectual property. In other words, private creators will have sufficient incentives only if they have the ability to capture at least some of the value that users place on such property. If they are unable to do so, the amount of innovative activity may be inefficient. There is also the issue of whether innovative activity takes place at least social cost. This may depend upon the extent to which creators may borrow ideas or concepts from earlier work. For example, rights to 'derivative work' are typically vested in the authors under copyright law, resulting in increased costs to subsequent authors. Somewhat related to this issue is whether the IPR regime maintains a proper balance between the creation and dissemination of intellectual property. A particular incentive structure may result in resources being assigned to the creation of many new works. If, however, these innovations are not widely used, the net societal benefits may be less than in the case where fewer resources are employed in creativity but the intellectual property created is more widely disseminated. This issue focusses attention on two important questions on the appropriate scope of protection. One relates to what constitutes the optimal duration of IPR protection, for example, in the case of patents. Second, what is the optimal trade-off between the duration and breadth of IPR protection. Another way of looking at this issue is in terms of trade-offs between static and dynamic efficiency. The former would require that innovations resulting from resources invested by private agents be made widely available to all who are willing to pay the (low) marginal cost of dissemination. Accordingly, public policy should facilitate the widespread use of these assets, implying minimal property rights in them. Dynamic efficiency considerations, on the other hand, would suggest that with minimal property rights, the creators may not recover their initial investment, let alone attain sufficient returns to motivate them to undertake such risk in the first place. Accordingly, property rights should be stronger ('exclusive') than would be implied under static efficiency.

Formally, IPRs were domestic policy instruments granted by national authorities. However, since innovations embodied in products (or by themselves) cross borders, the question of IPRs protection in international transfer is important. On the other hand, countries have differing perspectives on the socially optimal trade-offs between duration, breadth and what categories of knowledge may be conferred IPRs protection. The latter is particularly true in the case of protection offered to life forms. The questions of harmonization of IPRs legislation across countries and transboundary protection are important current issues of international political economy.

Developing country perspectives

The current Indian IPR system can be considered as a model of an IPR regime incorporating the typical concerns of the developing countries. This regime diverges from typical IPR regimes of Organization for Economic Cooperation and Development (OECD) countries in three major aspects. First, several categories of products and processes are excluded from IPR protection. They include horticulture, agriculture, food processes, medicinal and drug products. The rationale is that a majority of the population depends on agriculture and horticulture for its livelihood, the purchasing power of the poor for food is limited, and basic health care is scarce. Second, while the system rewards innovators, it is not intended to confer monopoly rights in manufacture or imports. Accordingly, the regime permits compulsory licensing[2] and issue of licence of rights for working patents in India. Third, the regime seeks to promote diffusion of existing technologies and innovation of technologies which create economic opportunities for a late industrializing economy. Accordingly, in several sectors (e.g., pharmaceuticals) processes may be protected while product patents are disallowed, facilitating the wider use of the products as well as local R&D in alternative manufacturing processes.

These features of the Indian IPR regime are expressions of equity and technological development concerns. Equity within the society is sought to be realized teleologically, focussing on the need to enhance entitlements to basic needs by the poor, particularly in respect of livelihood, food and medicine. This is attempted to be accomplished through the IPRs regime itself rather than by a separate overall policy framework for social welfare. Accordingly, in pursuit of equity, property rights (in respect of both duration and breadth) for creators are weakened.

The second policy imperative, of facilitating technology development, derives from the fact that comparative advantage across countries based on knowledge requires a policy framework which accelerates knowledge (and skill) acquisition. Accordingly, this policy objective justifies narrower IPR protection and exclusions from patentability.

These considerations are sought by DCs to justify differentiated IPR regimes in ICs and DCs. The scholars from DCs have argued that the General Agreement on Tariffs and Trade (GATT) draft agreement on IPRs, the 'Dunkel Draft', neglects these concerns, focussing instead on the interests of ICs. The proposals seek to expand the scope of the IPR system, increase the life of privileges granted or rights conferred, extend the geographical spread, reduce the restrictions on the use of rights conferred, and create an enforcement mechanism with retaliation across sectors.[3] More specifically, exclusions from patentability under the Dunkel Draft would be restricted to life forms, implying that exclusions on product patents would be disallowed. Further, the burden of proof in suits for violation would be reversed, with the onus on the alleged infringer. In addition, compulsory licensing would be severely restricted and imports deemed as working the IPRs. The period of protection would be extended from 14 years (the current duration in India) to 20 years. These are important deviations from current Indian patent law. Serious consequences are prognosticated: essential technologies may become unaffordable, the emergence of domestic technological capacity may be stymied, transfers of technology may be retarded, and restrictive business practices by transnational corporations (TNCs) might increase. These impacts would accentuate inequalities between ICs and DCs.

Some scholars have argued that strengthening IPRs protection in DCs (albeit not on the lines of the Dunkel Draft) would ensure continued foreign direct investment (FDI).[4] This is because of a perception in the international business community that investing in countries with weak IPRs protection is risky. Empirically, however, it has been noted that the laws governing foreign investment and technology transfer, as well as the general industrial environment, play a greater role in determining investment and technology flows than IPRs protection levels. Accordingly, strengthening IPR protection may neither adversely affect developmental concerns nor attract foreign investment and technology flows.

Principal types of intellectual property rights

The two principal types of intellectual property relevant for technology transfer in the global environmental policy context are patents and trade secrets. A discussion of the types of IPRs is important since a significant proportion of technologies is under such protection, and the alleged lack of adequate protection in certain developing countries could be cited as a deterrent to effective transfer. In the Convention, the mention of 'prior informed consent' includes an element of disclosure, the treatment of which varies with different IPRs instruments. Harmonization of domestic legislation to facilitate transboundary technology transfer may have repercussions within a country as well.

A *patent* may be granted by designated public authorities in a country on 'any new and useful process, machine, manufacture, composition of matter, improvement and plant as well as to new, original and incremental design for an article of manufacture.'[5] In India, patents are granted under the Indian Patent Act, 1970, which was based on the report of the Tek Chand/Iyengar Commission on the subject. There are important departures in the Indian statute from typical patent laws in OECD countries; these relate largely to duration and patentability.

What exactly are the terms of the property rights conferred on a patent holder? In exchange for disclosure of the subject matter of the innovation to the public (which would include actual and potential rivals), the patent holder (patentee) is enabled to exclude all others from making, selling or using the subject matter of the patent for a specified period. During this term, any use of the subject matter of the patent requires permission of the patentee, usually by means of a licence involving royalty payments. The patentee can even prevent an independent subsequent inventor of the same subject matter from making, using or selling it. At the end of the period of protection, the subject matter enters the public domain—that is, all property rights cease.

Many questions about patents are still widely debated.[6] There is little agreement among economists on the impact of patent protection on the growth of technology, or on the optimal (dynamically efficient) duration of patents. Further, the evidence on whether patents have helped cartelization is inconclusive.

Patents are frequently the subject of court proceedings, often suits by patentees alleging infringement. Courts may interpret the patent claim literally, or infringement may be found if there is a 'substantial, functional identity between the patent claims and the contested item'—the 'doctrine of equivalents'.[7] In fact, one important legal issue is whether a patent effectively covers more than the literal disclosure in the patent application or also includes the prospective technology that follows.

Four principal lines of defence are open to alleged infringers. The grant of the patent may itself be challenged: first lacking the requirements of novelty and non-obviousness; second, fraudulence by the patentee may be alleged by misrepresenting the prior state of the art in the patent application; third, a patent is invalid if it was patented elsewhere or described in a printed publication; fourth, the 'doctrine of misuse' relates to the use of a patent beyond its statutory scope. For example, if the licence involves a tying arrangement, the licensee must purchase another product from the patentee.

In India, biotechnological patents are classified by the Indian Patent Office in the International Patent Classification (IPC) sub-class C12D (second edi-

tion of IPC). This subclass entitles the 'production of chemical substances, other than ethanol, by fermentation or biosynthesis' and includes the microbiological production of vitamins, toxins, antibiotics and other compounds. There has been a predominance in the microbiological processes for antibiotic production and to a lesser extent in the case of genetic engineering and inventions directed to the composition of micro-organisms.

Trade secrets are specific commercial information. This can be a formula, pattern, compilation, programme, device, method, technique or process that derives actual or potential independent economic value from not being generally known. It is also information, which is the subject of efforts that are reasonable under the circumstances to maintain its secrecy (US Uniform Trade Secrets Act, 1979).

Trade secrets are, thus, not disclosed. Trade secret law only protects such information from 'improper' disclosure but not from independent discovery or reverse engineering (for example, determining the chemical formula of a pharmaceutical product through chemical analysis). The incentive to create and protect intellectual property as trade secrets derives from their potential value. Trade secrets also differ from patents in respect of subject matter and duration of protection. While innovation or novelty is required of the subject matter for patent protection, commercial value is the sole criterion for protection as a trade secret. Moreover, the duration of trade secret protection is indefinite, limited only by the accident of independent discovery (or improper disclosure).

Improper disclosure can be a breach of duty by an employee (with access to the trade secret). Alternatively, the improper act can be theft, bribery, misrepresentation, commercial espionage or anything that would count as wrongful conduct even outside trade secret law. Relief against improper disclosure includes injunctions and damages.

Clearly, many categories of inventions may be eligible for protection under either patents or trade secrets laws (but obviously not both).[8] Although trade secrets law offers lesser protection, because filing a patent application involves heavy transactions costs while the costs of preventing disclosure of a trade secret may be less, a trade secret is often the preferred course. Alternatively, the disclosure required of patent applications may convey sufficient useful information to potential rivals engaged in a race for related or next-generation innovations, and this may lead innovators to prefer trade secrets protection.

The need for *plant breeders' rights* (PBRs) came about because earlier classical breeding methods of crossing and selection were used to create new varieties, and they did not satisfy the conditions of patentability, in particular reproducibility and non-obviousness. To obtain protection the applicant must show that the submitted plant variety is stable (that it reproduces

true to form over repeated propagations), homogeneous (that important characteristics are uniform across a single planting), distinctive (clearly distinguishable from existing varieties) and has a variety denomination. Protection is normally granted for a minimum of 15 years. PBRs are subject to a farmer's exemption and a research exemption. The farmer's exemption allows users the right to retain part of the harvest for subsequent planting as seed. The research exemption permits breeders to use a protected variety in subsequent breeding and to apply for protection of the outcome as long as repeated use of the protected variety is not required. The UPOV Convention, administered by the International Union for the Protection of New Varieties of Plants, governs this form of IPR protection. This Convention also has a clause prohibiting 'double protection'—use of both patents and plant variety rights. The protection offered by PBRs differs from patent protection in that it only concerns the marketing of propagating materials (such as seeds) but not the growing and marketing of plants themselves. In the case of asexually reproduced plants, 'plant patents' are available.

Technology transfer

Technology transfer is the process by which technology, knowledge and information developed in an organization, in a given area, or for a particular purpose is applied and utilized in a different setting or context. Bell distinguishes categories of transferrable technology and has identified them as 'flows'.[9]

Flow A concerns transfer of capital goods, services and design specifications and refers to hardware or machinery and equipment which is acquired and brought into operational use during investment projects. Other technological and managerial services included in investment projects cover execution of planning and feasibility studies, types of design engineering, and project management services. The flow of capital goods and services adds to the production capacity of the transferee or, in the case of equipment designs, provides domestic capital goods producers with specifications for setting up similar facilities.

Flow B concerns transferable technology in the form of skills and know-how for production. Included in most technology transfer agreements is the flow of know-how required to operate and maintain new or improved production facilities. There are two main components in this flow: Paper-embodied technology and people-embodied technology. The first is in the form of manuals, schedules, flow charts, including operating procedures, maintenance and repair procedures, routine quality control and possibly procedures for marketing outputs and purchasing inputs. The latter refers to knowledge and expertise required to carry out procedures, which in turn

includes training of individuals in requisite skills or in dealing with situations not covered in manuals and routines. This flow (which includes know-how and expertise) also adds to the production capabilities of the transferee. Although both Flow A and B add to the production capacity of the transferee, they do not contribute substantially to the technological capacity of the transferee. Neither does the transfer of capital goods or of know-how (which aid in production of a product) add to the expertise and experience required to change, adapt and develop the product or process in the future. The prospects of subsequent improvements are neglected in Flows A and B.

Flow C concerns transfer of technology in the form of knowledge and expertise for generating and managing technical change (know-why). Like Flow B, it also consists mainly of information and people-embodied knowledge and expertise. It differs from Flow B in that it is concerned with changing technical systems. There is obviously some overlap between Flow B and Flow C. The depth of knowledge and information about the technology in Flow C would be greater than that required for routine operation and maintenance. The other (and crucial) component is the expertise required to undertake various engineering design studies, or the evaluation of alternative plans and designs, or the incorporation of technology in improved production systems. Through this flow, continuous technical change could be realized in existing production facilities.

The transfer of technology can occur from a supplier to a recipient by various mechanisms. The modes of technology transfer may be classified as commercial or non-commercial. Commercial transfers are contracted primarily through markets, and non-commercial transfers occur primarily through non-market institutions. The principal commercial methods of transfer are foreign direct investment in a host country subsidiary, or joint ventures; licensing of IPRs; technical assistance; sale, importation, installation and servicing of machinery and other capital goods; and franchising of consumer goods and services. Some of the non-commercial methods of technology transfer are advisory groups, personnel exchanges, information dissemination, education. It must be noted that successful transfers are usually a combination of several (all) of these mechanisms. The effectiveness of transfer is a function of the stage of technological development, characteristics of end users, potential for absorption within the recipient country and other factors.

Technology transfer is often a component of *foreign direct investment* (FDI). The flow of technology to developing countries has frequently constituted a part of FDI, typically by large TNCs. Technology transfers between affiliates constitutes a significant share of such transactions. Transfers involving the parent firm and their branches, or wholly (or majority) owned sub-

sidiaries are usually done informally and do not include formal agreement(s). In contrast, when the foreign investment is a joint venture, where the local partner is a majority owner, a formal agreement/licence is typically negotiated between the technology supplier and the recipient. The mechanism of transfer through FDI may appeal to the supplier because control is retained, apart from the earning of dividends rather than royalties. Control of the local enterprise is often comprehensive—management, operation and marketing, quality control of products. This facilitates control of the technology itself as a trade secret, rather than submitting to the disclosure required by patents. From the viewpoint of the recipient, foreign investment brings in venture capital in the form of foreign exchange and the security of the foreign partner's long-term commitment. However, local innovative improvement of the imported technology may be thwarted by the supplier quite deliberately.

Technology transfer can occur independently of FDI by means such as *intellectual property licences*. A patent licence transfers to the licensee several of the exclusive rights of the patent. The licence is usually obtained by the payment of lump-sum fees or royalty, although other commercial arrangements are also possible. Such an agreement enables a foreign licensor, unwilling to risk capital in a developing country, or uncertain of a project's profitability, or unable to invest in unfamiliar conditions, to benefit from an intellectual property holding. In countries where foreign investment is regulated and local entrepreneurship is strong, technology licensing is increasingly used. Similarly, where host country foreign investment laws are restrictive, either in the form of prohibition of foreign equity participation in certain sectors of the economy, or legislation requiring a phased 'fade-out' of foreign ownership in local subsidiaries/joint ventures, it encourages TNCs interested in penetrating these markets to opt for licensing agreements in place of foreign investment. This has been the typical experience in India until recently.

Licensing is also convenient in that it is for a finite duration. From the recipient's point of view, licensing leaves the recipient free of control and interference. The recipient may also benefit from government interaction in ensuring that the agreement is equitable. However, government interference may also result in restrictive licensing arrangements, which may not be perceived as in the licensee's interest. This mode of transfer appears more likely in the case of the Convention on Biological Diversity. Some aspects which could find inclusion in such a licensing agreement are obligations of the licensor (person granting licence to licensee) in terms of technology transfer, particularly when a genetic resource is supplied, applicable law[10] and allowance of cross-licensing so that further innovations can follow.

The role of the government in facilitating transfers of technology should not be underestimated. It is responsible for the economic framework of the

recipient country, a factor which would influence investment decisions of TNCs. The signals government gives to industry may discourage or encourage R&D as well as influence modes and depth of technology transfer. Governments are also heavily involved in funding or organizing R&D. In India, 80 per cent of scientific R&D is in the public sector, a situation similar to that in France. In the US, government funding accounts for 50 per cent of the total R&D investments, the investment being particularly high in the case of the biotechnology industry. Further, governments are heavily involved in establishing the IPRs framework, as well as in negotiating the international IPR regimes as in GATT.

Earlier India had followed a development path of import substitution, and in an effort to substitute imported technologies, indigenous technological capacity was encouraged by a restrictive regime of technology imports. No significant relationship between protection and degree of innovation has, however, been observed.[11] Recent policy changes have significantly liberalized technology imports.

IPR regimes may impact the balance of payment situations of countries in several ways. First, a strengthening of IPRs may mean that transferees would have to pay increased royalties in foreign exchange. On the other hand, a loss of IPR earnings due to weak IPR protection in transferees' countries could worsen a trade deficit. For example, it is claimed that the US loses $60 billion a year owing to IPR 'violations' in other countries. Government policy also affects technology transfer through regulation of FDI, in terms of restriction on import of capital goods and control of technology licensing. For example, India formerly insisted on a majority domestic equity share of at least 51 per cent, which has since been changed.

Appropriate technology

The technologies under consideration for transfer should be 'appropriate' from the standpoint of the recipient country. Considerations determining the appropriateness of a technology are environmental friendliness, conformity to development goals of the recipient country, harmonization with resource endowments (important for sustainability) and conditionality of transfer circumstances. Appropriateness, in the case of biotechnology, must also take into particular consideration the safety aspect (design defect and failure to warn) of some of the products of these technologies. The resulting implications may require a re-examination of the adequacy of existing domestic environmental legislation, particularly legal liability for damages.

Development goals may relate to self-reliance, removal of inequalities in income, and increased employment opportunities. Resource endowments relate to available natural resources, manpower and managerial skills. The prevailing conditions include the existing infrastructure, markets and other

institutional structures. Appropriate technologies in this context may include those that use local materials and are labour-intensive and small scale.

Global environmental agreements

The Framework Convention on Climate Change commits DCs to three specific actions. They are to formulate and implement publicly notified plans for abatement and adaptation; take action to minimize any adverse effects of abatement or adaptation measures on the economy, public health and environment; submit specific projects (such as reduction of greenhouse gases) for funding. In these, the DCs are entitled to financial resources, outside of normal developmental assistance, including the transfer of technology. The quantum of assistance is described as the 'agreed full incremental costs'. If such assistance is not forthcoming, DCs have no commitments.

Technology transfer is thus visualized in respect of both abatement and adaptation measures (in the context of climate change) and to ensure that any harmful impacts of the measures themselves are minimized. No concessional or non-commercial terms of technology transfer are envisaged; only that the financial component (in the terminology employed) shall qualify as grants. Further, no attenuation of IPR protection of the technologies is contemplated.

Similarly, the Convention on Biological Diversity requires all countries, including DCs, to formulate national strategies for conservation and sustainable use of genetic resources, integration of conservation concerns in policy-making, and establishment of protected areas to conserve biodiversity. It also calls for domestic legislation for conservation and promotion of public awareness for biodiversity conservation. The implementation of these commitments by DCs is, again, contingent on the ICs meeting their own (further) commitments relating to transfer of technology and new and additional financial resources for meeting the agreed full incremental costs of such measures. The question of what exactly would count as full incremental costs in the context of technology transfer is obviously important, and is discussed below.

The Convention recognizes that technology (inclusive of biotechnology[12]) and its access and transfer are a means for attaining the Convention objectives. Technologies are categorized as those relevant to conservation and the sustainable use of biodiversity and those based on utilization of the genetic resources themselves.

Technology transfer is constituted by a knowledge component and a payment component. The former includes elements such as extent of knowledge transferred, spatial conditions limiting the use of such knowledge, temporal restrictions, obligations of both licensor and licensee, retransfer of rights and obligations to third parties, R&D involving transferred

knowledge, allowance of cross licensing, length of agreement, depth of transfer and applicable law. The latter includes terms of compensation—both direct and indirect modes of payment. This component may also encompass incentives for innovation and conservation to parties supplying the genetic material either in a national or an individual (agent) capacity. Payment-related concerns also arise in the event that the contracting parties provide financial and other support for conservation facilities in developing countries, particularly with respect to access of the donor country to genetic material. Indirect means of payment may include the setting up of research facilities; direct means of payment could be in the form of up-front, lump-sum royalty payments, or running royalty payments.

The major movement of technology is anticipated to be from the ICs (which are technologically-rich and gene-poor) to the DCs (gene-rich and technologically-poor) with traditional knowledge and practices from the DCs to the ICs, although it is also important to examine the potential of indigenous technologies as well as South-South transfers.

The Convention recognizes the need for transfer of technologies relevant for conservation and sustainable use of biodiversity, on 'fair and most favourable terms' to developing countries. It is stated that the Contracting Parties are aware that conservation[13] and sustainable use of biodiversity are of critical importance for meeting the food, health and other needs of the growing world population, for which purpose access to and sharing of both genetic resources and technologies are essential. Legislative, administrative and policy measures would be undertaken to ensure that the private sector facilitates access to, transfer and joint development of the appropriate technologies. To fulfill this need, the Convention mentions the establishment and maintenance of facilities for *ex situ* conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources (that is, the country which possesses those genetic resources under *in situ* conditions). This facility of conservation will be encouraged by the provision of finance to developing countries.

A primary requisite for the development of technologies based on the genetic resource is access to such material, either under *in situ* or *ex situ* conditions. The sovereign rights of states over their natural resources are recognized in the Convention, and the authority to determine access to a country's genetic resources rests with the concerned national governments, although it is stated that environmentally sound uses of these genetic resources should be facilitated and no restrictions imposed which run counter to the objectives of the Convention. How this would be enforced is clearly a problem as it is difficult to restrict physical access to this resource. Another diluting factor is that most germplasm is exchanged informally and occasionally even through third parties. On the other hand, it is important to

clarify that DCs would like access to genetic resources of economic interest (including newly developed varieties and special genetic stocks, inclusive of current breeders' lines and mutants). A related issue, which has not been dealt with in the Convention is the absence of treatment of germplasm in existing international collections; these are excluded because the Convention is not retroactive.

The absence of detailed treatment of the depth of transfer should lead to its inclusion as a subject of future protocols. The Convention addresses the identification of innovative, efficient and state-of-the-art (SOA) technologies and know-how relating to the conservation and sustainable use of biodiversity (Article 25(c)) by the subsidiary body on scientific, technical and technological advice. Those relating to the development of genetic resources have not been addressed. An inventory of such SOA technologies appropriate for conditions in developing countries could be established and maintained. In the same vein it would be an important step to characterize and inventory existing national traditional knowledge.

Specifically, technology transferred may include both exchange of results of technical, scientific and socio-economic research (Article 17 (2)) and promotion of co-operation in the training of personnel and exchange of experts (Article 18(4)). It would also involve the promotion of joint research programmes and joint ventures for the development of technologies (Article 18(5)).

Regarding the potential for joint R&D, particularly in the area of biotechnology involving developing country participation, there are several issues of concern. For example, what would be the implications for IPRs regimes and ownership of rights? What are the incentives offered to ICs Contracting Parties (private sector) for participation? Potential reasons could be the high expenditure involved, spread of risk through the sharing of capital and access to genetic material held in the DCs. One model of patent ownership in joint ventures has been developed by the US Agency for International Development. USAID has developed a project whereby scientists of developing countries participate in joint research with private companies for the development of products for use in overcoming certain agricultural constraints in the developing world. Patents on resulting products (for example pest- and drought-resistant sorghum) would be held jointly by the private company and the scientist's home institution.

At its core, the Convention attempts to set up a framework by which access to genetic resources is granted (typically by DCs to ICs) in exchange for transfer of the technology embodying the genetic resource. Because it is physically impossible to deny access to the genetic pool conserved *in situ*, the framework stipulates (in the official Indian interpretation) that disclosure of the fact of use of particular genetic resources shall be made. The parties

shall conduct the exchange on 'mutually agreed terms', meaning commercial contractual agreements involving royalty payments. In this case, since what exactly comprises 'technology transfer' remains undefined, ICs may endeavour to place the least restrictive interpretation on the term. Apart from depth of transfer, since sharing of IPR rents are envisaged, questions about duration of transfer and geographical limits over which the licensed (transferred) rights may be exercised are important.

Serious legal issues are raised by the apparent requirement of compulsory disclosure of the source of genetic resources employed and transferring the 'make or licence' discretion from the IPR holder to the gene supplier. Trade secrets protection may no longer be available, and patent protection may significantly lose its exclusionary power. It seems that the stipulation of mandatory technology transfer in the framework for contracts confers little negotiating advantage to DCs. Further, the effectiveness of the new regime hinges critically on exactly what penalties follow in the event of non-disclosure.[14] If the penalties are non-existent or not severe, the regime would be ineffective. There will be a clear asymmetry of information between the gene supplier and the agent developing the biotechnology, notwithstanding the fact that supply of genetic resources is to be with the 'prior informed consent' of the supplier. At the time of negotiations, the supplier would have already done a significant amount of research in order to know fairly well what to look for; benefiting from the provisions of the Convention which facilitate mapping and organization of genetic information, and would also have a reasonably good idea of the chances of finding it. The developing country negotiators in such contracts would have relatively lesser information since much of it would be proprietary to the potential user and would therefore have little idea of the true value of the resource. At present there are no clearly defined penalties for failure to comply with disclosure requirements.

There is also the question of whether the requirement of (compulsory) transfer of technologies enhances the bargaining strength of DCs. As noted above, technology transfer may occur in several varying depths. The Convention is silent on this aspect.

Suppose that disclosure of use of genetic resource is, in fact, effectively mandated. In that case, biotechnology innovators must negotiate with the gene supplier regarding payments and depth of technology transfer in return for access to the gene pool. The gene supplier may be prepared to trade-off reduced depth for increased payments but would start with the disadvantage of not knowing the gene pool's true worth. It would, therefore, very likely make trade-offs along an indifference contour which at every point is below that which would be the case if it had full information. The latter, on the other hand, having revealed less than the gene pool's per-

ceived true worth, would also prefer to trade-off reduced depth for increased payments, within the disclosed valuation of the resource, since at least part of the negotiated payments may be paid by the multilateral fund. If the administrators of the fund do not intervene, the likely result is only nominal technology transfer and low level of payments. However, the administrators of the fund may seek to eliminate such free rides on its finances by the gene users. Accordingly, they may attempt to negotiate norms for both payments and depth of transfer (which may also be an issue in defining incremental costs). In this, ICs would collectively reveal less than their true valuations for access to genetic resources and might also attempt to protect gene users' rights by proposing restrictive norms for depth of technology transfer. Since DCs would not know the true valuation of the resource and collectively have little taste for increasing depth at the expense of payments on offer, the process of evolving norms may only tend to freeze the earlier outcomes. Further, even if such norms do not emerge and all payments are directly paid by gene users, rents from IPRs can be captured equally by sale of goods involving the technology or by licensing agreements.

What kinds of policy responses are possible and appropriate for DCs? A minimal step is that in negotiating protocols under the Convention, they should insist upon restricting the availability of IPR protection to biotechnology to categories in which full disclosure of the use of genetic resources is required, that is, trade secrets type IPRs must not be available for technologies employing genetic resources. Additionally, valid contracts for access must be filed along with the application for IPR protection for the innovation (biotechnology). This may be pursued in the GATT fora to ensure no conflict. Additionally, they should unilaterally incorporate this restriction on IPRs protection for biotechnology in their domestic legislation. It is only the unambiguous requirement of disclosure that will compel gene users to enter into contracts for access.

One issue in defining 'full incremental costs' would concern the 'depth' (in multiple attributes) licensee fees would be covered by multilateral transfers to DCs through the concerned financial mechanisms (FMs). ICs may be expected to support transfers through Flow A regimes and/or by FDI, while simultaneously pressing for liberalized FDI regimes in GATT, as well as bilaterally. DCs views may be more varied, with countries like China and India perhaps perceiving an advantage in Flow C types of transfers, and the use of FDI being a choice variable for national authorities, rather than the IPR holders. Rents for IPR licences will depend on the precise attributes of the licence, that is, depth, spatial and temporal extent of jurisdiction of the licence.

Clearly, what types of technologies and what depths of technology transfer would qualify for concessional funding are important areas of future ne-

gotiations. In negotiating technology transfer norms, ICs may argue (and calculate) that since 'no regret' measures are in themselves of net advantage to DCs, they should (may) adopt them anyway, without any external concessional funding for in-depth transfer of such technologies under the provisions of the Convention.

One argument that DCs may advance involves the concept of an 'investment hurdle' or 'capital-gap'. Several no-regrets strategies are typically not adopted on a wider scale because their up-front capital costs are higher than competing technologies, even though the no-regrets strategies are more (economically) efficient. The classic example in this respect is hydro versus thermal power; capital shortage typically leads to relative under-investment by DCs in the former, even though it is more economically efficient. DCs may urge that the 'capital gap' involved in such no-regret strategies be met by grant funding because the major decision criterion for investments in their case is initial capital costs rather than (relative) economic efficiencies of alternatives. Where technology transfer is involved, funding this 'capital gap' may involve royalty payments for in-depth technology transfer, instead of, or in addition to, purchase of capital equipment. This would, however, require the adoption of non-restrictive norms for technology transfers.

Another possible stratagem for DCs is to delink questions of depth of technology transfer from whether the options are 'no-regret' or involve positive (economic) costs; that is, the norms should apply to both categories identically. What would be the advantage to DCs? Many of the important abatement measures may, in fact, be in the latter category (for example, a switch to natural gas from coal-based power generation). If ICs perceive that it is in their interest to persuade DCs to adopt these measures, they would need to concede grant funding at sufficient levels that the DCs are at least indifferent between these and the conventional options. If DCs further insist that norms for depth of technology transfer are not restrictive (including restricted to positive cost options), enabling them to utilize such funding for technology transfer in depth, they may still be on strong negotiating ground in regard to conservation of genetic resources which are unique and whose loss is irreversible. The application of such non-restrictive norms to no-regrets strategies may enable DCs to employ capital gap funding for in-depth technology transfers in such cases also.

The problem of strategic bargaining to realize these and other advantages is complex. DCs are, as a group, more heterogeneous (including in their economic interests) than ICs. Further, they are susceptible in different degrees to bilateral inducements and pressures from powerful ICs. This is evident from the negotiating processes leading to Rio. On the other hand, a few key DCs have the potential to collectively alter use of global environ-

mental resources significantly in a few decades, giving their possible coalition considerable synergy. Strategic bargaining aspects of these questions, thus, need to be addressed carefully.

One possible response to the question of norms for technology transfer is for the financial mechanism to purchase the IPRs for a set of abatement (conservation) technologies outright and place them in the public domain. In that case, any country wishing to employ these technologies may do so at any depth, without it (or the FM) paying any further licensee fees.

Would such alternative arrangements be preferable for DCs? To answer this, one might note that the universe of possible benign technologies is extremely large. Any selection must be of a far smaller set because of limited financial resources with the FM. Since the technologies must be voluntarily placed on offer and the potential recipients involved in making the choice, the question arises as to whether or not one may expect outcomes in which the most efficient (or 'state of the art') technologies would enter the public domain. The vendors would have complete information about their own technologies, while the recipients would be unable to acquire such information, till the technologies are actually disseminated. Because of information asymmetry, only the worst of the benign technologies (which are still improvements over current practice) would be actually transferred. By this means, DCs would be able to choose only from a small set or be saddled with existing inferior technologies. Further, since the performance of any given technology is highly context-specific and the situations of DCs are extremely varied, there would be little assurance that a particular technology would perform as advertised in a given DC situation. This variant of the 'market for lemons' phenomenon may also arise in the alternative case of individual DCs identifying benign technologies and the associated depth of transfers. In this case, however, the choice would be from a larger set, and DCs may be better able to relate technologies to their own circumstances. The greater freedom of choice may be of advantage to DCs.

Conclusion

This chapter has drawn attention to the concerns of the developing world as expressed in IPR regimes. Technology transfer across nations would necessarily require a critical examination of existing IPR regimes. The requirement in the Convention that for those biotechnologies utilizing genetic resources, measures to ensure adequate and effective protection of IPRs will be taken, may imply that domestic legislation of DCs would require alteration. This is significant in that there are widely differing goals of the developed and the developing world, and the alleged lack of adequate protection has been a deterrent to successful transfers. The role of the government in maintaining a balance between public and private interests and as a facilitator of successful transfers has been briefly discussed.

The various instruments of intellectual property protection have been examined, although it is not possible to choose a single, preferred mode of protection for biotechnological inventions. It is yet to be seen which instrument would be best able to incorporate elements of 'compulsory disclosure' of source of genetic material without compromising commercial interests.

The discussion on the nature of flows of technology transfer highlights the fact that the Convention has not given adequate treatment to the subject of 'depth' of transfer. This is of consequence when attempting to define and estimate 'full agreed incremental costs' due to the element of depth which must be taken into account. Since DCs are not in a position to correctly assess the potential value of a genetic resource in the initial stages of exploitation (particularly due to a lack of information), it would be important to carefully devise contracts for access to genetic resources, negotiating the terms for actual commercial exploitation when greater information about the potential value of the resource is available.

Notes

1. This section is adopted from Besen and Raskind, 1991, pp. 3–28; see Nayyar, 1992, for developing country perspectives.
2. A compulsory licence is one of the means of limiting the exercise of patent rights in the interest of the public. It is an authorization by an authority designated for this purpose (in India it is granted by the Controller General of Patents) to a person other than the patentee to do, without authorization by the patentee, acts which would otherwise be excluded by the patent. In India, it is granted in the condition of non-working of a patent or if the patent-holder does not fulfill the obligations.
3. Nayyar, 1992.
4. Sengupta, 1991.
5. Chisum, 1989.
6. See Kitch, 1986, pp. 31–49; McFetridge and Rafiquzzaman, 1986, pp. 91–120; Hall, 1986, pp. 59–86.
7. See Besen and Raskind, 1991.
8. Under the International Convention for the Protection of New Varieties of Plants, UPOV (1983), there is a clause preventing the protection of biotechnological invention by both patents and plant variety rights.
9. Bell, 1990.
10. A clause of applicable law indicates which country's law is to be used for interpretation of the agreement. This could be the laws of either negotiating party or could be the laws of a third country.
11. Sengupta, 1991.
12. The Office of Technology Assessment of the US Congress (1987, 1991) has defined biotechnology as any technique that uses living organisms (or parts of organisms) to make or modify products, to improve plants or animals or to develop micro-organisms for specific use. The UNIDO/WHO/UNEP Working Group on Biotechnology Safety defined it as the application of biological systems and organisms to scientific, industrial, agricultural and environmental processes and uses. The Convention defines it as any technological

application that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for specific use.

13. *In situ* conservation has been defined as 'the continuing maintenance of a population within the community of which it forms a part, in the environment to which it is adapted' (Commission on Plant Gen. Res., Item 5, 11–15 March 1985). It is most often used for wild species and wild relatives of crops and animals but 'can include artificial regeneration whenever planting or sowing of seed is carried out, without conscious selection, on the same area where the seed was collected' (Commission on Plant Gen. Res., Item 5, 11–15 March 1985).

    Ex situ conservation is the conservation of organisms outside their natural habitat. Although *in situ* conservation is to be encouraged, the species to be conserved (other than those having potential for sustainable use) have not been identified.
14. It is critical that it is understood that it would not usually be feasible to detect non-disclosure of origin of the genetic resource.

10 Access to and transfer of biotechnology: Blind alleys and windows of opportunity

CALESTOUS JUMA AND
EDITH MNENEY

This chapter argues that international negotiations on technology transfer have often ignored the differences between technologies and that their results are likely to lead to the formulation of national policies that may not adequately promote technological development. The chapter examines the excessive emphasis placed on intellectual property issues and notes that the developing countries may be arguing for technologies that they already have, while the industrialized countries are attempting to restrict access to technologies that are available in the public domain. Using the case of biotechnology, the chapter stresses that the ability of the developing countries to benefit from this emerging field will largely depend on their existing technology policies and the incentives that they introduce to promote innovation.

Technology transfer: Fallacies and reality

Discussions over access to and transfer of technology have often taken the view that technologies have similar characteristics and are therefore transferred in the same way. Most of the discussions on biotechnology, especially in the context of international negotiations, have relied on metaphors borrowed from the 1960s and 1970s. These metaphors relied on lessons gained

in the transfer of mechanical technologies to the newly-industrialized countries.

Over this period, issues of intellectual property protection gained prominence as the emerging nations of Asia and Latin America formulated policies that promoted techonological learning through unpackaging technologies and conducting 'reverse engineering'. These policies raised concern over the possible violation of intellectual property rights (IPRs), a feature that dominated international debates from the mid-1970s through the 1980s.

Since then, intellectual property issues have tended to dominate discussions on biotechnology, especially after the US started including the violation of such rights as one of the main causes of the decline of its industrial competitiveness. The reasons, as have been illustrated in a number of recent studies, lie in the failure of the US system to invest adequately in process innovation and to introduce institutional reforms that are conducive to rapid technological development.

The emphasis on intellectual property protection by the industrialized countries has created a false impression among developing countries that such rights were indeed the main barrier to access to new technologies. This problem is compounded by the fact that a large share of the relevant biotechnology is available in the public domain and can easily be acquired through training programmes and information exchange. However, it cannot be readily applied in the recipient countries unless it is part of an institutional or corporate structure that is designed to turn knowledge into products for which markets exist or are being created.

There is a general view that an increase in the flow of overseas development assistance would necessarily promote technological development in the developing countries. This view emanates from the assumption that development assistance could be used to cover the royalties that would otherwise be paid to suppliers of technology. First, it should be noted that development assistance is not a major carrier of technology to the developing countries. Even in specific areas of technical co-operation, it is doubtful that aid programmes make important contributions to technological development. Second, most development assistance programmes focus on agricultural production which has less potential for technological development than industrial production. An increase in development assistance without the corresponding shift in focus would simply avail more funds that the developing countries cannot utilize effectively. Increases in aid flow cannot necessarily contribute to technological development.

The general perception of technology in most developing countries is the equipment, skills, managerial competence and technical specifications asso-

ciated with the production of goods. Technology transfer therefore refers mainly to the flow of such production capacity. This limited perception of technology has led to the false view that technological development is inherently an expensive process which must rely on external input and financial resources.

It would be wise for developing countries to focus on accumulating *technological capacity*, which is the ability to generate and manage technical change (including the related skills, knowledge and experience as well as institutional structure and networks). In this respect, technological development is a purposive and dynamic process that builds on period gains and is articulated through specific institutional arrangements. It takes concerted and guided efforts and does not simply emerge from the mere act of investing in new production facilities.

Biotechnology capacity development

The links between biodiversity conservation and biotechnology have become important elements in international negotiations. Access to biotechnology is not only important for the future of the developing economies but a crucial bargaining chip for allowing access to their genetic resources. The developing countries stress that the loss of biodiversity or the appropriation of genetic resources by other nationals constitutes foregone opportunities to develop new products and processes of economic value.[1]

While one cannot deny the links between biodiversity and biotechnology, it may not be viable to argue for reciprocal exchange between biotechnology and genetic resources. This is mainly because institutions which safeguard intellectual property at the level of technological innovations are more developed than those which protect the interests of local communities that are involved in conservation efforts.[2]

Further, the developing countries have often argued that IPRs are the main obstacle to access to biotechnology.[3] While such rights increase the transaction costs of accessing biotechnology, they do not constitute a major obstacle. To the contrary, most of the biotechnologies needed by the developing countries are available in the public domain and are based on conventional practices.[4] Indeed, those countries that cannot utilize public domain technologies are not likely to use patented ones. Further, training and access to information are essential in building capacity in biotechnology. However, this argument should not diminish the importance of IPRs, especially where they could be used as non-tariff barriers. Nor should this undermine the importance of the need for additional financial resources to support development efforts. For example, there is no reason why development assistance cannot be used to finance payments for proprietary technologies.

The discussions on biotechnology transfer to the developing countries have not been guided by a more careful assessment of the key features of this set of techniques. As pointed out above, access to information and training are probably the most important means of having access to, and acquiring, biotechnology. This view is based on the understanding that biotechnology is knowledge-intensive and does not involve the transfer of massive mechanical equipment. There is considerable evidence showing that even smaller countries with limited industrial capacity are able to move to frontiers of biotechnology in specific fields by enhancing their human resource capability.[5] This means that the developing countries must invest in training and improve the environment for access to information, especially to specialized databases. They must also seek ways of adding value to their genetic resources through screening and characterization.[6] This would strengthen their ability to develop new products from biological resources.[7]

It must be pointed out that many of the developing countries have imposed extensive restriction on international access to information or have failed to provide incentives to encourage the local scientific community to use these facilities. Some of the fundamental problems such as improving the communications infrastructure and liberalizing the research environment are going to be major determinants in the ability of the developing countries to enter the field of biotechnology.[8] Policies that deal with this are not specific to biotechnology or biodiversity conservation but fall in the broader domain of improving the institutional environment for innovation and scientific enquiry. Much of the challenge therefore lies in the ability of the developing countries to create a political, economic and institutional setting that will allow for the full realization of the provisions of the Convention on Biological Diversity.

Characteristics of biotechnology

Biotechnology is a set of techniques that uses living organisms or substances from those organisms to make or modify a product, to change the characteristics of plants or animals or to develop micro-organisms for specific purposes. In this respect, biotechnology is a collection of varied techniques that are targeted to a wide range of applications in other sectors of the economy. These techniques include genetic engineering, cell fusion and other bioprocesses. By virtue of being based on living material, the safety concerns of biotechnology have become an important factor in its diffusion. Indeed, biosafety has been one of the most controversial aspects of the Convention, and a proposal to determine the need for a protocol to the Convention on the matter has been extensively discussed.

In order to realize the objectives of the Convention in relation to biotechnology, it is important to understand the differences between biotechnology

and other forms of technology. First, biotechnology is a *knowledge-intensive* sector which requires high degrees of training in specific fields. The acquisition of specific skills in molecular biology, genetics and related fields are central to the ability of any country to move into biotechnology. Second, the acquisition of basic knowledge and technical skills considerably lowers the *entry barriers* into the field. In this regard, developing countries could easily enter the biotechnology field without heavy investment in equipment and infrastructure development. Third, biotechnology lends itself to the creation of a wide range of *market niches* because of the possibility of applying the techniques in a wide range of economic sectors (including industry, environmental management, mining, agriculture and land reclamation). The generic nature of biotechnology makes it possible to develop products that are unique to local markets. For example, a biotechnology programme in Africa could result in the development of diagnostic kits and vaccines for tropical human and livestock diseases. Fourth, the development of biotechnology requires an elaborate system of *institutional networking* and cooperation through measures such as consortia. Countries that have a tradition of stand-alone institutions are going to find it difficult to harness the synergy necessary to develop biotechnology. Those countries that promote the establishment of isolated biotechnology institutes are unlikely to benefit from the investment in these ventures. A more viable institutional networking system should extend beyond *national boundaries* and link into research efforts in other countries. An appeal to the so-called 'African science', for example, is unlikely to result in the promised benefits. Such levels of co-operation will require that local scientists are competent enough to command respect in other institutions.

The role of prior national technological capacity

The only way developing countries will be able to engage sensibly with biotechnology is when they themselves have built up a critical minimum level of biotechnological competence. The notion of 'technological capability', which has become increasingly prevalent in recent literature, is designed to capture this idea of competence—of being able to control the ways in which a new technology is deployed for socio-economic ends. It has been emphasized largely because most technology transfer mechanisms often fail to bridge the 'technology gap' between rich and poor countries.

The acquisition of technological production capacity is associated with the flow of different kinds of knowledge and expertise. The first category includes the knowledge and expertise needed to transfer and set up production facilities and all the various services required to operate the investment project in question.[9] The second category includes the know-how needed to operate and maintain the new system once it has been installed. This is often

embodied in people but will also be codified in written forms in manuals, schedules, charts and diagrams. People-embodied know-how is often fostered through training and information services but is also developed through on-the-job learning. The third category includes the knowledge and expertise for implementing technical change which involves both the underlying know-why of the technological system itself as well as the various techno-managerial capabilities needed to evaluate and transform existing plants to meet new and innovative operating conditions.[10]

Genuine technology transfer requires the eventual flow of all three categories of capacity and a gradual build-up from the first to the third. It is the third category that enables a country to acquire *technological dynamism* and be able to fully utilize both public domain and proprietary technologies. The stage of technological dynamism cannot be achieved through policies which rely on merely adapting to international trends. It requires major national policy measures which include integrating enabling legal requirements in technology transfer contracts (for example on local content); use of national consultant engineering companies at all stages of project planning; provision of national facilities for research and technological services; adequate national training system for scientific, technical and managerial manpower; and other appropriate forms of social and economic infrastructure.

The above assessment shows that the issue of access to technology should be seen in a broader context of the acquisition of knowledge and expertise. Much of this is generic and therefore not restricted to a specific category of technology. Arguments for singling out specific technologies, as in the case of biotechnology, are likely to shift attention from those basic forms of expertise and knowledge that would make it possible for the developing countries to build up capacity in this subsector.

One emerging area that is critical to the debate on access to genetic resources is the ability of the developing countries to add value to the resources. Effective 'conservation of genetic resources must become self-supporting by producing income needed for activities which ensure the long-term viability of resources, while providing incentives for enhancing our understanding of materials conserved.'[11] In this regard, the developing countries will need to do more than simply undertake conservation measures and expect to reap large returns from such efforts. These countries will have to invest in efforts to understand and characterize the genetic composition of the conserved material. It is only through such science-intensive activities that they will be able to attract further resources needed to support conservation. This point is well illustrated by the agreement by Merck Pharmaceuticals and the National Institute of Biodiversity (INBio) of Costa Rica.[12]

In the context of the Convention, *biotechnology* is defined to mean 'any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.'[13] This definition reflects the broad nature of biotechnological applications. While many of the core techniques used in this field rely on knowledge in molecular biology, their commercial application requires the use of a wide range of other technologies that are based on biological systems. Studies on the strengths and weaknesses of the biotechnology programmes of developed and developing countries show that the most important factor in enhancing global competitiveness is the ability of a country to co-ordinate and mobilize the available knowledge expertise to bear on the development of specific products and processes.[14]

Most of the discussions on biotechnology transfer have tended to use approaches formulated for negotiating for other forms of technologies. The ideas are similar to those in the Montreal Protocol and London Agreement. There are important differences between the two categories of technologies. Ozone-related technologies are clearly identifiable products and processes, where biotechnologies represent a set of techniques whose application requires expertise in a wide range of other sectors. The scope of application of the ozone-related technologies can be easily identified; the biotechnologies are generic, and their full scope of application is illimitable.

It has been argued that the entry barriers for biotechnology, defined broadly to include traditional techniques such as tissue culture, are lower than in other frontier technologies such as microelectronics. This provides the developing countries with new opportunities to enter the field. Available evidence, such as the development of diagnostic kits for tropical diseases in Africa, confirms the view that a small core of well-trained scientists could make major contributions to the development of biotechnology. However, the ability of these countries to benefit from such developments and contribute to technological dynamism will depend largely on the level of technological capacity in complementary fields such as fermentation technology and process engineering. In addition to the available scientific and technological potential, institutional factors such as research co-operation are critical to the realization of biotechnology development programmes.

For developing countries to benefit from access to biotechnologies, it is vital that they build a broad base of knowledge and expertise in complementary fields. The issue of biotechnology cannot be addressed in isolation from broader technological concerns. In this regard, the ability of the developing countries to benefit fully from the implementation of the Convention will depend largely on the degree to which complementary requirements are incorporated into the Convention. So far much attention has been given to financial resources, for obvious reasons. Other important issues are

receiving less attention; these are mainly the provisions that would enhance the ability of the developing countries to acquire the essential *information* and *knowledge* that is related to the development of biotechnology.

Of particular interest are the articles dealing with research and training, access to genetic resources, access to and transfer of technology, exchange of information and technical and scientific co-operation. As noted earlier, due to the fact that biotechnologies are science-intensive and their economic application relies largely on the available technological capacity, those articles that promote training, information exchange and technical co-operation are the ones that will most effectively facilitate the transfer of biotechnology. It should be noted that 'technology transfer' is a description of a complex process involving the use of specific channels to effect the flow of equipment, knowledge and expertise. As pointed out earlier, it is the flow of knowledge and build-up of expertise that ultimately contributes to technological dynamism.

The manner in which developing countries have generally approached the issue of access to technology has raised a number of questions on the ability of these countries to fully benefit from any scheme that allows access to essential technologies. Judging from the record of technological performance in Africa, the relevant policies and institutional arrangements for supporting technological transformation are virtually non-existent in most countries: The general tendency in Africa is still to refer to 'technology transfer' in the context of policy and practice.

The phrase *technology transfer* has been used to a large measure in United Nations circles and has come to mean 'the transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service and does not extend to the transactions involving the mere sale or base of goods.'[15] This definition refers to a transaction or movement of systematic knowledge but does not make a judgement on the transacting parties.

In practice though, most developing countries have tended to treat technology transfer as a process that involves mainly the source of the technology. The general assumption, which also underlies the declarations, is that the mere removal of certain barriers will lead to the transfer or flow of technology to the developing countries. Relaxation of intellectual property and licensing restrictions, for example, will not necessarily lead to technology transfer. This is illustrated by the failure of developing countries to fully utilize the technological information that is in the public domain—or whose patents have expired.

A genuine and effective technological partnership will require willingness to transfer the relevant technology. However, this is only one aspect of the process—and one that has been the focus of technology transfer discussions

for a long time. The other is the effort of those acquiring the technology. The effectiveness of this effort is reflected in absorption and assimilation of the technology as well as the development of local technological capability. It would be meaningless to discuss the prospects for partnership in technological development without paying special attention to the ability of the developing countries to effectively acquire technology. This ability depends largely on the policy incentives provided at the national level to promote technological innovation.

Reforming incentive policies

Incentives and disincentives: The African case

In most African countries, incentives for technological development have often been implicit and mediated through investment incentives for industry. Where explicit incentives have been provided for technological development, they have often remained in the books or only articulated in policy documents. What so far emerges is that the main incentives for industrial development have favoured the importation of large-scale, capital-intensive investments with little consideration for technological development.[16] In many cases, the incentives explicitly provided for industry have tended to implicitly undermine the prospects for technological development. For example, incentives provided in many countries to facilitate the installation of industrial plants have often worked against local technological development. These incentives often provide for lower import duties and tariffs on whole plants and impose higher import duties and tariffs on raw materials that could be used to fabricate such equipment locally. The effect has often been that equipment that could be fabricated locally is often imported.

Many African countries have the potential to manufacture most of the components necessary for assembling solar panels, but the high tariffs imposed on the necessary raw materials make it easier for firms to import complete sets of panels. Because of the high labour costs in industrialized countries, such products are usually expensive, and only a few institutions and a small section of the population are therefore able to secure solar panels. Relaxation of tariffs would make it possible for cheaper solar energy panels to be manufactured in some African countries.

In many cases, tariff regulations are simply insensitive to the imperatives of technological development. For example, despite the growing importance of computer equipment in scientific research, many countries still place high tariffs on such equipment. Part of the problem lies in the misconception propagated in the 1970s that computerization was likely to displace jobs. Those countries which had strong job-creation policies imposed high tariffs on computer equipment.

Commercial organizations and individuals may not find it worthwhile to take into account environmental factors in the technologies which they develop or use. Entrepreneurs will be motivated by the existence of a suitable market before developing technologies. Incentives are therefore important in that they create conditions which encourage involvement in a new area. Incentives cannot be established unless there is a clear government policy on technology and development.

After independence most African countries established tariffs and import licensing systems to encourage investment in import substitution industries. The industries depended heavily on imported machinery and inputs. Some of these countries also liberalized foreign investment policies by taking measures to protect foreign investors against nationalization, reduce limitations on share ownership, increase field of activities and size of profit remittances and accept arbitration as a means of settling disputes. These incentives proved useful in guiding activities of investors into areas which were deemed to be priorities. However, these incentives had their own limitations.

Experience has shown that the most effective and efficient inducements are those arising from financial stability, policy transparency, availability of skilled manpower and large growing domestic markets. More incentives are needed for those investments which encourage indigenous capacity building. Incentives are also needed in areas that provide input which firms and individuals are unable or unwilling to provide themselves or which help to reduce the risk of uncertainty associated with some types of investment in the accumulation of knowledge and skills.

Manufacturers in most African countries receive no income tax concessions, tariff reductions or other incentives for their R&D efforts. Also, most research activities are not well co-ordinated despite the establishment of national institutions for the purpose. Most intellectual property laws in Africa do not encourage the use of knowledge which is already in the public domain. These laws are also deficient in that there is no room for appropriate technologies developed by indigenous people.

The barriers encountered by transnational corporations in the transfer of biotechnology include:

- reduced expectations of profits from sales of such technologies due to lack of markets, complex legal requirements, lack of market information;
- lack of adequate technical and social infrastructure;
- unfair competition due to lack of environmental regulations and standards in developing countries.

During the 1980s, many developing countries relaxed regulations governing technology and foreign investment in their countries. Policy changes easing controls over patents, licensing and trademarks were introduced.

These efforts revealed a recognition of the importance of technology and also the importance of international collaboration in this area. However, more *direct incentives* need to be provided to support technological development in general and biotechnology in particular.

Incentives for technological change

The growing liberalization of economic systems worldwide has changed the role of the state in development and altered the patterns of policy-making. Whereas African governments have tended to invest directly in enterprise development, their role in the 1990s will become more regulatory. This, however, does not mean that the state will play a lesser role in development activities. To the contrary, there is a need for the state to provide the necessary incentives and improved policy environment for entrepreneurial activities. In most countries the policy environment is still hostile to private enterprise activities. The challenge for government is not how to recede into the background but how to improve the policy environment for entrepreneurial development.

In some sectors of the economy, especially in technological development, traditional policy measures may be necessary even though the general trend is to use other economic instruments. The issue is not so much the use of interventionist measures but the discipline that is needed in applying such measures. Korea gives an example of discipline in the use of subsidies to promote technological innovation.[17]

The need for discipline and long-term considerations in the use of instruments such as subsidies is becoming more critical as new evidence on the rate of industrial learning in infant industries emerges. Evidence from Korea suggests that the learning time in the engineering industry is usually two decades, much longer than previously thought. Further, due to both the speed of technological change and the increased globalization of industries, the learning period has extended in the past 15 years, and the social cost of supporting the infant industries has increased.

Before one considers the specific incentives that can be used to promote the application of biotechnology, it is important to consider the overall policy environment in which these incentives operate. The issue of *time* is essential to the process. Since technological development requires long-term planning, the policy environment must be predictable. In this respect, policy instruments should not be changed without considering their long-term impacts on technological investment. Provisions need to be made to ensure that those who are affected by policy changes are adequately *compensated.*

Compensation, however, should not be used as an excuse to introduce unexpected changes in policy instruments. Where the policy environment is predictable and reliable, entrepreneurs are more likely to adapt to changing

market conditions. For example, a country that puts in place clear long-term goals to select technologies on the basis of their environmental soundness will provide signals to entrepreneurs to start investing in meeting the demand for such technologies.

In addition to predictability, issues such as *participatory policy-making* are becoming equally critical to the development of technologies. In most African countries, policy-making is treated as a secret activity performed only by certain individuals in a few state agencies. This non-participatory practice makes it difficult for entrepreneurs to make long-term plans or to offer ideas to the policy-makers. A participatory policy-making process is inherently transparent and brings the stakeholders into partnerships with governmental and non-governmental agencies in ways that facilitate the development process.

Trade policies are important determinants of the prospects for successful investment in biotechnology. In the past, trade policies have relied on protectionist measures. However, most African countries are now shifting towards export-directed trade policies. Trade in environmentally sound products is going to become an important aspect of trade in general.

While protection of infant industries is deemed to create unnecessary inefficiencies, it may be necessary to provide learning-related protection in certain areas of industrial activities. It is unlikely that African countries will accumulate the necessary technological capacity unless their investments are partially shielded from direct competition with the more industrialized countries. Such protection must be directly linked to industrial learning and not as a way of protecting inefficient production methods. Industrial learning would manifest itself in increased production efficiency and accumulation of technological capacity at the national level.

Many countries have used *interest rates* to stimulate borrowing for investment in certain sectors of the economy such as agriculture. Such measures could be applied for promoting biotechnology. Low interest rates, however, could reduce the amount of capital available for lending, making it necessary to introduce interest rate subsidies. The effectiveness of this measure as a way of promoting biotechnology does not seem to be high.

The role of *public procurement* in promoting technological change has not been given adequate attention in African countries, especially given the lack of measures such as venture capital which could be used to promote technological development. So far, most African countries operate tender systems which emphasize competitive prices where the lowest tenders are usually awarded contracts. This helps to reduce public expenditure. However, it also undermines the capacity of local manufacturers to enter the market, especially where the products are new and the prices are high due to low volumes. A public procurement policy would ensure that local

products are sold and that markets are created through government purchases.

Since government is still a major economic actor in Africa, a procurement policy would enable the government to put pressure on manufacturers to improve the quality of their products, reduce prices, maintain certain performance standards and improve design. The difference in cost between the lowest price of a product and the cost of the local product could be considered as government investment in R&D. With this level of investment, the government would have the power to influence and direct the pace of technological innovation.

Implementing a technology-based procurement policy would require a change in the composition of skills in the tendering agency. This would require engineers, designers, materials scientists and other relevant technologists, depending on the priority products supported by the government. The policy would also require a review of the current standards policy adopted by most African countries. So far, standards are enforced without due consideration to the technological needs of the country. They normally do not account for the fact that standards evolve and that efforts should be made to allow for this gradual improvement.

It should be pointed out that procurement programmes can also be abused. Since the procuring agencies will have extensive powers and influence on the direction of technological change, it is important that criteria for choice of technology be made in the context of national priorities. Further, government procurement programmes should emphasize innovations that come from the private sector or those for which commercialization options already exist. This will force public sector R&D institutions to forge links with the private sector. There is always the danger of the state procuring from itself in such a way that the technology does not get established in the market place. The aim of the procurement programme should be to promote technological innovation in the pre-commercialization stages up to the stage when the technologies have established their own market niches. This can be achieved by setting market targets which the firm must achieve in order to continue receiving support through procurement programmes.

One of the incentive regimes that has been widely covered in the literature is *intellectual property protection*. In the past, this regime has not provided particular attention to environmental protection, but it could form an important area of the incentive system, especially at the stage of technology development and innovation.

Creating incentives for environmentally sound technology development will require specific changes in the existing *investment codes* of various countries. The codes outline the benefits offered, criteria for eligibility and obligations of investors as well as governments. Investment codes of most

African countries provide fiscal and tariff concessions to enterprises that meet specified conditions which relate to the use of domestic input, firm size, employment creation, choice of site and sector and others. The use of biotechnology could be included as part of the criteria for fiscal and tariff concessions.

Tariff concessions could be used to promote investment in biotechnology. One way of doing this is to provide import duty exemption for raw materials necessary for the manufacture of environmentally sound products. Another way is to reduce duty for imported products that are environmentally sound in the general framework of trade liberalization. Where such concessions are made, additional measures would need to be used to ensure that local manufacturers who are likely to be affected by this provision are supported so that they can improve the environmental standing of their products.

Countries may wish to protect their natural resource base and human health through higher tariffs for products that are known to be harmful, especially in cases where alternative technologies exist. Such measures should not be used as a way of restricting trade and should be carried out within the limits of the rules of the General Agreement on Tariffs and Trade (GATT).

Many African countries are starting to offer *export incentives* which include exemption from export tax as well as export compensation. Other measures include tax rebates for duty paid on imported input, preferential tax on export earnings, retention of part of export earnings in foreign exchange, access to export processing zones and export insurance. Such incentives could be used to promote the export of biotechnology products.

Tax concessions are the most commonly used incentive for technological development and can be used to support the development of biotechnology. So far, most African countries do not provide tax concessions for R&D expenditures, but such concessions, especially in operating plants, could stimulate incremental innovations that would reduce energy consumption or pollution emissions. They could also encourage industrialists to switch to new raw materials or fuels for which they can receive concessions.

In addition to tax concessions, *tax disincentives* could also be employed to discourage the use of environmentally unsound technologies. The introduction of tax disincentives would only be feasible if environmentally sound technological options are available to the entrepreneurs and clear environmental standards have been introduced. In the absence of such options, industrialists are likely to object to the introduction of such disincentives.

Tax holiday, or the full or partial exemption from income and other taxes for a period, could be used to stimulate investment in biotechnology. This measure has been widely used and has in recent years been integrated

into operation of export processing zones (EPZs). Many of the EPZs have more emphasis on export promotion than on technological development.

Accelerated depreciation is a form of tax holiday which allows a firm to write off the cost of its capital equipment or scientific instruments against its gross revenue. This reduces the cost of capital and increases the liquidity of the firm. Accelerated depreciation would allow firms to invest in new facilities that are environmentally-sound.

Reinvestment allowance, which is used to encourage firms to expand, could be used to promote investment in pollution abatement at the firm level or incremental improvement that saves on energy or raw material use. Such allowances exempt firms from tax on reinvested capital. This is a more positive measure than the practice of taxing savings or tax-exempt corporate profits that are distributed to the shareholders as a way of forcing firms to reinvest.

Incentive schemes that allow for high percentages of *profit repatriation* could help to attract foreign investment. Such a scheme for biotechnology would have to give preferential treatment to this subsector on the basis of certain environmental standards.

Offsets are economic benefits directed at national goods. They are essentially 'off-balance sheets' and are not associated with direct costs to the government. They could encourage firms to use their capabilities to invest in the development of biotechnology. The use of offsets could encourage entrepreneurs to give services such as management skills at no or cheaper cost.

The development of *infrastructure* for biotechnology is essential for long-term capacity building. The issue is of critical importance to Africa because of the deterioration of infrastructure and declining ability of governments to support new investments. The decline in infrastructure may lead to the concentration of new technological investment near or in urban areas. The required infrastructure may range from the supply of critical equipment to establishment of 'science parks' or 'industrial estates' and support to institutions of higher learning.

Access to information on biotechnology is a key service for industry and forms part of the incentive system. The institutions providing such services would need to ensure that systematic information on sources and prices of technology also includes advice and assistance in bargaining, details on trade restrictions and practices, warranties and the scope of proprietary rights.

African countries could involve *insurance* firms in covering damages that might occur during production, transportation, storage, utilization and final disposal of environmentally sound products. This would assist in at least two ways. Firstly, assessment of risks and premiums could encourage companies and institutions to develop and promote biotechnology. Secondly, the insur-

ance company will assist in inspecting and regulating the means to improve environmental risk management.

In order to attract people into research-related jobs, some countries such as Kenya have created separate schemes of service for researchers. Similar schemes could be designed to attract people into institutions that work on biotechnology. Other ways of creating *employment incentives* for biotechnology development could be to provide tax deductions on activities such as training which are critical to capacity building.

Conclusion

This chapter argued that international negotiations on technology transfer have often ignored the differences between technologies and that their results are likely to lead to the formulation of national policies that may not adequately promote technological development. It examined the excessive emphasis placed on intellectual property issues and noted that the developing countries may be arguing for technologies that they already have, while the industrialized countries are attempting to restrict access to technologies that are available in the public domain. Using the case of biotechnology, the chapter stressed that the ability of the developing countries to benefit from this emerging field will depend largely on their existing technology policies and kinds of incentives that they introduce to promote innovation.

Notes

1. Touche Ross, 1991.
2. Reid, 1992b.
3. Juma, 1989; UNEP, 1990.
4. UNEP. 1991c.
5. Clark and Juma, 1991.
6. Cohen, 1992.
7. For example, new bio-pesticides could be developed from a wide range of plants. See van Latum and Gerrits, 1991; Bunders, 1988.
8. OTA. 1990.
9. These include feasibility studies, plant commissioning and start-up services, design engineering and training.
10. Fransman and King, 1984.
11. Cohen, 1992, p. 9.
12. 'In October 1991, Merck Pharmaceuticals agreed to pay INBio $1 million for the opportunity to screen the samples that INBio is collecting. INBio will receive royalties on sales of any products developed from these samples. Even if INBio receives only 2 per cent of royalties on pharmaceuticals developed from Costa Rica's biodiversity, it would take only 20 drugs for INBio to be able to earn more funds than Costa Rica currently gets from coffee and bananas—two major exports,' WRI/IUCN/UNEP, 1992, p. 152. This view, however, is not shared by those who believe that relations between transnational corporations and the developing countries cannot be equitable. Merck, they would argue, has more lawyers than the whole of

Costa Rica, and therefore the country is unlikely to benefit from the arrangement.

13. UNEP. 1992b.
14. Clark and Juma, 1991.
15. UNCTAD. 1990, p. 48.
16. Steel and Evans, 1984.
17. Amsden, 1989.

11 Intellectual property institutions and technological co-operation

MANUEL ILLESCAS

Intellectual property rights (IPRs) are often considered serious obstacles to the transfer of technologies related to the conservation of biological diversity. In the Convention on Biological Diversity, the main problem areas were summarized as access to genetic resources; access to, and transfer of, technology; exchange of information; technical and scientific co-operation; handling of biotechnology and sharing of benefits.

Developed countries introduced some amendments to the original text, to preserve the rights of the IPR holders for the automatic transfers of technology to private firms or public bodies of developing countries. This exchange of information, access to genetic resources and access to and/or transfer of technology were to be based on mutually agreed terms. Hence, private sectors of developed countries may freely negotiate preferential flows of technology and/or information to developing countries on matters related to the conservation of biodiversity. Financial mechanisms provided by developed countries would encourage co-operation in this field not only between public, but also private, sectors.

The role of patent offices may become crucial at a certain level. Most patented technology only remains secret in its legal life, during the application period and (in most countries) only during part of this period. Once the patent is granted, or the application published, there is an automatic disclosure of its content and free accessibility to it. Information, at this stage, may be freely exchanged and/or transferred to developing countries

with minimal cost. Search reports on matters concerning conservation of biological diversity may be performed by the patent offices of developed countries at reduced prices. The Spanish Patent and Trade Marks Office has done this for years in any technical sector, in the context of co-operation with South American countries which signed agreements in this sense. In spite of previous assessments, to fully use a patent, there must have been a prior negotiation with the patent holder on know-how, marketing and other factors necessary for putting a competitive product into the market.

These are some of the roles to be played by the public bodies which are in charge of the administration of IPRs—mainly the patent offices—in order to assure full co-operation between developed and developing countries on conservation of biological diversity. This chapter illustrates some new perspectives on mutual respect between industrial property legislation and the goals of the Convention.

Patents and biodiversity

A patent is generally defined as a contract between an inventor and society in which each party must meet some requirements. Society must guarantee to the inventor the monopoly in the exploitation of the invention. This is the essence of IPRs. The inventor, on the other hand, must disclose the invention. This contributes to the growth of common technical knowledge or the 'state of the art'.

Consequently, IPRs are useful tools in maintaining the innovation process inherent in many industrial activities. Without effective legal protection, new inventions arising from any human activity including those relating to the environment, biological diversity and biotechnology would suddenly decrease. In fact, in some circles, the future of biotechnology innovations is bleak unless patent laws are rapidly adapted to this growing sector.[1]

Biotechnology offers new opportunities for global partnerships, especially between countries rich in biological resources (mainly developing countries) and others which have developed technologies to transform these resources to serve the needs of sustainable development.[2] Patent and other IPRs designed to protect technology (for example, plant variety certificates and utility models) support the innovation process. Without such protection through the legal framework, advances in science and technology would slow down considerably. The lack of a satisfactory IPR system would also be an obstacle to the diffusion of information as most of the inventions would be kept secret.

Biodiversity includes variety and variability of genes, on our planet. It provides an abundant and essential supply of indispensable goods and ser-

vices. To solve the most critical problem for the conservation of biodiversity requires a major shift in thinking at all levels of decision-making. This must be reflected in a commitment to stepping up levels of human, financial and other resources, especially for capacity-building in the developing countries.[3] In this sense, biodiversity conservation is a task involving all peoples worldwide. It should serve to balance the differences between developed countries which depend on it for future research and development (R&D) projects, and developing countries which have the responsibility of conservation because the resources are within their territories.

There is a need for urgency in adopting conservation measures. An estimated 25 per cent of the world's species present in the mid-1980s may be extinct by the year 2015 or soon after.[4] This realization led to the signing of the Convention. It is noteworthy that IPRs have in some instances been seen as obstacles in the implementation of the Convention. This chapter endeavours to show that, on the contrary, IPRs could be tools to enable patent offices to disseminate technologies and information contained in patent documents.

Access to genetic resources protected by IPRS

Article 15 of the Convention may not seem relevant to IPRs. It endeavours to secure access to genetic resources by encouraging Contracting Parties to create conditions to facilitate access by recognizing the sovereignty of each nation over its natural resources; determining that access shall be on mutually agreed terms between parties and insisting on the sharing of results and/or benefits of the R&D from the genetic resources.

In facilitating this access, generation of biodiversity is assured. The article is also relevant in that IPRs restrict access to genetic resources. Access is a small but difficult part of the problem. Genetic resources not protected by IPRs are accessible after negotiations between Contracting Parties on mutually agreed terms. However, what happens when genetic resources (genetically improved and protected through patents) are obtained from the territory of a developing country by a firm from a developed country? Is access to the developed and patented genetic material possible?

As a general principle, access to any patented material is only restricted for a short period of time, until its first publication. Normally, the aspect first to be published is the application. This usually takes place after 18 months from the filing date of the first application. However, some countries, like the US, make the first publication after granting the patent. The period hence, when the patent remains secret, is slightly longer, about 24–36 months. Once the publication takes place, the invention is

disclosed, and anyone may consult it or obtain copies of it. There is only one exception to this general principle—patents which are declared secret due to defence or national security policies. However, these patents are of little statistical significance.

Special mention is made of the restrictions that run counter to the objectives of the Convention. IPRs may be considered as such. IPRs were designed to act as useful and effective tools of a free market economy, and they have been operating well as such for many years. Since their inception, IPRs have developed in line with the new technologies and the economy itself. An objective of the Contracting Parties and of the Convention itself should be to make the two instruments compatible: IPRs and the Convention. Though designed for totally different purposes, they must coexist and assist each other to achieve certain goals.

Access to genes or DNA sequences

Recently, the patentability of isolated human genes has been discussed widely by patent offices in the US, Japan and Europe. The problem was raised by the patent applications for human DNA sequences isolated in Dr. Venters' laboratory in the USA. The discussions[5] tend to consider only the genes and/or sequences with known functions as suitable for patentability . This transactional solution solves, for the time being, the problem raised by the automatic sequencing of DNA material due to the technical development of DNA sequences achieved recently.

The problem also has an ethical component. Many people question the propriety of private ownership of human genetic heritage. This problem is the same for isolated animal or plant genes of DNA sequences (including RNA, mRNA, rRNA, cDN)..

Although the patentability of this type of invention has not definitely been decided, its influence on the implementation of the Biodiversity Convention is evident. In any case, co-operation between countries rich in animal and plant genetic resources and countries which have developed isolation and sequencing technologies of genes and/or DNA sequences must guarantee access to such genetic materials and reciprocal sharing of benefits resulting from those materials. This can be effected by scientific co-operation, including training programmes for scientific and technical staff, exchange of information, sharing the ownership or licensing of IPRs derived from the invention or sharing monetary benefits if the invention is put on the market.

Access to living matter

For purposes of this discussion, living matter is divided into plant and animal micro-organisms. This division is not based on taxonomy but on IPR problems inherent in each category.

At present there are no IPRs for races of animals. They are excluded from patenting in most patent laws. However, recently, some patent applications have been deposited mainly at the US Patent and Trade Marks Office (USPTMO) and at the European Patent Office (EPO) which are related to transgenic animals and applications of breeding methods such as surgical manipulations (embryo transfers). Until the last decade, inventions related to animals were restricted to biological methods of breeding to obtain new races of animals. Both methods and races are expressly excluded from patenting. With the introduction of biotechnology and genetic engineering to animal breeding techniques, effective protection of results became necessary.

No definite decisions have been made in this respect but the tendency is to consider these inventions suitable for patenting. Future co-operation is necessary between countries with autochthonous races adapted to certain biotopes and countries with technologies to incorporate the genes where those features are located into commercial races of animals.

At this point a good solution could be experimental farms in developing countries for breeding new, commercially more profitable races from local races, while conserving the native species. This solution is spelt out in paragraph six of Article 15 which talks about the location of research activities in the Contracting Parties.

The European Parliament, in its session of October 5, 1992,[6] introduced important amendments to the original Council Directive Proposal on Intellectual Property, Protection of Biotechnological Inventions, reflecting society's general concern about the ethical aspects of patenting animal and human genes among others. The Commission services have drafted a new directive version with most of the amendments introduced by the Parliament.[7] Even earlier, a proposal was made by the European Popular Party and the Rainbow and Green groups expressing a strong opposition to the European Patent Office granting animal patents until a further study regarding the new situation created by these inventions is concluded.[8] A similar waiting period of study was also laid out by the USPTMO, when animal patent applications began to appear.

Plants are protected by patents in certain cases and by widely used breeders' rights, in others. Usually patents cover biotechnology and genetic engineering inventions; breeders' rights cover more traditional methods such as selection. In fact, under most patent laws, traditional breeding methods and the varieties obtained thereof are expressly considered unpatentable. All general principles governing patents apply to those protecting plants.

The FAO conference in November 1989 opposed any restriction to the access to germplasm whether protected by IPRs or not. Otherwise, unfair

situations may arise where restrictions, due to IPRs, are placed on local populations but the original germplasm is developed via biotechnology and protected later on.

The International Union for the Protection of New Varieties of Plants (UPOV) has recently approved a new draft of its Convention—touching on the access to plant varieties protected by plant breeder's rights (PBRs).[9] No specific provisions have been adopted about the access itself. The scope of this right covers production and/or reproduction, conditioning, selling, export and import of the plant variety's propagating material. There are, however, some exceptions to the PBRs which may be important in implementing the Convention on Biological Diversity. These are non-commercial uses, experimental uses and breeding of other varieties derived from the protected ones. These exceptions make these two bodies of law—the UPOV Convention and the Convention on Biological Diversity—compatible.

There is also the traditionally accepted exemption known as *the Farmer's Privilege, farmers' rights*. This privilege allows farmers to use the material they harvest as seed for the next season within their own properties. It is crucial that this privilege is maintained in developing countries, because farmers in these countries lack the means to purchase seeds every year. The recent UPOV revision leaves member countries free to keep this exemption as it is or revise it to curb its abuse by reselling used seeds.

The Keystone Center encourages the developing countries which are members of the UPOV Convention and those considering joining it to keep Farmer's Privilege as it is very advantageous to small farmers and developing economies.[10] Keystone also warns countries of the risks of extending PBRs and plant patents as well as their negative influence on traditional selection breeders who maintain important biological diversity by their practices.

The Keystone Center recognizes, however, the substantial role of IPRs in stimulating the innovation process in plant research. It promotes development of new varieties through the exemption of breeders and farmers.

Breeders are exempted by being allowed the unrestricted use of the protected varieties as sources of initial variability in the selection processes for obtaining new varieties. It is only in cases of varieties essentially derived that the holder of the former patent has rights over the new one. This exemption is consistent with the aim of UPOV, which is to encourage the creation of plant varieties by enhancing legal protection without blocking the generation of new varieties.

Farmer's Privilege contributes to biodiversity by allowing farmers within their properties to use seeds from their harvests and to continue selecting varieties in the traditional fashion. The four main requirements that plant varieties must meet to be granted a breeder's right are novelty, distinctiveness, uniformity and stability. The need for uniformity may, on the other hand, restrict the use of native varieties which are adapted to local conditions and are genetically more diverse. Uniformity is required to secure what is under protection but may run against the creation of biodiversity.

Plant patents are seen by some authors as restricting both the access to and use of plant genetic resources. New plants coming from biotechnology research tend to substitute traditional varieties in agriculture, which are abandoned, and in so doing, diminish biodiversity. Plant patents do not recognize any breeders' or farmers' exemption for the time being. Patents do not act in the same manner as breeders' rights. They are, however, more powerful instruments of protection. Patents are not encouraging merely by the virtue of the monopoly they assure the owner. Their success is based on their ability to effectively protect inventions, thus attracting investment by inspiring confidence in the security of the legal protection offered.

In any case there are also exceptions in patent law which allow the use of patented plants for experimental research. In the draft of the EC directive on 'Legal protection of biotechnological inventions,' there were also some mechanisms to allow the creation of new varieties of plants from patented inventions—genes, plant cells or tissues. A licensing system was laid out to permit the acquisition of new varieties of plants which would otherwise be impossible without the infringement of a previous patent. The directive was recently discussed by the European Parliament and sent back to the commission for introduction in the draft together with other amendments like the farmer's privilege principle.[11] Hence, with time, different rights systems, such as patent laws, breeders' rights and, in some ways the Convention on Biological Diversity, tend to harmonize in many different aspects.

In the field of IPRs, the term *micro-organism* refers to any living matter that may be deposited in recognized institutions. In the patent granting procedure, applications dealing with microbiology, biotechnology and genetic engineering processes and/or products have to include a deposit of the material mentioned in the patent document in an international authority, for instance the American type culture collection. The deposit requirement complements the written description that is very often inadequate when living matter is involved.

The term *micro-organism* includes bacteria, fungi, algae, protozoa, plants, seeds, animal embryos, tissue cultures, cells, plasmids, among others. The functioning of the international authorities is recognized by the World Intellectual Property Organization (WIPO) and the deposit and access of sample by the Budapest Treaty.[12] Once the patent application has been published, access to the samples deposited is permitted to any person or body, provided no information about the culture obtained is communicated to a third party and the culture is only used for experimental purposes.

These requirements are valid only so long as the patent is in force, that is, it has not expired or been rejected or abandoned. Prior to the publication of the patent application, only those legitimized by the infringement of another patent right and in some legislations, anyone who goes through a third person called an 'expert', are allowed to obtain samples of the deposited material.[13] Access, hence, is only restricted in consonance with the secrecy of patent applications. Once the publication takes place, the samples deposited are widely accessible.

Access to and transfer of technology

The Convention intends the access to and transfer of technology for only environmentally-sound uses and other uses related to the conservation of biological diversity. Article 16 of the Convention frequently refers to IPRs. Articles 15 on one hand and 16–19 on the other are in a certain sense the two plates of a balance, a balance that was clearly laid down in the Convention's Preamble and objectives.[14] Article 15 assures access to genetic resources as a substantial mechanism to preserve and enhance biological diversity. Articles 16–19 on their part set up the compensation to be paid by the Contracting Parties using such genetic resources.

Compensation has several modalities: transfer of technology (Article 16), exchange of information (Article 17), technical and scientific co-operation (Article 18) and sharing of benefits (Article 19). Why are there so many references to IPRs in Article 16 but none in the rest of the articles dealing with compensation? The answer is found in the aim of IPRs, that is, to protect technology developed to be used by the industry. This is crucial to the understanding of the role that IPRs are going to play in the effective implementation of the Convention.

Although some IPRs are owned by public institutions, for example, public research centres and universities or by governments themselves, most of them belong to the private sector. The only way to involve the private sector in the Convention is to respect IPRs. The access to and transfer of technology in the realm of public bodies is not hindered by IPRs but by inadequate co-operation policies. Where governments are willing,

this problem is easily eradicated. A conflict could arise when governments try to oblige the private sector to make economically-unsound decisions regarding technology access and/or transfer. The only way to attract the private sector to the Convention is to encourage it to co-operate, while at the same time, respecting the market rules. This would require effective protection of IPRs. In this respect, the balancing stated in Article 15 is vital. It is also important, as stated in Article 16, that any agreement or compromise between Contracting Parties shall be done on mutually agreed terms.

The encouragement offered to the private sector would probably have to include financial mechanisms as provided by Articles 20 and 21 of the Convention, to avoid the blocking of transfer when negotiations are not successfully concluded. Financial items were broadly discussed at the Joint Development/Environment Council of the European Communities.[15] It was generally agreed that additional external funding for sustainable development and for action to combat global environmental problems shall be provided by developed countries, sharing the burden equitably. The most common instruments used to transfer technology protected by IPRs are licences. Whether such a licence shall be preferential, exclusive, concessional or most favourable, shall be left to the Contracting Parties. If commercial mechanisms alone do not adequately address the specific needs of other countries, then legislative, administrative or policy measures should be taken by Contracting Parties to ensure the implementation of the Convention. Where necessary, financial provisions according to Articles 20 and 21 could also be used by governments of developed countries to purchase patents or non-exclusive licences and offer them to the developing countries providing genetic resources, as part of aid packages.

The development of national technologies and endogenous scientific and technological capabilities in developing countries, together with the strengthening of industrial property policies, would promote technology transfer. Transfer of environmentally sound technology has to be intensified, not only between developed and developing countries, but among the developing countries themselves.

Agenda 21 also deals with this subject. The technology transfer process, including the state-of-the-art technology and related know-how, should entail a system involving governments, the private sector and R&D organizations.

What role is to be played by patent offices and other offices in charge of the administration of IPRs in the access to and/or transfer of environmentally sound technology? First of all, the patent offices in their daily work are facilitating the access to technology via routine tasks:

- classifying the documents according to the International Patent Classification (5th edition) (The classification facilitates the ordering and recovery of patents in each industrial sector.);
- systematizing patent documents in collections by numerical order, classification or country;
- introducing patents in databases, Compact Disk-Read Only Memory (CD-ROMs) and microfiches;
- translating the same family of patent documents into different languages;
- producing monographs, search reports, technological surveillance.

Patent documents are systematized, classified, ordered and availed in different languages to the public once publication occurs. These are the features which distinguish patent information from other sources of knowledge, especially traditional information, like native modes of fermentation or breeding of plants. Such information, although very useful, is generally not systematized and is in some cases unwritten and therefore difficult to obtain and disseminate.

As regards the transfer of patented technology, patent offices, though secondary, play a crucial role. Mutually agreed licences are the instruments most commonly used to transfer patented technology. In some legislations, patents that are not exploited are deemed to have expired. This need for exploitation is also fulfilled when a patent holder who is unable to exploit it himself offers the licence to the public via a newspaper advertisement. Patent offices could help here by sending monthly lists of licences so advertised and related to biodiversity conservation to developing countries to facilitate contact for transfer of technology on mutually agreed terms. The Spanish patent office also collaborates with various departments of the Spanish industry ministry to evaluate partnerships in industrial projects between Spanish and foreign firms where transfer of technology is involved.

Exchange of information

Article 17 of the Convention deals with exchange of information and is complementary in many ways to Article 16. In many cases, and especially when developing countries are involved, a guarantee of free access to technology is not sufficient; knowledge must also exist about which technology is relevant to or developed from the genetic resource provided. Co-operation must go a step further and assure a fluid flow of information from developed to developing countries, in matters related to the conservation of biological diversity.

Article 17 answers the question about what information is to be exchanged: publicly available information. Know-how, trade and

industrial secrets, secret patents and unpublished patent applications do not fall under the genre of publicly available information.

If co-operation in the field of exchanging information has to go further than assuring access to technology, the role of patent offices must also expand. The Spanish patent office, for instance, has an entire department devoted to technological information with a diffusion section dedicated to distributing patents, utility models, trade marks and other such information to users. These services include copies of patent documents; publication of bulletins with bibliographic data and abstracts; annual indexes, statistics and monographs; retrospective searches in national and international databases or CD-ROMs assisted or done on-line by the user; search reports; biotechnological and environmental surveillance and technical assistance.

The Spanish patent office, in line with most industrial property authorities, has gone a long way to diffuse patent information. Users are charged for most of these services, but the prices for public use are subsidized. Since 1982 the office has exchanged patent information with 17 South American countries who may order patent copies and search reports on any industrial sector and receive patent documentation free of charge because of bilateral co-operation treaties signed between the respective patent offices. These activities related to the exchange of patent information have culminated in the creation of an International Center of Documentation in Spanish and Portuguese Languages.[16]

Technical and scientific co-operation

Although mainly covered by Article 18 of the Convention, technical and scientific co-operation is linked to previous articles about exchange of information and access to and transfer of technology. All these articles are in conjunction with Article 19—dealing with sharing of benefits—the bases of the whole co-operation scheme outlined in the Convention. These articles decree the compensation that must be awarded to the providers of the genetic resources—the developing countries—to enable co-operation. The compensation is designed to lighten the burden of biodiversity conservation that largely falls on the developing countries.

It is generally accepted that patents are better technical instruments than scientific ones. For scientific purposes, journals and books are much more useful. However, scientific literature is also included in the search files routinely classified by each examiner. Certainly, patent offices are not the most suitable documentation centres to gather, organize and disseminate scientific information. On the other hand, they are not entirely useless in this regard. In any case, Article 18 does not strictly limit scientific co-operation to the issue of information. From this point of view, technical and scientific co-operation in general terms is not within the scope of

patent offices but instead is a matter of general policy. Article 18 envisages the creation of a framework to encourage co-operation in technical and scientific fields. To achieve this goal, the private sector must be wooed, probably by attractive economic and fiscal policies.

The role of IPRs in this co-operation process has been discussed previously. Know-how can be considered an unwritten IPR. What then is know-how? The disclosure of an invention must allow any skilled person to put the invention into effect. Nothing has been said however about disclosing optimal parameters, more profitable embodiments or best ways of action. This hidden knowledge, saved legally by the holder of the patent, constitutes know-how. Most technology transfer contracts include the terms, *IPRs to be transferred* and *know-how*. Technical co-operation must also include human resource development, through training programmes, for instance. Know-how covers proper personnel instruction for the utilization of the invention in the most effective manner.

Distribution of benefits

Distribution of benefits is covered in paragraphs one and two of Article 19. In this particular case, the mechanism of compensation is derived from biotechnology. Despite many discussions on this matter, the necessity of specifically mentioning biotechnology is not evident.

It is true that technologies involving living matter, and covered by the term *biotechnology*, have undergone enormous development since the DNA recombination techniques introduced by Boyer and Cohen in 1974.[17] It is also true that natural genetic resources are commonly used by the biotechnology industry. Huge amounts of money have been invested in this sector during the last 10 years. Despite all this, biotechnology can only have specific mention in the Convention as a source of biodiversity .

A separate article dealing with biotechnology and the concepts of *safe handling* and *sharing of benefits* is not very agreeable. Unlike the concept of *sharing benefits*, safety has no meaning in patent laws and, by extension, IPRs. A patent gives its holder a monopoly of exploitation. How can this monopoly be made compatible with distribution of benefits?

Article 19 only talks about access to the results and benefits arising from biotechnologies based on genetic resources provided by developing countries. The access to the benefits must be on mutually agreed terms. This last expression, present in most of the articles of the Convention, is the key idea to any co-operation between countries providing genetic resources and those providing technology. A good example is the DNA recombination technique invented by Boyer and Cohen. Stanford University, where Cohen worked at the time of his discovery, patented the DNA recombination technique. The patented techniques were left free to be

used by researchers. Public researchers are not charged; private researchers are. Companies, for instance, were levied a 0.5–1 per cent royalty of total commercial sales. This more-than-reasonable royalty earns Stanford University more than US$1 million per year from over 70 licences granted from the patent.[18]

Countries providing genetic resources could specify in the contract the percentage of sales they are to be paid. However, the distribution of benefits does not merely imply the sharing of monetary gains. It may also be important to assure returns in the form of staff training, establishment of industries in developing countries, priority access to the new material developed and so on.

Biotechnology inventions are so far inadequately covered by the present patent system. The EC Commission has drafted a directive aiming at effectively protecting these inventions and adapting and harmonizing existing patent laws while respecting international conventions on industrial property, for example the EPC and the UPOV convention. The directive attempts to meet the demands of European industries working in this sector, in order to allow them to compete in more equitable conditions with American and Japanese companies which have had a clear domain of the biotechnological market during recent years.[19] The latter countries have more permissive legal patent systems when patentability of living matter is involved.

This new directive has four salient points. As a general principle, it does not exclude inventions for patentability merely because they involve living matter. It considers biological classifications other than plant and/or animal varieties for patenting. It extends the scope of patent protection over genetic material to any future generations of the material obtained by multiplication and propagation and to any host that contains the said material. It limits access to deposited living matter when patent applications are unsuccessful, withdrawn or delayed until technical preparations for publication are deemed to have been completed.

With this legal instrument, the EC Commission hopes to create an effective structure for the protection of biotechnological inventions that will further insure the investments of the companies working in this field. All these future measures have a direct impact on the implementation of the Biodiversity Convention. Article 19 assures money returns for companies investing in biotechnology research. When benefits are generated, it is feasible that they are shared with the countries providing the genetic resources used in the said research.

Chapters 15 and 16 of Agenda 21 relate to the importance of biotechnology in a convention of this nature, and the crucial role of sharing of benefits with the communities whose indigenous lifestyles are a continu-

ous source of biodiversity and by extension a continuous source of development capability for industries in developed countries. The benefits arising from biotechnology would assist the developing countries providing genetic resources to preserve traditional knowledge and skills of indigenous people, as they are highly relevant to the conservation of biological diversity.

The implementation of the Convention greatly depends on additional financial funds from developed countries. The costs accrued by developing countries in the implementation of the provisions of the Convention need to be covered.[20] Only a few states, such as Spain, have made financial commitments to increase the percentage of their Gross National Product (GNP) dedicated to global conservation efforts.

The EC has always been aware of the transnational nature of conservation problems which exceed the community borders. The EC has been an active participant in various conventions related to conservation—the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Lomé IV—whose aims are to safeguard ecosystems in danger. Forests are a case in point. Member states of the EC signed the Convention on Biological Diversity conscious that conservation of biological resources implies financial funds to assist poorer countries to preserve their ecosystems and native species. These funds and long-term investments are important, not only for the specific regions where biological diversity is located, but also for the future of humanity.[21]

In conclusion, IPRs are an instrument of co-operation between developed and developing countries and must be seen as a means of achieving the ultimate aim of the Convention—the conservation of biological diversity as the common heritage of humankind.

Notes

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PART IV

SHARING THE BENEFITS OF BIOTECHNOLOGY

12

Valuing biodiversity: The scope and limitations of economic analysis

KATRINA BROWN AND
DOMINIC MORAN

Valuation of biodiversity appears fundamental to the effective implementation of the provisions of the Convention on Biological Diversity as signed in Rio de Janeiro in 1992. The text of the Convention acknowledges the intrinsic value of global biodiversity and its components and also recognizes a whole range of other values: ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic. The Convention also observes the lack of information and knowledge about many of these different aspects of value but at the same time affirms the need for adequate measures of these values. Measures are needed in order to formulate policy which will best remedy the underlying causes of the degradation of biodiversity. They will also assist with the equitable sharing of the benefits of the conservation and sustainable use of biodiversity.

The economic value of biodiversity is something one expects to be more readily measured. Countries party to the Convention have undertaken to evaluate the potential economic implications of sustainable resource use; this includes a broad identification of costs, benefits and unmet needs for conservation. The economic approach to valuation will be central to this exercise. This chapter reviews the merits of this contribution while highlighting its deficiencies. Reference will be made to a number of existing valuation studies and the issue of valuing medicinal plants.

The economic approach to conservation decisions attempts direct monetization of the elements that constitute the total economic value of a resource. Valuation in this context is essentially utilitarian, anthropocentric and instrumentalist, giving rise to market-based measures of willingness to pay or accept as explicit measures of value. This approach is informative but incomplete.

The conditions that allow economic values to be complete rarely hold even in the limiting case of private goods. The absence of complete markets for biodiversity depletion (public goods) reveals that valuation is not a systematic, market-based exercise but rather an *ad hoc* search for values to plug into a common cost-benefit framework. This approach inevitably fails to deal with less commonly recognized elements of value. Cultural values, for instance, are generally consigned to the existing value category rather than regarded as integral to many other use and non-use values. Such a generalization underestimates the significance of cultural values, especially those associated with indigenous peoples and their knowledge, which may be important determinants of natural resource management practices. Local knowledge and belief systems are already underlying effective conservation practices with systems of values which diverge significantly from received economic definitions. A discussion of medicinal plant valuation highlights progress in economic valuation and exposes the economic/cultural value dichotomy. The relevance of this issue to the appraisal, implementation and outcome of conservation initiatives is emphasized.

Rationale for valuing biodiversity

It is possible to characterize two paradigms which represent the extreme views supporting the conservation of biodiversity.[1] The first is utilitarian and considered to be appropriate to a science coincident with, and funded by, industrial economies, whereby a lost species is a lost commodity. This is illustrated by the case of potential pharmaceutical values of plants.[2] Machlis argues that this biotechnological stance redefines natural variation into a 'pharmaceutical and industrial warehouse', so that decline in biodiversity represents a potential reduction in future stock value, dividends and profits. It is this view which is conventionally assumed to underscore an economic analysis of biodiversity loss and conservation strategies.

At the opposite end of the spectrum, is the argument that species have intrinsic value, a central tenet of the deep ecology movement. Biodiversity is framed as a moral condition, its preservation a moral responsibility based largely on the rights of non-human species and never subject to the whims of human preferences.

In between these utilitarian and deep ecology perspectives lies a range of arguments in support of the conservation of biodiversity: for example, the

scientific evidence indicating that species loss may lead to synergistic effects upon other species, altered energy flows and nutrient cycling, reduced ecosystem services such as oxygen production and climate modification and limited ecosystem resilience. This chapter tries to explain how the economic valuation of biodiversity does not necessarily conform to the first view and is not necessarily opposed to the second.

The essence of the economists' approach to measuring importance is to measure peoples' preferences. Economic valuation in the environmental context is about measuring the preferences of people for an 'environmental good' (that is the willingness to pay, WTP—in this case to conserve biodiversity), or against an 'environmental bad' (willingness to accept, WTA—a loss of biodiversity).[3] Valuation is therefore *anthropocentric*[4] since no other species demonstrates relative utility through a monetary medium.

In effect, what is being valued is not the environment or biodiversity, but people's preferences for changes in the state of their environment. There is no reason to reject the idea of intrinsic values because the idea of measuring preferences is adopted. Indeed, such an approach implies that the notion of intrinsic values is never represented in utility functions or that they are in some way diminished in a function demonstrating a form of separability. More importantly the claim of moral exclusivity between intrinsic values and revealed preferences only serves to throw up another moral dilemma if one considers what may be called *contemporary rights*. Variously defined, contemporary rights might be revealed through routine preferences (doing the shopping or buying a new car) but more critically through transactions which involve the right to live free of poverty in a smoke-free environment and to drink clean water. Contemporary rights are also manifestly instrumental values. One may have an ethical claim to pollution-free water, but this does not preclude an expression of WTP if surveyed. If contemporary society considers these to be moral imperatives or rights, how are they to be weighted relative to those embodied in the notion of intrinsic value?

Such a dilemma can very simply be countered using the deepest ecological rationale predicated on the total separation of subject and object. Under such conditions value simply 'is'; anthropocentric measurements of relative value are abstractions and there are essentially no bases (moral or empirical) for resource allocation decisions. Neither extreme of the value spectrum actually approximates the criteria underlying decisions driving current rates of depletion. The focus is on what is potentially an irreconcilable dichotomy between the value of people's preferences for or against environmental change (environmental values), and the value that intrinsically resides 'in' the environmental assets (intrinsic values). Once it is accepted that both forms of value exist (whether or not one is actually

embedded in the other), the issue becomes one of which values should inform and guide the process of making public choice. Since both values are legitimate, both are relevant to decision-making. Decisions on the basis of economic values alone do not describe real-world decision-making; governments and other agents involved in the development process have multiple goals.[5]

There is one other reason that the utilitarian approach is morally flawed. The expression of relative utility inferred from WTP is a function of both tastes for relative states of nature and, more critically, income endowments. That said, it seems that the neoclassical paradigm would essentially disenfranchise preferences unsubstantiated by disposable income. Income-based want satisfaction is clearly at odds with any egalitarian notion of resource use based on individual universal suffrage; an issue particularly relevant to indigenous forest communities with few endowments recognized by the market. Moreover, this shortcoming may compound a further problem which highlights the potential divergence between personal preferences and social preferences.[6] The neoclassical approach posits societal values as merely the algebraic sum of individual valuations (WTP or WTA); it is, in other words, entirely non-judgemental about translating individual human wants into societal decisions. However, just as there is uncertainty about the intrinsic value content of revealed value (or hypothetical responses), little can be said about the degree to which societal welfare is factored into private responses. Responses to contingent valuation surveys may be influenced by desire for equity and empathy for future generations, but this is by no means certain.

One difference between the economic and intrinsic value approaches is that economic values can, in principle at least, be measured; intrinsic values cannot. The practical problem with economic valuation is one of deriving credible estimates of that value in contexts where these have no apparent markets or very imperfect markets.[7]

Quantification can help make choices between competing or alternative policies with different environmental impacts. As any economic decision, investment in conservation is a question of scarcity and choice. Institutions responsible must make cost-effective decisions which in the case of biodiversity necessitate a difficult process of prioritization. As economic values are commonly quantified in pecuniary terms, they relate most readily to decisions which are likely to attract donors to invest in conservation, protection and sustainable use of biodiversity. With limited funds available for conservation, it must be demonstrated that the economic values of the sustainable use of biodiversity are positive and often higher than the alternative 'development' value. Biodiversity matters for many reasons, but it matters in this perspective because it has economic value. These values

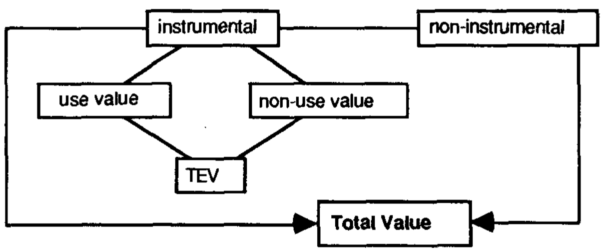
can be realized through the creation of property rights where none exist and the modification of property rights where they result in distorted incentives to destroy biodiversity.

Economic valuation can be conceptualized as a two-part process in which it is necessary first to demonstrate and measure economic values and secondly to find ways to capture the value. These two processes have been described as *demonstration* and *appropriation*.[8]

Demonstration and measurement

One can break down the value of environmental assets into a number of different components. The concept of Total Value provides a valid framework within which to identify the usefulness and limitations of the economic and monetary valuation of natural resources, including biodiversity. As shown in Figure 2, Total Value represents the sum of instrumental and non-instrumental values. Non-instrumental values may be intrinsic or inherent values.[9] Instrumental values provide a range of services and functions, either directly or indirectly to humans, and consist of use and non-use values. Non-use values include existence values.

Figure 2 Total Value of an environmental asset



Environmental economics claims to be able to estimate the value of the components of Total Economic Value (TEV) rather than Total Value, although there are two important caveats concerning the applicability of TEV as an aggregate measure. First is that the function values and service values are seldom mutually exclusive; hence, attempts to aggregate these values are misleading and will inevitably lead to double counting. Secondly, non-use values and use values are interdependent: the non-use value of a particular resource may be dependent on its use. For example, the use of a wetland as a sink for certain pollutants may undermine its value as a wildlife habitat and hence its value to naturalists. Thus TEV can therefore at most provide the lower bound estimate of the value of a given resource. Total Economic Value (TEV) can thus be expressed as:

TEV = Direct-use value + Indirect-use value + Option value + Existence value

Total Economic Value does not claim to capture all aspects of value. Any human appreciation of intrinsic value can only be assumed to reside within existence values.[10] Although some environmental economists might claim that it does represent all the economic value, many ecologists believe that TEV does not account for the whole economic story. There are still some underlying functions or primary values which are essential system characteristics upon which all ecological functions are contingent.[11]

This TEV concept can be examined by looking at the example of the values of moist tropical forest. These are illustrated in Table 1. This does not provide an exhaustive list but shows a range of services and functions offered by tropical forests.

Table 1 Total Economic Value of a tropical forest

Use value		***Non-use value***	
(1) *Direct value*	(2) *+Indirect value*	(3) *+Option value*	(4) *+Existence value*
Sustainable timber	Nutrient cycling	Future uses of (1) and (2)	Forests as objects of inherent value as bequest, gift, responsibility
Recreation	Micro-climate		
Medicine	Air pollution reduction		
Non-timber products			
Plant genetics	Watershed protection		
Education	Carbon fixing		
Human habitat			

Source: Pearce, D.W. 1991. 'An Economic Approach to Saving the Tropical Forest.' In *Economic Policy Towards the Environment*, edited by D. Helm. Oxford: Basil Blackwell.

Such an approach to economic evaluation underlines the importance of biodiversity in three ways: First, in terms of expressed willingness to pay (abstracting from qualifications made above); secondly, because TEV will understate the 'true' economic value because of its failure to measure primary life-support functions (until something catastrophic happens); thirdly, because economic value may not capture, or may be irreconcilable with, intrinsic value.

Valuation methods in high and low income contexts

A potentially important issue arises in investigating the *methodologies* for eliciting economic values because much of the world's threatened biodiversity is in the developing world, whereas the theory and practice of

economic valuation has been developed and applied mainly in the developed world. Accordingly, it is important to assess whether methodologies are transferable. It could be argued that a number of methodologies will not be applicable due to the absence of even moderately freely functioning markets for input (labour, capital, raw materials) and output (agricultural produce) in developing countries. There is fairly extensive literature on the valuation of environmental change in developing countries, and the problems of application, while significant, are not insuperable.

It has been shown that procedures which require individuals to state their 'willingness to pay' in hypothetical contexts for goods and services ('contingent valuation') work well in most developing country contexts.[12] As in any developed country, the respondent faces a budget constraint (income or wealth), but if respondents are familiar with the goods being offered, responses in developing country contexts appear to be as reliable as in other contexts. Other techniques observe actual behaviour and infer valuations based on that behaviour. For example, water users might have three options facing them—water being brought to the door, water purchased from a local 'kiosk' and water carried from a fairly distant well. It is possible to value the time spent collecting the well-water by looking at the differences in prices in the three options ('discrete choice' approach). In addition, approaches which link some change in an environmental variable to a change in a marketed output provide a potentially large set of estimates. This is, for example, how most studies on the economic costs of soil erosion have been carried out.

Extending these procedures to the valuation of biodiversity is complex. Indeed, the valuation of preferences for biodiversity is perhaps the most challenging issue in the context of economic valuation. There are many 'use' values, such as ecotourism, in which various valuation procedures (such as the travel cost method) might be used, and a broad range of techniques have been used to assign values to forestry, wetlands and rare species in the developed country context. To date, very few studies have been used in developing countries asking individuals their willingness to pay to conserve biodiversity, but valuations of the sustainable uses of habitat have been carried out (for example, for medicinal plants and for other products). Hence there is considerable scope for at least securing *minimum values* for biodiversity through the use of market values approaches.

There are various techniques currently employed in natural resource valuation. Issues of validity and applicability have been applied to existing case studies. There are four broad categories of valuation technique that have been developed to a sophisticated level.

Conventional market approaches with measurable output

Conventional market approaches use market prices for the environmental service that is affected, or, if market prices are not an accurate guide to scarcity, then they may be adjusted by *shadow pricing*. Where environmental damage or improvement shows up in changes in the quantity or price of marketed input or output, the value of the change can be measured by changes in the total 'consumer plus producer surplus'. If the changes are small, the monetary measure can be approximated by market values.

Two approaches can be distinguished. First is the dose-response approach. Under this approach a given level of pollution, for example, is associated with a change in output, and that output is valued at market or shadow prices. Good examples include damage to fisheries from upstream pollution or air pollution damage to forests. The technique can be extensively used whenever 'production function' relationships between environmental damage and a measurable output or impact are known. Second is the replacement cost technique which looks at the cost of replacing or restoring a damaged asset using cost as a measure of the benefit of restoration. Implicitly, this measure of benefit is assigned to the original asset; hence, the watershed regulation function of a forest might be inferred from the cost of constructed flood prevention schemes. The replacement cost approach is operationally attractive, but it raises a methodological problem: if the costs are used to estimate benefits, the benefit-cost ratio is universally equal to unity.

Household production functions

In the household production approach expenditures on commodities that are *substitutes* or *complements* for the environmental characteristic are used to value changes in that environmental characteristic. Thus, noise insulation is a substitute for a reduction in noise at source; this is the aversive expenditure method.

The Travel Cost Method uses travel as a complement to the recreational experience at the recreation site (it is necessary to travel to experience the recreational benefit). Expenditures on travel necessary to reach the recreational site can give an estimate of the benefit arising from the recreational experience. This approach has relevance for valuing ecotourism and has been applied to a tropical rainforest site in Costa Rica.[13] It can also be used to value the benefits of forest and woodland conservation for fuelwood (using travel time as a measure of the value of the fuelwood) and similarly for water supply (using travel time as a proxy for the value of improved water supply facilities).

The procedure requires a detailed sample survey of travellers' visitation rates, together with their costs of travel to the site. Complications arise when netting out the possible benefit people may derive from actually travelling (so-called meanderers) and the problem of multiple-purpose visits which complicate the identification of travel costs to any single site.

Although the procedure is broadly consistent with underlying economic theory, there are some doubts about 'construct validity' in that number of trips should be inversely correlated with 'price' of trips, that is, distance travelled. Some UK studies do not show this relationship. Convergent validity is generally good in US studies, and the technique is generally very acceptable to official agencies and conservation groups there.

Hedonic price methods

In the hedonic method an attempt is made to estimate an *implicit price* for environmental attributes by looking at real markets in which those characteristics are effectively traded. Thus, 'clean air' and 'peace and quiet' are effectively traded in the property market since purchasers of houses and land do consider these environmental dimensions as characteristics of property. The attribute 'risk' is traded in the labour market. High risk jobs may well have 'risk premia' in the wages as compensation. There are two widely used proxy markets: hedonic (land or property) markets and wage markets. Neither is commonly used in biodiversity valuation *per se*, although the former is frequently applied to determine the value of landscape characteristics. *Hedonic house (land) prices* can be employed for valuing air quality, noise, neighbourhood features such as parks. Ostensibly, land values in developing countries may well reflect the presence of soil conservation measures or access to fuelwood. *Wage risk premia* can be used to value changes in morbidity and mortality arising from environmental (and safety) hazards. Since labour markets in many developing countries are unlikely to function so as to capture risk aversion, this approach has limited relevance in the developing country context.

Experimental methods

With experimental approaches a direct attempt is made to elicit preferences by questionnaire ('structured conversations'). Two kinds of questioning may take place: questions to elicit *values* and questions to elicit *rankings*. In the first, a direct attempt is made to ask: 'What are you willing to pay for X or to prevent Y?' and/or 'What are you willing to accept to forego Z or tolerate A?' This is the *contingent valuation method*. In the second, the questioner is content to obtain a ranking of preferences which can later be 'anchored' by the analyst in a real price of something observed in the market. This is the *contingent ranking* or *stated preference method*.

Highly publicized contingent valuation exercises such as the Exxon oil spill in Alaska and the Kakadu National Park in Australia have raised the profile of hypothetical techniques. Although in the former case the technique has been approved by the US Court of Appeals, considerable controversy still surrounds the exact meaning of valuation responses obtained using contingent valuation. Hypothetical techniques are widely applicable since they can be used to derive values for almost any environmental change. More importantly, survey techniques are the only suitable method for eliciting non-use values. The survey procedure involves setting up a carefully worded questionnaire which asks people their WTP and/or WTA through structured questions. Various forms of 'bidding game' can be devised involving 'yes/no' answers to questions and statements about maximum WTP. Survey results need econometric analysis to derive mean values of WTP bids.

Literature on studies carried out suggest that most sensible results come from cases where respondents are familiar with the asset being 'valued'. Further aspects of procedural validity concern various forms of potential bias in responses. Strategic bias arises if respondents make bids that do not reflect their 'true' values. They may do this if they think there is a 'free rider' situation. There is limited evidence of strategic bias. *Hypothetical bias* arises because respondents are not making 'real' transactions. Expense usually limits the number of experiments involving real money (criterion validity), but some studies do exist.

A further test of validity—convergent validity—can be checked by comparing contingent valuation with benefit estimates derived from alternative methods (travel cost or hedonic prices). Construct validity—verifying that the technique is consistent with underlying economic theory of preference measurement—is debated, especially the marked divergence in many studies between WTP and WTA. Discussion of the causes of this divergence is on-going, although it has been suggested that people essentially reply to WTA questions not in terms of prices but in terms of quantities of substitutes.[14] If goods in question have few substitutes (the case for some wild species or, say the respondent's own life), the amount respondents would be willing to pay might at the limit equal their entire (finite) wealth; the amount they would accept as compensation could well be infinite.

Application of contingent valuation methods to biodiversity has for the most part been restricted to developed countries. In developing countries the technique is limited to valuation of urban and rural amenities such as water and sanitation, although its potential is currently under investigation in the forest reserves of Madagascar.[15]

Some valuation procedures are widely used, but their interpretation as changes in consumer/producer surplus is not straightforward.

The *replacement cost approach* is straightforward. If environmental damage is done, it is often possible to find the cost of restoring the damaged environment. The replacement cost is often widely used to measure damage. The approach is correct where it is possible to argue that the remedial work *must* take place because of some other constraint. Such situations will be quite widespread. For example, where there is a water quality standard that is mandatory, then the costs of achieving that standard are a proxy for the benefits of reaching the standard. This is because society can be construed as having sanctioned the cost by setting the standard.

There are risks in this procedure. If the remedial cost is a measure of damage, then the cost-benefit ratio of undertaking the remedial work will always be 1: remedial costs are being used to measure remedial benefits. To say that the remedial work must be done implies that benefits exceed costs, whatever the latter are. Costs are then a *minimum* measure of benefits. If, to pursue the water quality example, the standard has clearly been set without thought for costs, then using replacement costs as a measure of minimum benefits could be misleading.

Another situation where the replacement cost approach is valid would be where there is an overall constraint not to let environmental quality decline (sometimes called a 'sustainability constraint'). In these circumstances replacement costs might be allowable as a first approximation of benefits or damage. The so-called 'shadow pricing' approach relies on such constraints. It argues that the cost of any project designed to restore an environment because of a sustainability constraint is then a minimum valuation of the damage done.

In the *opportunity cost approach* no direct attempt is made to value benefits. Instead, the benefits of the activity causing environmental deterioration—say, a dam—are estimated in order to set a benchmark for what the environmental benefits would have to be for the development not to be worthwhile. Clearly, this is not a valuation technique, but, properly handled, it can be a powerful approach to a form of judgemental valuation. It is used here to indicate the kinds of economic returns that must be secured by biodiversity use if such land uses are to be economically preferred to the alternative land use.

Appropriation

The second aspect of economic valuation concerns appropriation. The failure to capture the value of biodiversity lies at the heart of economic analysis of the reasons for erosion of global biodiversity.[16] The forces of globalization and specialization have actually encouraged biodiversity loss. In economic terms, a set of institutional, market and information failures has ensured that biodiversity remains not only undervalued (not just that it has

no market as such) but also that its value is not captured. Appropriation and policies which support the capture of this value of biodiversity are therefore fundamental requirements of conservation efforts. Important aspects of appropriation are therefore institutions and property rights which may influence the distribution and scale of costs and benefits of biodiversity as well as management of resources.

The appropriation problem has a distributional and intertemporal dimension. The intertemporal issue is best understood by considering the role of cost-benefit analysis (CBA); the vehicle for the elements defined in TEV and the mainstream economic approach to rationalizing conservation. Equity over time and intertemporal resource allocation issues are encapsulated in the discounting debate which has received wide coverage.[17] Net benefits (or costs) accruing over the lifetimes of competing projects are collapsed to the current period to provide a yardstick with which to guide efficient resource allocation. Thus a comparison of the financial rates of return to two competing land-use options might, for example, indicate that the returns to sustainable wildlife harvesting in range areas exceed those to land clearance and cattle ranching. Such comparisons are, however, seldom clear. The financial rate of return—that to the land owner or operator—is often heavily distorted in favour of land uses inconsistent with the conservation of natural habitat. In many countries, cattle rearing, cash crop production and deforestation are frequently observed to benefit from government transfers (taxes and subsidies) which distort land-use decisions by raising the opportunity cost of conservation to the private operator. Moreover, decisions taken on a financial basis alone may not be consistent with an economic appraisal which more appropriately reflects relative returns to the economy (as opposed to the individual investor) from competing project options. Economic appraisal would account for only the true resource costs involved. Taxes and subsidies would therefore be excluded from the appraisal since such transfers are generally unrelated to real resource flows. Additionally, all external costs and benefits would ideally be accounted for and factors of production shadow priced (to reflect the true opportunity cost of their use rather than their market price).

The CBA has undoubtedly been powerful in demonstrating how conservation decisions might be rationalized in a common investment framework, but it omits a discussion of the relevant perspective for ensuring resource use decisions. Thus, the harvest of secondary forest products in the Amazon may well provide a higher net present value than clear felled timber from the same area. However, actual use decisions may well be inconsistent with efficient use for other reasons. It is often the case that lack of secure land tenure, lack of credit and unstable market prices for secondary products are strong disincentives to pursuing land-use options

with immediate returns lower than those available from more destructive land uses (clear-felling timber). The application of CBA in the context of conservation can serve to highlight a basic asymmetry of values which exists between agents responsible for biodiversity loss on one hand and societal values (measured by an economic rate of return) on the other. For subsistence farmers, present value calculations of perpetually accruing net revenues are likely to be less relevant than the returns they perceive over a horizon which encompasses land clearance and subsequent crop rotation.[18] The intertemporal appropriation problem is then one of the agents responsible for degradation having a perception of future benefits highly distorted by time preference. Circumventing this aspect of the appropriation problem therefore becomes a matter of addressing the underlying market and government failures. On the one hand there is the appropriation of a return to the provision of global benefits; on the other a clarification of property rights and incentives for intensive rather than extensive land use.

Whatever the national or global value of biodiversity conservation, its size will be generally irrelevant if those values are not appropriable by the individuals making land-use decisions, whether they are loggers or squatters, permanent agriculturalists or ranchers. Benefits of biodiversity protection through national parks tend to be lowest at the local level and highest at the national and global level;[19] however, when costs are analysed, benefits are highest at the local level and lowest at the national and international level. As such, the net benefits of conservation are lowest for the local community and highest for the national and global community. Indeed, at the local level, net benefits may be negative, indicating that there is no local incentive to undertake conservation uses of land.

This suggests that not only must the local community be involved in any conservation effort, now a standard policy prescription, but they also need to appropriate a fair share of the wider benefits of conservation. Even where these two conditions of involvement and net local gain are met, it cannot be assumed that conservation will ensue. Additional requirements are needed, for example, accounting for the local state of the economy.[20] Providing an alternative, sustainable land use such as agroforestry may not result in reduced deforestation, for instance, if the local economy is characterized by surplus labour. The effect may simply be that the new land use is absorbed and the old land use continues. Demonstrating and marketing the value of a sustainable product could even backfire when property rights are weak.

Investment in biodiversity should take place in a context where the local community gains most relative to other groups in society, and at the very least, there should be net gains to the local community. Local involvement is a sustainability requirement. The idea of biasing investments so that their

distributional impact favours the local community is more than an issue of equity or fairness. It is an issue of efficiency; unless the local community secures net benefits from investment, it will have no incentive to sustain that investment. The incentive will remain for the local community to encroach on the protected area and to develop alternative uses which do secure higher local gains.

The values of medicinal plants

Plant species are essentially used for medicine in two ways: commercially, whether by prescription or over-the-counter sales, and as traditional medicines which may or may not attract a market price. In the rich world perhaps 25 per cent of all medical preparation are is based on plants and plant derivatives; in the poor world the figure is at least 75 per cent.[21] Clearly, both uses have an economic value, but most analyses undertaken have tended to focus on the first category, the value of medicinal plants as the source of substances for use by the international pharmaceutical industry. The analyses have considered only part of the use value of medicinal plants (column 1 in Table 2) and on the option value of maintaining diversity as a source of pharmaceuticals (column 3 in Table 2). Analyses of the other uses of medicinal plants, as an integral part of primary health care, show that the cultural role of these plants is central to how they are utilized and how their habitat is managed. This implies that these resources have not only great cultural value but also intrinsic value and rights vested in them.

The value of biodiversity as a source of pharmaceutically active substances has been the subject of a number of studies.[22] This value is now being cited as one of the many arguments for conserving natural habitats, and in particular, tropical forests, which contain the largest number of plant species. These analyses, however, ignore the additional role of these as herbal treatments used by the majority of people in developing countries. Further, this direct local use of plant resources contributes to the preservation of species and habitats and can be used as the basis for conservation policies centred on indigenous management regimes and utilization. The success of such policies depends on the allocation of property rights and the cultural status of herbal medicine, which could be an important component of primary health care in developing countries.[23]

Within the more narrow 'economic' perspective, medicinal plant values are relevant to use value arguments for conserving biological resources, especially in the developing world. However, in terms of how far this justifies the conservation of biodiversity as such is more problematic. Given that some commercial sources doubt that genetic engineering of micro-organisms will ever totally displace plant-based research, this would suggest an insurance argument for conserving at least minimum diversity.

Conservation is thus supported on the grounds of option values of biodiversity as a potential source of pharmaceutical substances.

Economic analysis of medicinal plants

Ascribing an economic value to medicinal plants can be done in two ways. The first relates to existing use values, which, in turn, are for commercial drugs and traditional medicine. The second relates to the option value of the plants—the extent to which conservation is required to protect future use values. Option values, in turn, are critically dependent upon the future of research in the medicinal drugs sector with respect to the base materials that are likely to be used.

Economic valuation has been fairly speculative but illustrative of the orders of magnitude involved.[24] There are several ways in which to approach valuation. One can look at the actual market value of the traded plants; one can look at the market value of the drugs of which they are the source material, or one can consider the value of drugs in terms of their life-saving properties, and using the value of a 'statistical life'.

In a study of the Korup rainforest in Cameroon, Ruitenbeek calculates a 'minimum economic value for genetic resources' by means of what he terms 'Expected Production Value Analysis'. Ruitenbeek's study illustrates the significance of the two aspects of valuation: demonstration and appropriation.[25] His analysis uses three parameters: the value of research discoveries (from historical information on patent values); the number of discoveries; an institutional factor describing the host nation's ability to capture research revenues. This is defined as the proportion (between 0 and 1) of revenue captured and depends on the licensing structure governing research in a country, whether research is undertaken by a domestic institution and the domestic research capability. In Ruitenbeek's case, 10 per cent of the revenue from research is captured by the country.

Economic appraisal requires the use of all resource flows deriving from the project, irrespective of recipients; therefore, the estimate of economic value, the expected annual value, suggested by the analysis is US$85,000 or UK£50,000 per year for the Korup rainforest. This figure can be divided by either 126,000 hectares (for the central protected area) or 426,000 hectares (central area plus surrounding management area), so that values per hectare would be in the region of US$0.2–0.7 per hectare per year. However, the total amount captured by Cameroon, the capturable value of production, is only 10 per cent (US$8,500 or UK£5,000) per year for the Korup forest. This is summarized in Table 2.

The demonstration of the economic value of medicinal plants from the rainforest is the Expected Value and is predominantly Option Value. Appropriation policies are concerned with increasing the value of the

institutional factor to greater than 0.1. As discussed below, the analysis does not value local health benefits so is incomplete as an economic study itself; it also ignores many more cultural values of these plants and their use.

Table 2 The Option Value and appropriation rate from medicinal plants, Korup rainforest

Expected annual value	=	Average value of discoveries	*	Average no. discoveries
UK£50,000	=	UK£5,000	*	10
Locally captured value	=	Expected annual value	*	Institutional factor
UK£5,000	=	UK£50,000	*	0.1

Source: Based on Ruitenbeek, J. 1989. *Republic of Cameroon: The Korup Project.* Yaounde: Cameroon Ministry of Planning and Regional Development.

Balick and Mendelsohn's study of medicinal plant harvesting in Belize takes a different approach, and the analysis is based on data from local markets for medicinal plants.[26] Their annual net revenues are US$19–61 per hectare. These values are not directly comparable to the estimates obtained by most other studies since they relate to local medicinal plant use. Another model estimates value as a function of the number of species at risk, the number of drugs based on plant species and the number of hectares likely to support medicinal plants (total area of tropical forest). It suggests commercial values in the range of very low to around US$20 per hectare.[27] These values can be construed as lower bound estimates, given that these only relate to species at risk, and the loss of large tracts of tropical forest would place many other plants at risk. These economic values are directly additive with the local economic values derived by Balick and Mendelsohn and suggest that global values per hectare for pharmaceutical value are lower than local traditional medicine values.

A cultural perspective on medicinal plants

The valuation of benefits of medicinal plants in health care systems is extremely complicated. This is because of the high incidence of self-administration and the non-marketed character of these products, but it is also due to the important cultural values of the plants. It seems likely that up to 80 per cent of the world's population relies chiefly on so-called 'traditional' medicine for primary health care; in many developing countries the majority of the population depends on traditional remedies. This is partly due to poverty, but it is also because traditional systems are more

culturally acceptable; they are able to meet psychological needs in a way Western medicine does not. The advantages offered by traditional medicine over biomedicine can be referred to as the 'Four A's': availability, accessibility, acceptability, adaptability.[28]

The issues of local use and values of medicinal plants have recently been explored by Brown.[29] This study, which reviews the work of ethnobotanists, medical anthropologists and economists, concentrates on the Ghanaian context. In contemporary Ghana, as in many other developing countries, two types of medical systems—the traditional and the 'scientific'—exist simultaneously. There are generally five options for treatment of most common diseases: a clinic or hospital; treatment at home from a nurse or paramedic; buying Western pharmaceutical drugs from a local trader; self-treatment using plant medicines; or traditional healers. A range or combination of these options is typically used, depending on the particular ailment, the patient's financial situation, access to Western and traditional healers and past experience.[30] There are complex and subtle determinants of people's choices for the use and management of these resources, which are inextricably linked to belief systems governing perceptions of different diseases and their causes (natural or supernatural), and the relationship between humans and the natural world.

Another absorbing study of sacred groves in northern Ghana is illustrative of these complex influences on the management and conservation of natural resources.[31] The study describes how the people of Malshegu in the northern region of Ghana have preserved a small forest they believe houses a local spirit, the *Kpalevorgu* god. Access to and utilization of plants and other resources in the grove are strictly controlled and have been for nearly three centuries. When it was first demarcated, unwritten regulations were put in place by the fetish priest and other village leaders regarding land use in and around the grove. Over time, these rules have been amended to ensure their continued relevance and effectiveness. Researchers contend that this sacred grove may represent one of the few remaining areas of closed-canopy forest in Ghana's northern savanna zone. The grove therefore constitutes a critical habitat for the fauna and flora of the area and serves important environmental and social functions for the people of Malshegu. The grove is an important source of seeds and seed dispersers vital to shifting cultivation practices, and of herbs for local medicinal and religious practices.

Such a situation is to be found in many parts of the (most often developing) world where complex sets of rules determine access to and utilization of natural resources. In many parts of West Africa, forest areas and specific trees are protected and valued for particular cultural occasions and as historic symbols. Each community has its own traditions associated

with sacred areas; as a result, the species found in them vary greatly. Sacred groves are the site of ritual and secret society initiations; in them, social and political values, morals, secrets and laws are passed on to young people.[32] Traditional societies have thus evolved novel ways of what Juma refers to as 'plant tenure', which in most societies predates land tenure.[33] Trees especially have important symbolic roles. In many societies, trees represent a maternal symbol, as protector and provider of many products, including food, medicines and shelter, protecting against evil spirits. Trees may also be phallic or paternal symbols. Falconer explains how forest trees, the links between the sky and the earth, often symbolize links between the spiritual world of ancestors and people.[34]

The rules governing such resource use and the adherence to practice vary considerably between communities, even within the same region. Therefore, it is very difficult to formulate policy based on such cultural values.

Conclusion

The brief review of different values associated with medicinal plants and their use has emphasized the cultural determinants of management and the importance of property rights for conservation policies to be effective. The economic approach is useful because it stresses the importance of the two elements of valuation—demonstration and appropriation; economic valuation also corroborates the primacy of property rights.

How can indigenous values and management regimes be incorporated into policy, especially given the wide variation in belief and practice? One study discusses the potential policy implications of religious forest classifications with reference to India and the US.[35] Although the state may apply classification according to economic, environmental and political criteria, people classify forests by different criteria, and their classifications embody values, motives and capacities—manifest institutions—that govern their own behaviour. Regarding the current Indian government's classification of forests, when the enforceability of government forest policy is slight, the policy effectiveness depends on the degree of complementarity between the categories the state creates and seeks to implement and the differentiations and purposes the people actually apply in their uses of land. In other words, the disparity between *de facto* and *de jure* classifications of forests affects the outcome of public policy.

The example of medicinal plants outlined above shows how environmental economics can play a role in many different aspects of the management and use of natural resources, but it does not properly address culture-environment linkages. Another important factor is in distinguishing the scale of costs and benefits; this can be illustrated by the tropical forest

case: micro (local), meso (national/regional), macro (global). The developed countries tend to put more emphasis on the global value of these resources (hence the concentration on 'global commons' in Rio), for example, attempts to quantify the carbon-fixing capacity of tropical forests and the potential effects of their destruction on global concentrations of greenhouse gases. This has particular implications in terms of policy formulation and implementation, especially in light of current emphases on global environmental issues and the mechanisms for funding conservation.

In summary, economic valuation consists of two processes, demonstration and appropriation. Both aspects are beset with conceptual and practical difficulties which underscore much of the criticism levelled at the economic approach to putting values on natural resources. Such valuation is, by definition, utilitarian, instrumentalist and anthropocentric. Total Economic Value does not equate to Total Value of an environmental asset because the taxonomy has difficulty integrating any concept of intrinsic value as well. Valuation of biodiversity is therefore incomplete, and particular problems arise in assessing the scale and distribution of costs and benefits. However, such an analysis may be useful in investment decisions and deciding between alternative conservation strategies. This study has highlighted the fundamental importance of cultural values, which are not captured in economic analysis but which underscore the valuation, appropriation and management of biodiversity. However, while cultural, intrinsic and primary values are illustrative of the potential shortcomings of an economic approach, they do not in themselves invalidate the approach. It seems likely that environmental valuation will play an increasingly important role in environmental policy-making, so it is especially important that practitioners and other protagonists join the debate on evaluation and contribute towards the quest for a more complete and interdisciplinary understanding of the issues at stake.

Notes

1. Machlis, 1992.
2. For example, Principe, 1991.
3. Derivation of these measures is the subject of intense debate. Proponents of revealed valuation methods and more particularly the contingent valuation technique (see Mitchell and Carson, 1989), mainly view these as the most convenient means of correcting market failures which exclude environmental costs and benefits. Sceptics claim that such techniques are of little economic significance since responses are merely the product of a potentially biased interview process (Bowers, 1993).
4. Randall, 1988.
5. Pearce *et al.*, 1993.
6. Sagoff, 1988a; Swaney and Olsen, 1992.
7. Pearce *et al.*, 1992.
8. Pearce *et al.*, 1993.

9. These are what Ehrlich and Ehrlich (1992) call *ethical values*.
10. Whether intrinsic values are embedded in existence values is a contentious issue. Indeed, to claim that they are may be to misunderstand the definition of intrinsic value as totally independent of human existence. There is nothing axiomatic in the word *value* which designates it as a purely anthropocentric concept. Appreciation of intrinsic value may therefore be restricted to degrees of conceptual empathy which influence preferences in an unordered and undetermined fashion.
11. Turner, 1992.
12. Wittington *et al.*, 1991; Boadu, 1992.
13. See Tobias and Mendelsohn, 1991.
14. Hanemann, 1991.
15. Kramer *et al.*, 1992.
16. Swanson, 1992.
17. Leslie, 1987; Markandya and Pearce, 1991.
18. Pinedo-Vasquez *et al.*, 1992.
19. Wells, 1992.
20. Brandon and Wells, 1992.
21. Principe, 1991.
22. For example, Pearce and Puroshothaman, 1992; Farnsworth and Soejarto, 1985; Principe, 1991.
23. WHO, 1978.
24. Farnsworth and Soejarto, 1985; Farnsworth et al., 1985; Principe, 1989, 1991.
25. Ruitenbeek, 1989.
26. Balick and Mendelsohn, 1992.
27. Pearce and Puroshothaman, 1992.
28. Anyinam, 1987.
29. Brown, 1992.
30. Falconer, 1992.
31. Dorm-Adzobu *et al.*, 1991.
32. Falconer, 1990.
33. Juma, 1989, p. 232.
34. Falconer, 1990.
35. Chandrakanth and Romm, 1991.

13

Technology and genetic resources: Is mutually-beneficial access still possible?

ABDULQAWI YUSUF

It was assumed by many participants in the negotiations on the Convention on Biological Diversity that there could be a trade-off between access to genetic resources and transfer of technology. They felt that the Convention offered a unique opportunity to strike a fair and equitable bargain between technology-rich developed countries and gene-rich developing countries, in the interest of the conservation and sustainable utilization of biodiversity as well as the development of developing countries. What has become of that trade-off? Has the bargain been struck, and if so, on what terms and conditions? If not, what does the Convention offer to both sides in terms of access to genetic resources or to technology? Is an effective and mutually beneficial co-operation on these issues still possible under the terms of the Convention?

Ownership rights

In the past, free access to genetic resources prevailed in most countries. Little or no thought was given by scientists and breeders to the existence of sovereign rights or of property rights, except with regard to high value commercial crops such as rubber. On the other hand, there was no attempt to enforce such rights by those governments from whose territories the resources were taken.

This situation came under attack in the 1970s. Developing countries realized that the genetic materials taken from their territories were being increasingly used as the basis of more advanced biological materials which were subject to property rights. It appeared unfair to them for the basic source material to be regarded as freely available while derived improved materials were subject to proprietary protection. Developed countries of course argued that there were no legal barriers to developing nations improving the materials themselves. However, this was tantamount to saying that both the rich and the poor have the right to sleep under bridges and to beg in the streets, to paraphrase the famous words of Anatole France.

It was against this background that the FAO Undertaking was adopted in 1983.[1] The Undertaking defined a free-flow regime that applied not only to basic source materials but also to improved and elite varieties. A number of developed countries rejected the Undertaking, arguing that they could not freely give them the rights of private breeders. Thus, in 1989 an agreed interpretation was adopted, accepting the permissibility of flow restrictions based on plant breeders' rights. The developing countries got in return the recognition of a new concept of *farmers' rights*.

The concept of *farmers' rights* constitutes a recognition of the contributions of the traditional farmer who, by selecting seeds over generations, has seen to its adaptation to local conditions. However, as defined in the compromise, the right does not belong to the individual farmer or the farmer's dependants but to the state (of which the farmer is a national), which is entitled to receive assistance in the maintenance of genetic resources. Thus, there is a general obligation of the developed world to provide aid and assistance to developing countries in the conservation of genetic resources.

The increasing availability of patent protection for improved and elite varieties of genetic material and the growing importance of biotechnology have cast further doubt on the viability or relevance of the compromise and of the Undertaking to the present circumstances in international economic relations. A number of developing countries have come to doubt the wisdom of the position embodied in the Undertaking and have also abandoned the common heritage concept. The UN ECLAC urged its member states to consider their genetic resources as tradable goods.[2]

Perhaps more important is the impact of recent developments in intellectual property protection on the ownership and access to genetic resources. The two most important are the revision of the International Convention for the Protection of New Varieties of Plants (UPOV)[3] and the TRIPs negotiations in the Uruguay Round.[4] A common characteristic of these developments is that they substantially broaden the gap between source materials and improved varieties in terms of the value and ownership rights

attached to them. Indeed, both instruments further strengthen the rights of breeders/inventors over improved varieties but fail to recognize any rights with respect to source materials such as landraces, wild species and varieties selected and conserved by farmers.

The clash is partly between the value attached to technological efforts which are prevalent in the North and traditional knowledge possessed by southern communities. It is also between the perception of genetic resources which have always been considered 'community property' and technological advances to which property rights have long been attached. Indeed, ownership rights in technology have long been grounded in the intellectual property legislation of most countries and have allowed those countries to offer incentives to inventors and creators in exchange for the public disclosure of their ideas. Traditionally, an 'intellectual property bargain' underpinned such ownership rights so as to ensure a proper balance between the encouragement of creativity and the maximization of social welfare arising from the fruits of that creativity. The recent trend toward more protection for proprietary rights in technology and less emphasis on the promotion of public diffusion is leading to the modification of the terms of the public bargain. This is bound to result in further monopolization of knowledge and a consequent increase in the restraints affecting access to foreign-held technologies. This situation would naturally be disadvantageous to developing countries who are net importers of technology.

Thus, many developing countries looked forward to the elaboration of the Convention on Biological Diversity for an international recognition of the value of their genetic resources and for an international consecration of ownership rights in respect of such resources. The assumption was that this would enable developing countries to obtain access to advanced technologies—particularly biotechnology—in exchange for granting genetic resource access to developed countries' enterprises and scientific institutions.

Access to genetic resources

The Convention establishes a new international regime governing access to genetic resources (see Article 15). It recognizes the authority of national governments to determine access to genetic resources in their territories. It also provides that such access is subject to national legislation. Thus, the Convention confirms the definitive abandonment of the principle of *common heritage*. In its place it provides for the application of the principle of *permanent sovereignty* over genetic resources. This is to be the foundation of the new legal regime. The application of this principle does not imply that there will be no access to such resources. It only indicates that the state of origin exercises legal power and control over such

resources and regulates or denies such access where it is considered contrary or incompatible with national interest.

The Convention exhorts the countries of origin of genetic resources to facilitate access to such resources for 'environmentally sound uses by other Contracting Parties', and not to 'impose restrictions that run counter' to its objectives. The determination of what constitutes 'environmentally sound uses' manifestly rests with national legislation. In view of the powers vested in the country of origin of genetic resources, the Convention lays down certain conditions affecting access to genetic resources. This is of course in addition to those that may be laid down by national legislation. The first and most important is that such access is subject to 'prior, informed consent' of the country providing the resources. The most interesting and unusual aspect of this requirement is that the consent should be an *informed* one. In other words, the consent may be considered vitiated unless it was given in full knowledge of its implications for the resources as well as for the sovereign rights of the state granting it.

Secondly, where access is granted, it must be done on 'mutually agreed terms' and in conformity with the provisions of Article 15 of the Convention. Of particular importance in this regard is the right of the state providing the resources to participate in research and development activities carried out on the basis of such resources and to share in a fair and equitable way the benefits arising from their commercial and/or other utilization.

The scope of the new regime of access established by the Convention is subject to an important limitation. It applies only to *in situ* and *ex situ* resources acquired in accordance with the Convention but not those taken away and deposited in genebanks prior to the Convention.

Transfer of technology

Access to and transfer of technology are explicitly recognized by the Convention as essential elements for the attainment of its objectives. Thus, each Contracting Party undertakes to 'provide and/or facilitate access for and transfer to other Contracting Parties' of two types of technologies: those that are relevant to the conservation and sustainable use of biodiversity and those that make use of genetic resources and do not cause significant damage to the environment.

Paragraph two of Article 16 stipulates that access and/or transfer of technology is to be provided to developing countries under fair and most favourable terms, including concessional and preferential terms. However, concessional and preferential terms will only apply 'where mutually agreed' and 'where necessary, in accordance with the financial mechanism established by Articles 20 and 21'. These qualifications make it extremely doubtful that such terms will ever be applied. The issue is further

complicated by the distinction between patented and non-patented technologies. For the former, access and transfer shall be provided 'on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights'. In other words, its transfer will be subject to the new and higher standards of protection stipulated in the Draft TRIPs agreement of the Uruguay Round.

The provision of this paragraph would apparently apply only to technologies relevant to the conservation and sustainable use of biodiversity. With regard to technologies which make use of genetic resources, paragraph three obliges Contracting Parties to adopt the necessary legislative, administrative and policy measures in order to provide access to and transfer of such technologies on mutually agreed terms to those Contracting Parties, in particular developing ones, that have supplied the genetic resources. In this case, the technologies to which access should be provided include those that are protected by patents and other intellectual property rights (IPRs).

Legislative, administrative or policy measures shall also be adopted to ensure that the private sector facilitates access to joint development and transfer of technology to governmental institutions and private sectors of developing countries. This is to be done in accordance with the obligations undertaken in paragraphs one, two and three of Article 16. However, these obligations are far from being clear.

The provisions of the Convention on access to and transfer of technology are—to say the least—ambiguous, confusing and sometimes contradictory. The commitments undertaken are not specific, and no concrete modalities are envisaged for their implementation. Thus, they are unlikely to result in a substantial or effective transfer of technologies relevant to the conservation and utilization of biodiversity to developing countries.

Some positive elements may, however, be gleaned from these provisions. Firstly, they establish a clear link between the supply of genetic resources and subsequent access to technologies using such resources. This link is further reinforced by the right to participate in R&D results enshrined in Articles 15 and 17 of the Convention. Secondly, they provide a basis for financing the transfer of technology to developing countries provided that they can show an incremental cost in complying with the Convention and that specific modalities can be worked out. Thirdly, although the Convention does not in any manner jeopardize the IPRs of technology owners, it calls upon Contracting Parties to ensure that such rights are supportive and do not run counter to its objectives. In view of recent trends to oblige developing countries to strengthen IPR protection, the Convention may offer an opportunity to reject the establishment of higher standards which may be incompatible with its objectives.

The question then arises as to how developing countries could best capitalize on these positive aspects or use them as building blocks for benefiting from technological advances based on genetic resources or required for their conservation and sustainable utilization. The most promising avenue is the line relating to the link between the supply of genetic resources and access to technologies which make use of those resources. It would therefore be interesting to examine possible mechanisms for rendering this link operational.

Mechanisms for sharing

Efforts to obtain access to or transfer of technology through multilateral conventions or agreements have hitherto failed to bear fruit. Similar fate has been encountered by attempts to modify the terms and conditions under which such transfers are effected through internationally agreed instruments. Suffice it to refer here to the mandatory transfer of technology provisions of the Law of the Sea Convention and to the negotiations on an international code of conduct on the transfer of technology. Technology transfer in the area of environmental protection was expected to fare better. The Montreal Protocol and its amendments were viewed as a possible model. However, the Convention on Biological Diversity does not seem to have escaped the predicament of earlier instruments. Nevertheless, the link established between the supply of genetic resources and the technologies using such resources provides an innovation upon which technology and knowledge-sharing mechanisms can be based. This testifies to the need for a sectorial or even case-by-case approach to transfer of technology issues even within the area of environment.

A possible mechanism of this kind is 'technology collaboration agreements' or 'knowledge-sharing arrangements' modeled on the 'R&D agreements' concluded among enterprises of developed countries for the development of new and advanced technologies. As opposed to licensing agreements, the advantage would be that developing countries would not have to give away evaluated and characterized genetic material to foreign enterprises interested in further development and eventual commercialization of derived products. The foreign enterprise would bring into the partnership its advanced technological know-how—especially in the field of biotechnology. Both the evaluated and characterized genetic material and the technological know-how of the foreign enterprise would be considered as 'background knowledge or information' belonging to each contributor, while any new improved or elite material or product generated through the collaboration would become 'foreground knowledge', the benefits of which are to be shared by the partners.

The objective of such a legal framework would be to establish a set of basic rules capable of ensuring an effective sharing of knowledge, materials

and information among the contributors. Its main advantage would be that neither side would lose its control or its rights over the contribution made into the partnership and would be able to use and acquire property rights over any eventual results generated by the venture. As such, it would bring about mutually beneficial access to genetic resources and to technology through the application of foreign proprietary or non-proprietary technology to the needs of the developing countries and the provision of an opportunity to derive maximum benefits from genetic resources under their control. At the same time, it would address the concerns of all parties relating to sovereign, patrimonial and IPRs in respect of genetic resources as well as advanced technologies.

Various questions may arise as to the legal underpinning of such a mechanism as well as its financing. The legal basis for this contractual arrangement is to be found in the Convention itself. It would, however, need to be complemented by national legislation on genetic resources. This legislation should spell out the various types of rights that may be attached to different categories of genetic resources. It would in particular be important to distinguish between sovereign rights and IPRs depending on the degree of knowledge available on or incorporated into a category of resources. The main issues would be to determine the transition from sovereign rights to IPRs and to identify the title-holders of the IPRs (associations, state organizations, indigenous or local communities).

As regards financing, there is no doubt that the collaborative ventures described above could be eligible for financing under the Convention. The pledge made by developed Contracting Parties in Article 20 of the Convention to provide 'new and additional financial resources' may not materialize until the mechanism envisaged by Article 21 is established. However, once such financing is made available, two aspects of the technology collaboration arrangements could benefit from it. First, as regards the characterization and evaluation of genetic resources, developing countries would require both financial and technical assistance from developed countries party to the Convention. Secondly, the collaborative venture itself would need to be financed under the scheme envisaged by the Convention. Both activities could be viewed as part of the incremental costs that developing countries have to incur in complying with the obligations prescribed by the Convention for the conservation, maintenance and sustainable use of biodiversity.

Concluding remarks

The Convention has not clearly resulted in a trade-off between access to genetic resources and access to technology. However, it has established a clear link between the supply of genetic resources and access to technologies

which make use of those resources. This link can be exploited to the benefit of both gene-rich countries and technology-rich ones. Operational modalities and viable mechanisms are called for in order to render such co-operation effective. One possible mechanism is technology collaboration or knowledge-sharing agreements. It would address the concerns of both parties with regard to control, sovereignty and IPRs and at the same time offer an opportunity for mutually beneficial access to knowledge and resources on the basis of equal partnership.

Notes

1. See International Undertaking on Plant Genetic Resources, Resolution 8/83 of the twenty-second session of the FAO Conference, 1983; and Agreed Interpretation of the International Undertaking Resolution 4/89 and Farmers' Rights, Resolution 5/89, both of the twenty-fifth session, 1989.
2. See UN ECLAC, 1991.
3. See Correa, 1991.
4. Trade Related Aspects of Intellectual Property Rights. See Yusuf, 1989.

14 Biodiversity prospecting: Strategies for sharing benefits

WALTER V. REID

In September 1991, Costa Rica's National Biodiversity Institute (INBio)—a private, non-profit organization—and the US-based firm, Merck Pharmaceuticals, announced an agreement under which INBio would provide Merck with chemical extracts from wild plants, insects and micro-organisms from Costa Rica's conserved wildlands for Merck's drug-screening programme in return for a two-year research and sampling budget of US$1,135,000 and royalties on any resulting commercial products. INBio agreed to contribute 10 per cent of the budget and 50 per cent of any royalties to the government's National Park Fund for the conservation of national parks in Costa Rica, and Merck agreed to provide technical assistance and training to help establish drug research capacity in Costa Rica.

This agreement represents a watershed in the history of 'biodiversity prospecting'—the exploration of biodiversity for commercially valuable genetic and biochemical resources. For decades, ecologists and environmentalists have been arguing that pharmaceutical and other commercial applications of biodiversity should help justify its conservation. However, industry investment in natural products research since the mid-1960s has been small, and it actually declined in the pharmaceutical industry during the 1960s and 1970s. Clearly, the INBio-Merck agreement demonstrates a shift in industry focus and the true economic potential of these resources.

This ground-breaking agreement also shows how companies can return a portion of the benefits of pharmaceutical development to the developing country where the chemical compounds originated. Further, it ensures that some of these proceeds will directly finance conservation while the

remainder will indirectly finance conservation through biodiversity research, development and industry in association with the national parks. Coming as it did during the final negotiations of the International Convention on Biological Diversity, the Merck-INBio agreement validated what was becoming—after heated debate—an underlying tenet of the Convention: the fair and equitable distribution of the benefits of the use of genetic resources among *all* those who invest in their continued existence.

Although its close link to conservation efforts has earned it exceptional attention, the Merck-INBio agreement is just one of a rapidly growing number of biodiversity prospecting ventures. Japan has launched a major biodiversity research programme in Micronesia, the US National Institute of Health is screening wild species for compounds active against HIV and cancer, both Indonesia and Kenya are establishing inventory programmes similar to INBio's.

This flurry of interest and enthusiasm in biodiversity prospecting is taking place in a policy vacuum. Virtually no precedent exists for national policies and legislation to govern and regulate wildland biodiversity prospecting. Yet, the 166 countries that signed the Convention in 1992 now must pass implementing legislation that establishes just such a policy framework.

The stakes are high as countries begin to fill this policy vacuum. Done well, biodiversity prospecting can contribute greatly to environmentally sound development and return benefits to the custodians of genetic resources—the national public at large, staff of conservation units, farmers, forest dwellers and the indigenous people who maintain or tolerate the resources involved. Carried out in the mould of previous resource-exploitation ventures, biodiversity prospecting can have a negligible or potentially harmful effect on biodiversity conservation and environmentally sound development.

This chapter[1] offers suggestions to governments, non-governmental organizations, scientists and industry on designing effective and equitable biodiversity prospecting programmes, with a particular focus on the use of biodiversity in the pharmaceutical industry. The chapter's premise is that appropriate policies and institutions are needed to ensure that the commercial value obtained from genetic and biochemical resources is a positive force for development and conservation.

The value of biodiversity as a raw material for pharmaceutical and biotechnology industries is only a portion of its value to society. It makes good economic sense—and often meets ethical norms—for countries and communities to conserve biodiversity whether or not they become biodiversity prospectors. Indeed, it is entirely possible—and sometimes highly appropriate—for nations to invest in biodiversity conservation without ever seeking to commercialize genetic and biochemical resources. The normative

question of whether or not countries should commercialize genetic and biochemical resources is not addressed here, but the urgent need to ensure that the commercialization already under way supports conservation and development is. In particular, three problems must be overcome if biodiversity prospecting is to contribute to national sustainable development and the long-term survival of wildland biodiversity.

First, growing commercial interest in biodiversity will not necessarily fuel increased investment in resource conservation. Genetic and biochemical resources are often described by economists as 'non-rival public goods'. In other words, their use by one individual does not reduce their value to others who use them. Because any user benefits from investments in their conservation, market forces will lead to less conservation of the resource than its value to society warrants.[2] In fact, unregulated biodiversity prospecting and drug development could speed the destruction of the resource. In one particularly egregious example, the entire adult population of *Maytenus buchananni*—source of the anti-cancer compound, maytansine—was harvested when a mission sponsored by the US National Cancer Institute collected 27,215 kg in Kenya for testing in its drug development programmme.[3]

Second, there is no guarantee that the institutions created to capture the benefits of biodiversity will contribute to economic growth in developing countries. Quite the opposite has been the case historically. The chief commercial beneficiaries of genetic and biochemical resources found in developing countries have been the developed countries which are able to explore for valuable resources, develop new technologies based on them and commercialize the products. The Convention provides a framework that may boost developing countries' negotiating strength and foster needed investments in conservation, but it will be up to individual nations to pass the laws and establish the regulations needed to achieve these benefits. From a conservation standpoint, unless developing countries *do* realize benefits from these resources, summoning the political will to conserve them will be difficult.

Finally, biodiversity prospecting is just one of many forms of biodiversity development that could take place in the countryside to help raise living standards there. In most countries, the people living side by side with wildland biodiversity—farmers and villagers, indigenous peoples, forest dwellers, medicinal healers and fisherfolk—hold the key to its survival. If the local and national citizens do not get something out of maintaining wildland habitats, the habitats will be converted to timber plantations, farms or other productive uses harmful to biodiversity. Yet, in many cases sustainably managed wildlands will not yield enough direct economic benefits to support large local populations, so governments will have to ensure that a share

of the national benefits from activities such as biodiversity prospecting are used to meet rural development needs. How well biodiversity prospecting institutions contribute to sustainable development thus ultimately depends on effective local and national government policies for conservation and development—a big question in many countries.

Many institutions involved in biodiversity prospecting are described in this volume, but most attention is given to INBio because of the worldwide interest it has generated and the demand for detailed information on its structure, objectives and operations. INBio is a product of Costa Rica's biological, political and social environment. Costa Rica, with its high percentage of conserved wildland, highly educated population, relatively small indigenous population, small size and considerable scientific capacity, is a friendly climate in which to attempt innovative structures for biodiversity management. The processes that are being fostered at INBio as a pilot project are, however, relevant throughout the tropics. No doubt, the biodiversity management needs in other countries will require unique solutions, but useful guidance can be obtained from the experiences of INBio and other institutions discussed here.

What is at stake?

All else being equal, the growing demand for genetic and biochemical resources should increase the potential market value of the raw material. However, given the high revenues generated from the final products developed in the agricultural and pharmaceutical industries, it is easy to misjudge how much money might actually be involved.

Many of the industries using genetic and biochemical resources produce high-value commodities and thus enjoy substantial gross earnings from the commercial product. Two drugs derived from the rosy periwinkle—vincristine and vinblastine—alone earned US$100 million annually for Eli Lilly.[4] This figure is sometimes erroneously cited as the 'value' of the rosy periwinkle. Unfortunately, sales of a product provide little indication of the potential market value of the unimproved genetic material in the source country. Most of the industries using these resources are capital-intensive ventures that invest substantial time and money in the production of a commercial product, and most are far removed from the original source of the genetic or biochemical material.

In the US pharmaceutical industry, a commercially marketable drug requires an estimated US$231 million and 12 years on average to develop. These costs cover the process of screening candidate compounds, isolating active compounds, testing for possible toxicity and undertaking clinical trials, as well as failed attempts to discover and produce a new drug. Developing agricultural products through genetic engineering also entails

substantial costs. For example, the successful introduction of Bt genes into plants took several years and cost US$1.5–3 million.[5]

In any given trial, the likelihood of discovering a valuable compound for the pharmaceutical industry is quite low. By most estimates, only about one in 10,000 chemicals yields a promising lead, and less than one-fourth of the chemicals reaching clinical trials will ever be approved as a new drug.[6] For example, of 50,000 extracts put through an HIV screen in the natural products research programme of the National Cancer Institute, only three are likely to wind up in clinical trials, and of 33,000 extracts screened for cancer, only five are receiving further study.[7]

Given the high value added in both the pharmaceutical industry and agriculture, the abundance of unimproved genetic and biochemical resources and the low probability that any specific sample will have commercial value, the holders of unimproved material are likely to receive a relatively low payment for access to the resource, current heightened demand notwithstanding. In agriculture, Barton estimates that the total revenue gained if developing countries sought royalties for unimproved genetic material could amount to less than US$100 million annually.[8]

Even in the pharmaceutical industry, possible earnings from the sale of raw materials are smaller than might be thought given the industry's worldwide sales of roughly US$200 billion—more than 30 times that of the seed industry.[9] In this industry, typical royalties paid for samples of unknown clinical activity (for example, new synthetic chemicals) amount to only 1–5 per cent of net sales—a range of royalties likely to apply to natural products as well. Consider an institution that supplies 1,000 chemicals to a pharmaceutical company in return for a 3-per cent royalty on the net sales of any commercial product. Given the need to screen roughly 10,000 chemicals to find a single lead, a one in four chance of a lead being developed into a commercial product, a 5-per cent discount rate, a 10-year wait before a product is ready to be marketed and 15 years of patent protection while it is being marketed, and assuming that a drug, if discovered, generates US$10 million net annual revenues, the present value of the agreement to the supplier is only US$52,500. More sobering, there is a 97.5 per cent chance that the 1,000 chemicals will not turn up any commercial product at all, and if they do, royalty payments will not begin until more than a decade after chemical screening commences.

The prospects for success are raised with natural products, since any extract from a species will contain hundreds or thousands of different chemicals that might result in a pharmaceutical 'lead'. Moreover, the probability of success can be increased through the use of multiple—and higher quality—screens. Thus, for natural products research using current technologies, the probability of success could easily be ten times that of the example

above and thus produce promising leads at a rate of about one per 1,000 samples.[10] The probability of developing at least one commercial product in the above example would then grow from 2.5 to 22 per cent, and the present value of the agreement would grow accordingly, to US$461,000. If a 'blockbuster' drug—earning US$1 billion in sales annually—happens to be discovered under this scenario, that value would swell to US$46 million.

Biodiversity prospecting does involve financial risks. With the odds against striking it rich, it often makes economic sense for biodiversity prospectors to hedge their bets by seeking advance payments and relatively small royalties rather than foregoing collecting fees and holding out for higher royalties that may never materialize. Moreover, a risk exists that the market for natural products could quickly become saturated. While a number of pharmaceutical firms have natural products research efforts under way, most are small in scale, and the demand for chemical extracts from plants, animals and microbes might be saturated by a handful of large-scale suppliers. As Costa Rica, Indonesia, India, Brazil and Mexico establish biodiversity prospecting institutes, the growing supply may well lead to steadily declining prices for raw materials.

Finally, there is no sure way of projecting future demand for biological samples on the part of the pharmaceutical industry. Within a decade or two, advances in synthetic chemistry, biotechnology and medical sciences may curtail interest in natural products. On the other hand, wild species will continue to be a source of novel genes and proteins, as well as a source of insights into chemical and physiological processes. Nobody knows whether natural products will fall from favour in several decades or become even *more* valuable in medicine and in industrial applications.

In sum, while biodiversity prospecting can return profits to source countries, institutions and communities, the amounts involved are likely to be small relative to the market value of the final products; a decade or more may pass before significant revenues materialize. A good chance exists that no commercial drugs will be produced, and late-comers may find a market already saturated with suppliers. On the other hand, given the scale of revenues generated in the pharmaceutical industry, even a relatively small share of net profits may amount to extremely large revenues for a developing country. If nations add value to genetic resources domestically and build technical capacity for improving the resource themselves, biodiversity prospecting could become an important component of a nation's economic development strategy.

Biodiversity prospecting institutions

The increasing value of wildland genetic resources to private industry, combined with many countries' growing sense of national identity and de-

sire for greater control over their destiny, has created incentives for new kinds of institutional arrangements for capturing the return on investment in the use of biodiversity. In particular, genetic resource property rights, international agreements and the use of intermediary organizations are three critical institutional arrangements whose evolution must be guided to ensure the sustainable and equitable use of biodiversity. (For wildland biodiversity, a 'sustainable use' is one that does not diminish the diversity of wild species through time.)

For decades, the major trend in the evolution of intellectual property rights (IPRs) for improved genetic and biochemical resources has been a gradual expansion in the scope and strength of ownership. As a result, two different systems now govern ownership and access to genetic and biochemical resources. On the one hand, 'unimproved genetic material'—wild species and traditional varieties of crops and livestock grown by farmers—is treated as an ownerless, open-access resource.[11] On the other, IPR regimes—including patents, plant breeders' rights and trade secrets—establish ownership for new varieties of plants and animals developed by commercial breeders and chemicals isolated and developed by pharmaceutical firms.

The biodiversity prospecting industry falls squarely between these two systems inasmuch as it seeks to locate wild resources with commercial potential. Not surprisingly, considerable controversy surrounds the applicability of property rights to wild biodiversity and to information about its potential use.

IPRs are used to grant private ownership to genetic and biochemical products because of the ingenuity involved finding, identifying and developing them. Unlike personal property regimes, intellectual property law secures ownership in the particular form or expression embodied in things, not over the tangible properties of the thing itself. Like knowledge or information, the costs entailed in discovering and developing new genetic or biochemical products can be quite high, but once developed the product can be replicated easily at low cost, thereby undermining the ability of a seed company or pharmaceutical firm to recoup its development costs. Without protection for intellectual property or, alternatively, public funding to support development costs, less investment in research and development would take place than is socially desirable.[12] For example, agricultural research investments yield extraordinarily high returns to investments—often more than 50 per cent—but capturing the economic returns from the research is so difficult that little private investment occurs.[13]

Historically, unimproved genetic and biochemical resources were regarded as the common heritage of all people, freely accessible by anyone. Scattered efforts to control ownership amounted to what would today be

considered 'trade secret' protection. Brazil, for example, tried unsuccessfully to prevent the export of rubber tree seeds, and for good reason. Just 20 years after the first rubber trees were established in Malaysia, the Brazilian rubber industry that had once commanded 98 per cent of the world supply was exporting virtually nothing, while Singapore became the rubber capital of the world. Similarly, Andean nations' attempts to prevent the export of cinchona—the source of an anti-malarial compound—were eventually overcome, again by British plant explorers. As early as 1873, however, a new type of ownership was extended to certain genetic resources: the patent. In that year, Louis Pasteur was awarded a patent in the United States for a yeast culture, giving him a limited monopoly over the culture, enforced by the state, in recognition of his intellectual contribution to the creation of the product.[14]

Beginning in 1930, IPRs for genetic and biochemical resources began to expand rapidly in breadth and scope. In that year, the United States passed the Plant Patent Act, which allowed patenting of asexually reproduced plants such as roses, other ornamentals and fruit trees. In the 1940s, European countries established plant breeders' rights (PBRs) protecting sexually reproduced plants, and the United States followed suit in 1970 with its Plant Variety Protection Act. To address issues arising from international trade in species protected by PBRs, the International Convention for the Protection of New Varieties of Plants—commonly referred to as the UPOV Convention—was adopted in 1961.[15]

With the exception of early patents such as that granted to Pasteur, IPRs granted for plants and animals were not formal 'utility' patents. Neither PBRs nor plant patent legislation requires the same standards of novelty, utility and non-obviousness (that is, innovation that would not be obvious to the average person skilled in the art) required for a utility patent, and, in turn, neither system provides as much protection for the innovation as utility patents.

The most significant step in the expansion of IPR coverage for genetic resources took place in 1980 when the US Supreme Court ruled in the case of Diamond *vs.* Chakraborty that a genetically altered bacterium could be granted a utility patent under standard patent law.[16] Then, in 1985, the US Patent and Trademark Office ruled that a corn plant containing an increased level of a particular amino acid could also receive a utility patent. In 1988, the first animal was patented—a mouse carrying a human cancer gene used in medical research. The extension of patents to human life took place over the same period. Human cells—cancerous cells taken from a leukemia patient—were first patented in 1984. In 1991, the US National Institute of Health filed patent applications for the structure of 337 human gene fragments identified with an automated sequencing machine and in 1992 ap-

plied for patents on a further 2,375 gene fragments.[17] (The first of these applications was rejected by the US Patent and Trademark Office in 1992, but reportedly will be amended and re-submitted.)

Countries differ widely in the patent protection they offer for living material. At one end of the spectrum, the US grants patents on novel DNA sequences, genes, plant parts, plant or animal varieties and biotechnological processes. In contrast, while they do grant patents for plant and animal genes, European countries have only recently extended patent protection to plant varieties. Recently, a patent was also granted for the Harvard mouse in the UK, though the court decision allowing the patent indicated that a criterion of clear human benefit must be used in determining the patentability of an animal. Many developing countries exempt biological processes and products entirely from their patent regimes.

Chemical compounds and processes have long been subject to patent protection in most industrialized countries, though drugs and other types of chemical products are sometimes excluded from patentability. For example, patent protection for pharmaceutical products was extended only in 1958 in France, 1968 in the Federal Republic of Germany, 1976 in Japan (when it ranked second in world drug production) and 1978 in Italy. As recently as 1990, Finland, Norway and Spain did not patent pharmaceutical processes and products.[18]

The gradual expansion of IPR protection raises an important and fundamental question: How can anyone 'own' genes or biochemicals that occur in nature? In most fields, patents are granted only for innovations, not for discoveries. Is it right for someone to possess an exclusive right to a naturally occurring gene or chemical?

No uniform standards exist for the treatment of discoveries by intellectual property regimes in different countries, particularly for discoveries relating to natural products like genes and chemicals. In many industrialized countries, patents are allowed if the discovery requires notable input of human effort and ingenuity. For instance, in the case of agriculture, a gene will usually be patentable only if it is used in a species in which it did not evolve or to which it could not have been transferred through conventional breeding. Similarly, a longstanding US legal doctrine holds that the purified form of a chemical can be patented if the chemical is found in nature only in an unpurified form.[19] Thus, in the US, Europe and Japan, pharmaceutical companies can patent chemicals derived from natural sources and genes that have been transferred to unrelated organisms.[20] In contrast, a number of developing countries exclude drugs and/or biological materials from patent protection.

International agreements

Even as the scope of property rights for improved genetic resources expanded over the past century, unimproved genetic resources retained their 'common heritage' status until well into the 1980s. Beginning in the mid-1970s, however, questions surfaced in international fora over the nature of the institutions governing access to these resources.

In agriculture, a significant fraction of so-called 'unimproved' genetic resources was actually the product of the hard work and ingenuity of farmers as they selected and bred crop varieties fit to local conditions and tastes.[21] Similarly, many pharmaceutical products developed from natural products were first 'discovered' by traditional healers. Why, more people began to wonder, did not these intellectual contributions receive the same IPR protection as the contributions of plant breeders and pharmaceutical companies? Or, alternatively, if these contributions were freely available to all, should not the same apply to the products developed by pharmaceutical firms and seed companies?

A second concern revolves around ownership of the genes, seeds and chemicals themselves. Developing countries began to question why individuals and companies based in the gene-poor developed countries were obtaining resources free-of-charge from the gene-rich developing countries, then patenting the genes and chemicals and selling the patented products back to the country where they originated. Since these were the raw materials used in agricultural breeding and pharmaceutical development, why should not companies pay for them just as they would pay for coal or oil?

In the agricultural arena, these debates quickly escalated in the early 1980s into a bitter 'Seed War' between North and South. Since then, the resolution of this dispute through international mechanisms has moved at a glacial pace. In 1983, the Commission on Plant Genetic Resources was established through the Food and Agriculture Organization (FAO) of the United Nations and the 'International Undertaking on Plant Genetic Resources' was signed by most developing countries and some industrialized countries. This undertaking initially held that *all* genetic resources (including the elite lines of private plant breeders) should be considered common heritage and thus freely accessible. Needless to say, few developed countries with established seed industries supported it.

In 1987, the Commission on Plant Genetic Resources accepted the legitimacy of IPR protection for breeders in exchange for recognition of the concept of *farmers' rights*. These were defined to be communal rights, vested in the international community through the International Undertaking on Plant Genetic Resources, recognizing the contributions of local communities and farmers in creating and maintaining genetic re-

sources. In this same year, the Commission established a 'Fund for Plant Genetic Resources' to fulfill the obligations inherent in the concept of farmers' rights by compensating developing countries for the use of their genetic resources, though donor countries never have provided more than token sums for this Fund.

The debate over ownership and access to genetic resources shifted venue in the late 1980s to the negotiations for a Convention on Biological Diversity. Here, countries quickly agreed to recognize that biodiversity was a sovereign national resource and a 'common concern' of humankind, not a common heritage. Up until the very end of the negotiations, developed and developing countries could not agree on mechanisms for protecting intellectual property and for allocating the benefits of the use of biodiversity. The final Convention recognizes nations' obligations to ensure that both the countries supplying biodiversity and those using it receive economic benefits and even notes that countries should encourage the 'equitable sharing of the benefits arising from the utilization of [the knowledge, innovations and practices of indigenous and local communities].'

Biodiversity prospecting intermediaries

The final element of the evolution of biodiversity prospecting institutions has been the recent emergence of new intermediary arrangements to facilitate access to genetic and biochemical resources and their transfer to the pharmaceutical, agriculture or biotechnology industry. A wide range of such institutions already exists, and many more are being planned.

One outstanding example is Costa Rica's INBio. This private, non-profit organization was established to facilitate the conservation and sustainable use of biodiversity. It uses its income and donations to support a wide array of conservation actions—from carrying out the national biodiversity inventory in collaboration with the Ministry of Natural Resources, Energy, and Mines (MIRNEM) to conducting and facilitating biodiversity-prospecting activities to support its conservation mission. Many other private non-profit intermediaries are based in developed countries. For example, the New York Botanical Garden, the Missouri Botanical Garden and the University of Chicago have all contracted with private pharmaceutical companies and with public research organizations to provide samples of biodiversity for pharmaceutical development. Increasingly, these intermediaries also enter into contractual relationships with the countries—or appropriate institutions within a country—where they pursue their collecting activities.

Private for-profit intermediaries also exist in both developed and developing countries. Biotics, a private firm based in the UK, works as a broker, providing pharmaceutical companies with plant genetic resources. Biotics buys samples and, through a contract, agrees to share any royalties with the

source country institution. Similar contracts are drawn up between Biotics and the pharmaceutical firms, which would ultimately hold the patent on any discovery. Numerous collectors in developing countries also make a business of supplying plant and animal samples to industry. While most large pharmaceutical companies rely on other organizations to collect natural products, smaller firms—such as Shaman Pharmaceuticals—collect biodiversity samples and develop drugs.

Public organizations have also begun to serve as intermediaries. Mexico's National Biodiversity Commission, established in February 1992, may seek to play much the same role for Mexico that INBio does for Costa Rica. Similarly, Indonesia and the Asian Development Bank, have considered establishing a Biodiversity Marketing and Commercialization Board. Elsewhere, the US-Japan Environmental Partnership will be providing US$20 million annually from 1994 to 1997 to establish several Natural Resource Conservation and Management Centres in Asia, some of which may undertake biodiversity prospecting. Three US government agencies established a programme in 1992 to fund 'International Cooperative Biodiversity Groups' designed to 'promote conservation of biological diversity through the discovery of bioactive agents from natural products, and to ensure that equitable economic benefits from these discoveries accrue to the country of origin'.[22]

Finally, some collaborative efforts between the public and private sector have been established. For example, 24 Japanese corporations—including Suntory, Nippon Steel and the Kyowa Hakko Pharmaceutical Company—and the Ministry of International Trade and Industry have established the Marine Biotechnology Institute in Micronesia. Researchers at this institute, with some 80 employees, two research laboratories and a research vessel, are looking for new anti-bio-fouling agents, oil-eating bacteria, phytoplankton that fix atmospheric carbon dioxide and new pharmaceutical compounds. (No arrangements have been made to share royalties with Micronesia or to pay an exploration fee.)[23]

Biodiversity prospecting intermediaries have been established for various purposes. Some are strictly money-making ventures. Others carry out basic research or spur conservation or economic development. Nearly all of the commercial collection programmes of these institutions are young and experimental.

Biodiversity prospecting guidelines

Although the mission of some organizations engaged in biodiversity prospecting is primarily one of conservation, most have evolved primarily in response to growing commercial demand for the resource, rent-seeking by commercial ventures and public policies designed to foster innovation in

the extension of IPRs. None of these factors provides a sufficient incentive for resource conservation, the survey and description of biodiversity, local economic development or the distribution of the benefits from biodiversity to those who pay the direct or opportunity costs for developing and maintaining it.

Biodiversity prospecting has attracted the interest of environmentalists and developing countries because it may provide significant incentives and funds for conservation and could contribute to economic development in regions rich in genetic and biochemical resources. However, this dual potential will not be realized unless new policies are established to steer the evolution of the institutions toward these ends.

The remainder of this chapter summarizes general principles that can guide the development of such policies. These guidelines, derived from more detailed chapters in Reid *et al.* (1993) and based largely on the experiences of INBio in Costa Rica, should help governments, NGOs and industry develop appropriate property rights regimes, intermediary institutions, collecting agreements, contracts, collecting regulations and technology policies. In the absence of detailed empirical and theoretical studies, these conclusions are tentative and must be modified to fit specific circumstances. Taken as a whole, they approximate the state-of-the-art of biodiversity prospecting policies today.

Role of intermediaries

Few generalizations about the diverse intermediary organizations involved in biodiversity prospecting hold. Intermediaries can support—or undermine—the conservation and sustainable use of biodiversity, whether they are public or private and whether they are located in the source country or in a foreign land.

Nevertheless, more than any other component of biodiversity prospecting programmes, well-designed intermediaries have the potential to promote conservation, development and equity. As a pioneering institution, INBio's activity as a biodiversity prospecting intermediary has received particular attention as a 'model'. The founders of INBio reject the assertion that INBio is a model but accept that it is an instructive 'pilot project'.[24]

Perhaps the most important insight from INBio's experience is that biodiversity prospecting activities are only a means to an end. INBio was established to help identify and inventory Costa Rica's biodiversity and to integrate its non-destructive use into the intellectual and economic fabric of the society. Biodiversity prospecting helps fund conservation, but, more important, it demonstrates the economic value of biodiversity and thus helps convince policy-makers that biodiversity conservation should figure centrally in all development planning.

Whatever intermediary organizations are established, the array of institutions involved in biodiversity activities should fill three basic needs: *saving* representative samples of wild biodiversity in protected wildlands, *knowing* what this biodiversity is and where it is to be found in those wildlands and *using* biodiversity non-destructively for societal aims. If biodiversity is to survive, the society in whose custody it resides must perceive it as an asset. That will happen only through understanding what biodiversity is and seeking ways to use it to satisfy local and national social and economic needs.

Any effort to save, know and use biodiversity requires the joint efforts of widely different sectors of society—including universities, museums, conservation ministries, commercial firms and rural communities. INBio's experience demonstrates that one organization can catalyze the integration of these sectors. INBio's inventory of Costa Rica's species provides employment for rural people as technicians—'parataxonomists'—in this venture. The institute is generating abundant information that is needed to wisely manage the country's biodiversity for a wide variety of users, developing the capacity to undertake chemical screening and pharmaceutical development and working with Merck and other corporations to develop—and share the benefits from—new products based on that biodiversity. In essence, INBio closes the loop between studying, saving and using biodiversity.

In other countries, biodiversity management institutions may or may not be involved in biodiversity prospecting. They may build on existing public-sector institutions like universities, environment ministries and national museums, or they may take the form of new public or private institutions. Multinational management and prospecting organizations may make sense in some regions, while provincial or state-level organizations may be needed in others.

Clearly, institutions designed to gather information on biodiversity management and to develop new products of value to the biotechnology or pharmaceutical industry address only one portion of biodiversity conservation needs. For example, such institutions can create some employment in rural communities and may develop new products that local entrepreneurs can market, but it is unlikely that they could make rural development their mission. Yet, actions to reduce poverty in rural areas and to provide alternatives to habitat conversion that meet the needs of rural communities rank at the top of biodiversity-conservation priorities.[25] By contributing to economic and technological development, and by contributing user fees or taxes directly to the public sector, biodiversity-prospecting initiatives can provide a share of the resources needed to meet this broader array of conservation and development needs, but the responsibility rests with national

and local governments to ensure that these resources are used appropriately. When governments are unable to meet these responsibilities, the potential for success of biodiversity prospecting will be diminished.

One serious concern is that the revenues governments earn from biodiversity prospecting and the economic gains stimulated by commercialization of new products based on biodiversity may sometimes enrich the few rather than contribute to rural development. Certainly, biodiversity prospecting institutions often return some benefits directly to the individuals, landowners and communities involved in biodiversity collecting activities. More typically, as when biodiversity is collected from public lands or without the benefit of local information, there is no alternative to effective public sector mechanisms for returning benefits to local communities. For those countries that have shown a commitment to biodiversity conservation and the development needs of rural communities, biodiversity-prospecting intermediaries can be a valuable element of biodiversity-conservation policies. Without such a national commitment, biodiversity prospecting may be nothing more than the newest unsustainable resource-commercialization venture.

Company-collector contracts

Contracts are an important means of distributing the costs, benefits and risks between the collecting organization and the companies interested in developing products from genetic and biochemical resources. Through them, the portion of benefits that will return to the country that possesses the biodiversity can be determined. Contracts can be established even if countries lack intellectual property regimes or legislation governing the activities of collectors. They are an extremely flexible form of agreement that could, in theory, be used to ensure that the source country receives financial returns from biodiversity prospecting and that these funds are used to promote resource conservation.

However, contracts alone will not make a country's conservation and development objectives materialize. Such agreements can be expensive and difficult to draft, negotiate and enforce, and any company negotiating such a contract is motivated by the desire to acquire useful samples for screening,[26] not to conserve resources. As a result, any provisions for conservation, the return of benefits to local communities, technology transfer and so forth are likely to be limited (even if they are the collecting organization's primary goals).

Company-collector contracts typically involve a fee for samples and, occasionally, advance payments to the collector. In such cases, the collector must determine how to disperse these in the country of collection. As countries begin regulating access to genetic resources, the collectors' obligations to in-country collaborators and to collecting regions are likely to become

more stringently defined. Laird notes that while most collectors take responsibility for determining equitable relationships with their in-country collaborators, collecting regulations must be developed that will hold up regardless of whether personal relationships do.[27]

One of the most striking aspects of the Merck-INBio contract was the size of the advance payment to INBio for services. Customarily, pharmaceutical plant collectors receive payments of US$50 to $200 per sample. In sharp contrast, the US$1.1 million paid by Merck in exchange for samples is nearly ten times the traditional service payment. Merck was asked to pay virtually all of the real costs of a sample, rather than be subsidized by the social and institutional backup that a pharmaceutical collector normally receives but does not charge to the company. From Merck's standpoint, this sum is warranted by the greatly increased quality of the samples that it receives from INBio during the initial two-year agreement and in future years if the agreement is renewed. How often payments of this magnitude will be made depends on how often sourcing institutions can offer samples of such quality, whether all collectors choose to charge all of the real costs to the purchaser and whether competition among collectors drives prices to below-cost levels. As in many other markets, product quality is likely to be strongly proportional to the price paid for the sample and its associated services.

Many provisions could be included in company-collector contracts to further conservation, development and equity. For example, contracts could specify that future supplies of raw material would be obtained from the country of origin, that royalties would be distributed to individuals (such as traditional healers) who provided information on the resource or that a specified fraction of royalties would be dedicated to conservation. While such stipulations may currently be uncommon, the rules of biodiversity prospecting are changing rapidly. For example, all INBio-commercial contracts state explicitly what portion of the research and royalty budget goes directly to the National Park Fund at the Ministry of Natural Resources, Energy, and Mines and what portion is used for other kinds of wildland conservation activities. Similarly, all INBio samples must come from inside the conserved wildlands so that there is no contest over where the funds should be spent.

Property rights

There is no more fundamental and divisive issue related to biodiversity prospecting than the question of who owns biodiversity. Developing countries have long been frustrated with a system that labels their resources as 'open access' but then establishes private property rights for improved products based on those resources. Is it possible to modify IPR regimes to

internalize the cost of biodiversity loss and management and ensure that the source countries and the custodians of biodiversity within them receive more of the economic returns from its development?

On the surface, the idea of extending IPR protection to wild species would seem to resolve the apparent imbalance between the rights of ownership for improved and unimproved genetic resources, thereby providing an incentive for resource conservation. Just as the individual who purifies a naturally occurring chemical is able to patent it, the individual (or nation) first spending the time and money needed to identify a new species and bearing the cost of maintaining that species could be granted exclusive rights to its use or sale.[28] By assigning such rights, some would argue, the opportunity cost of the loss of the resource could be internalized, and market forces and legislation might then lead to an 'optimal' investment in conservation, at least with respect to biodiversity's genetic and biochemical value.

However, the extension of IPRs to wild species is unworkable at present. From a pragmatic standpoint, patent offices would be deluged with speculative claims on species whose utility was unknown. More important, such a step would place more of the 'public domain' in private hands than would be justified to maximize social benefits.[29]

More generally, the various types of IPRs that exist today are of limited use in promoting the conservation of wild species (but also do not necessarily hasten the loss of biodiversity). On the other hand, IPRs can help stimulate domestic innovation and technology acquisition, thus providing an incentive for the sustainable development of the resource within the source country and generating economic benefits that may then be used to support conservation or to compensate the custodians of biodiversity.

If extending IPRs to unimproved genetic resources fails to capture benefits from the use of the resource, what other mechanisms are possible? Three mechanisms are described in this chapter: contracts, access restrictions and the promotion of value-added industries. Efforts to add value to biochemical and genetic resources may be particularly rewarding since they contribute directly to the development of the source country's technological capacity. Strengthened capacity, in turn, allows source-country institutions to enter into more profitable partnerships with technology-intensive industries.

The economic returns generated from biodiversity can be enhanced either by providing a service related to the unimproved resource or by improving the resource itself. For example, in its agreement with Merck, INBio is basically selling biodiversity prospecting services, not any IPRs that it holds. Among the services it offers are sample identification, further samples from species of the same quality, known and user-sensitive processing

methods. The Merck-INBio agreement is not exclusive: Merck is free to buy samples from others in Costa Rica, INBio can provide samples to other organizations and other organizations can collect the same samples and sell them to Merck or any other user. Although INBio agreements include stipulations that for six months to two years it will not send the same sample to a competing company, in no sense does INBio control access to—or 'own'—the resource.

Institutions can also increase economic returns by developing information about the resource. A biodiversity-prospecting institution could undertake preliminary chemical screening of samples to identify those with promising biological activity, thereby raising their potential market value. Such work could be undertaken with no intent to seek a patent; indeed it could be undertaken in a country with no patent protection for biological materials. The increased commercial value would come from new information on the materials' potential use. In the pharmaceutical industry, for example, it is common to receive royalties of 1–6 per cent of net sales for unscreened chemical samples, 5–10 per cent for material backed by pre-clinical information on its medical activity and 10–15 per cent for fractionated and identified material with efficacy data.

INBio is already establishing chemical screening and bioassay facilities to explore Costa Rican species for potentially valuable compounds.[30] Once active substances are discovered, INBio will be in a stronger position to negotiate royalty arrangements with foreign companies and can even isolate new products by itself.

Today, traditional knowledge is rarely involved in the development of new pharmaceutical products from biodiversity. Natural products chemistry today is based primarily on research by scientists, physicians and pharmacologists. The screening programmes used by large pharmaceutical companies are more likely to make use of phylogenetic information—screening organisms related to those that have proven their pharmaceutical worth—than indigenous knowledge, and new genes for agricultural breeding are increasingly found among wild species where farmers have played little role. In some cases, however, the discovery of new medicines or promising genes is due in part to the knowledge of traditional healers or the work of generations of farmers. In such cases, how can these people be equitably compensated?

Knowledge of the therapeutic properties of wild species is often held in confidence by traditional societies, both because considerable training is needed before the materials can be used safely and effectively and because widespread knowledge of the cures would undermine the healers' vocation. Historically, ethnopharmacologists have not seen the need to protect these secrets (though often researchers have attempted to negotiate compensation

for the information provided). For example, the author of *Medicinal Plants of East Africa* (which gives complete descriptions of the taxonomy, distribution and uses of the medicinal plants) writes in the foreword:

> Many of the herbal medicine men will not like this book since it may deprive them of their profession once their secrets are revealed. The majority of them were reluctant to show me the drug plants as a whole for this reason. In most cases, I was given the leaves or root of the plant already crushed or picked. But after some persuasion, I was shown the plant on the condition that I would not reveal it to anyone else.[31]

Though such practices were once commonplace, today this would be considered a misappropriation of trade secrets that could and should be prevented by legal means, including lawsuits.[32]

Issues of equity in the distribution of benefits from the use of traditional medicines and traditional crop varieties have underlain international debates over biodiversity for more than a decade.[33] The issue of what represents 'just compensation' for the holders of traditional knowledge is far from resolved. Some of the questions that arise include: How can the efforts of generations of farmers be equitably compensated through their descendants for developments in agriculture? Should a traditional healer be compensated for indigenous knowledge, or should the debt be paid to the community or to the state? Is a one-time payment to the deserving party or group enough, or do the bearers of traditional knowledge have a basic right to the fruits of their inspiration that goes beyond the labour effort involved?

The subjectivity of any definition of equitable compensation ensures that no mechanism for allocating benefits will appear 'just' to all, and North-South questions of equity will be particularly troublesome. In a cohesive and well-integrated society where it can be shown that privatizing specific types of knowledge leads to greater public good, this 'implicit' compensation ensures reasonable equity in the distribution of benefits.[34] For example, when the US grants a patent to a US drug company that develops an anti-cancer compound made from a local plant, 'implicit' social benefits accrue nationally in the form of a lessened incidence of cancer. It is hardly surprising that equity issues come up when the actors are traditional healers living outside of market economies in Brazil on the one hand and genetic engineers in the US on the other. What benefits return to a remote region of the Amazon from a new drug designed to fight diseases common only in the developed world, and too expensive for purchase by local people in any event?

One mechanism for meeting global obligations to the generations of farmers and healers who have developed and protected the genetic and biochemical resources now used in industry is through an international financial mechanism such as the Fund for Plant Genetic Resources or the

Convention.[35] Can other mechanisms complement such international agreements? Specifically, can IPRs be used to protect the knowledge of indigenous people, traditional healers and farmers?

The answer is 'sometimes'. Most current IPR regimes would, in principle, allow the extension of IPRs to cover the innovations and knowledge of traditional healers and farmers. Traditional healers could be granted patents for novel uses of a compound under most systems of patent protection. As a corollary, if a traditional medicinal use of a compound is public knowledge, then patent laws should be applied to prevent others from patenting that compound for the same purpose. Similarly, there is no compelling reason why a farmer who breeds a new variety of plant could not receive protection under most systems of PBRs.

Any number of practical problems crop up, however, when IPRs are extended to these 'informal' innovations, and promoting their use in this context is somewhat disingenuous. The scope of protection of IPRs is generally as much a function of the political and economic power of those seeking protection as it is of wise or just economic policy. Moreover, the utility of IPR regimes is always a function of the enforceability of the rights. Society can establish the legal framework governing such disputes, but, ultimately, the rights-holder must be able to identify infringements and challenge the infringing party. Clearly, a traditional healer in Brazil or a farmer in Ethiopia can rarely do either. Farmers and traditional healers cannot effectively claim ownership to a resource if they cannot control access to it, and they are in no financial position to challenge IPR claims made by others.

Finally, the costs of enforcing the right may often outweigh any benefits. A farmer might well be able to file for plant variety protection on a new plant variety but why bother if the new variety is locally adapted to just one small region of the country? The market for the variety simply will not be big enough to repay the effort. Thus, while farmers and traditional healers are in a position to seek formal intellectual property protection (in countries that provide it), seeking compensation for their knowledge and inventions more directly through contracts and informal agreements usually makes more sense. For example, by refusing access to knowledge of traditional seed varieties, individuals can at least establish a framework for negotiating an equitable settlement.[36] These two avenues for compensation are not mutually exclusive, and, indeed, recognition of the legal right may encourage formal negotiations for compensation.

Increasingly, biodiversity collectors, anthropologists and scientists are recognizing their responsibilities to local communities and negotiating formally or informally for access to information held by the communities. Professional organizations and UN agencies are now developing codes of conduct to promote greater equity in the relationship of researchers with

local communities and source countries.[37] National legislation regulating biodiversity collecting activities provides another, more formal, mechanism for ensuring that the rights of local communities and source countries are respected. Collecting permits could, for example, require collectors to get prior informed consent from local communities before collecting begins and, in some cases, to negotiate the terms by which they would be given access to land or to local knowledge.

Legal guarantees

Each of the policy tools discussed above—organizational design, company-collector contracts and IPRs—can help achieve the objectives of conservation, development and equity. However, without effective national regulation, the attainment of these objectives may be the exception rather than the rule. Private intermediaries are more likely to be established with profit, rather than conservation, in mind. The parties to contracts will rarely agree on both the need for conservation and technology transfer, and it will be easy for commercial collectors and companies to slight the contributions of farmers and traditional healers to new medicines and crop varieties.

The best means available to ensure that biodiversity prospecting does meet these broader social objectives is national policy.[38] Biodiversity collecting regulations should be part of legislation established by countries to implement the Convention. (Costa Rica, for example, adopted a Wild Life Protection Law on October 12, 1992, which declares all wild plants and animals to be 'national patrimony' and requires collectors to submit an application for a licence that details their collection plans, deposit voucher samples in the national collection and send copies of publications resulting from the work to the national library. Collection for non-scientific purposes requires a special licence and must involve the use of public bids, concessions or contracts.)

The agreement reached between a biodiversity collector and society is, in essence, a research *contract*. Where past collecting activity has been regulated informally, if at all, the state should now ensure that in return for access to genetic and biochemical resources the collector assumes certain obligations with regard to conduct, liability and payments. The most critical elements of such regulation are firstly user fees for access to genetic or biochemical resources on public or private land, and secondly requirements that collectors negotiate equitable arrangements with the local communities, wildland administrators, private landowners, farmers and healers who were the custodians of the biodiversity collected or who contributed to the discovery or development of valuable genetic or biochemical resources.

Critics have charged that private biodiversity prospecting intermediaries inappropriately exploit the public domain for private benefit.[39] This criticism

is often valid: private commercial collectors do often obtain genetic resources freely from the public domain and sell them for private gain. Public policies should thus seek to ensure that private collectors pay local or national governments for access to biodiversity.

Nobody would expect a nation to allow a private timber company to use public timber resources free of charge or to mine on public land without reimbursing the state. A similar system of user fees—or biodiversity prospecting concessions—should be established for access to public lands for biodiversity prospecting ventures.[40] Ideally, such fees would be used to maintain the biodiversity, thereby internalizing part of the costs of conservation. INBio, by investing 10 per cent of Merck's initial payment of US$1 million in traditional conservation activities and agreeing to spend half of all royalties on conservation through MIRENEM, the remainder on conservation through its own activities and conducting all of its activities as development of the conservation areas, basically paid such a user fee, even though no national legislation required it at the time.

The time has come for *all* research on biodiversity—whether commercial or scientific—to be strictly regulated by public institutions (or their designated representatives).[41] This does not mean that all researchers must pay user fees. For example, scientists carrying out basic research on biodiversity—such as inventory and taxonomic work—return 'in-kind' benefits to a nation instead of direct payments. Similarly, governments might set lower fees for local (as opposed to foreign) collectors, thus giving them an incentive to develop local industries based on these resources.[42]

The nature of compensation for access to biodiversity must be based on what the researcher has to provide, which is not necessarily money. Nonetheless, some user fees may be appropriate even for those engaged in 'basic' rather than commercial research. Scientists readily accept the notion that they must contribute to the overhead of their home institutions; they should not object to the idea that they should also contribute to the 'overhead' of their research sites. (Nor should their granting agencies discourage such expenses.)

An alternative to systems of user fees would be for the state to control all aspects of the commercialization of the resource. Genetic and biochemical resources do have unique attributes that set them apart from other elements of a nation's patrimony—among them, its timber, minerals and fisheries. For example, the sale of rights to a gene or chemical to a foreign company exhausts the local rights and control over the resource. Whereas local communities or future generations may have an opportunity to challenge forest or mineral leases, for genetic resources the deal is final. The real value of the resource lies in the information contained in the genes or chemicals, not in its physical properties. Though an intermediary may be selling only a

service related to the resource, its actions may make it easier for individuals with technological expertise not available in the source country to establish private property rights for that information.

Whether stronger control by national governments would better serve national interests is far from clear. Such a system could run into tremendous practical problems. For example, INBio is paid for the service and information it provides, not for licences to IPRs. A system that retains national control over all such information and services—as well as the right to the resource itself—would be unwieldy at best and fraught with inefficiency and corruption at worst. In many countries, the balance between local and national control over resources has shifted too far toward the latter, undermining prospects for sustainable use and equitable distribution of the benefits from resource use. With too much national control, for example, indigenous groups would lose their right to contract with a pharmaceutical company for the use of their knowledge. In an ideal world, the national government might assume that right and make sure that the local community is compensated equitably, but in most countries the retention of local control is more likely to achieve the social objectives.

In any event, where private biodiversity prospecting is allowed, governments should protect the public interest by regulating access to the resource, charging appropriate fees and using the revenue so generated to support conservation and rural communities near protected wildlands.

The need for user fees is relatively clear on public lands but somewhat problematic when applied to biodiversity collected on private lands. Almost all countries, for example, consider plants growing on private land to belong to the land-owner, though wild animals are the property of the state. Individuals can cut a tree on land they own without the state's permission but—because wild animals move across property lines—must follow state regulations governing the harvest of wildlife.

The issue of ownership and access to genetic and biochemical resources is closer to that of the right to harvest wild animals on private lands than to that of plant ownership. When an individual cuts and sells a tree, nothing prevents another individual from cutting another tree of the same species on adjacent land and selling it. Only the first individual who sells a chemical extract that is later developed into a drug will receive the economic benefit associated with the discovery and associated property right.

Thus, following the same policy that governs the harvest of wild animals, nations should not allow all rights to these resources to be 'bundled' with private property rights in land. While local land-owners may regulate access to the resource and charge collecting fees, local and national governments should also regulate the exploitation of these resources and charge user fees where appropriate.

Technology policy

Their long-term contribution to economic development, conservation and the equitable sharing of benefits from genetic resources may be greatest if biodiversity-prospecting policies foster the development of national capacity in biotechnology. Efforts that do not will fall victim to the historical mistakes of other export industries based on raw materials in developing countries.

A narrow focus on the sharing of returns on the sale of products derived from biological material is misguided. This approach can give developing countries financial incentives to conserve biodiversity, but even longer-term benefits will stem from technological co-operation and capacity building in science and technology. For this reason, biodiversity prospecting should be considered part of the larger issue of national biotechnology policy and should be treated as a capacity-building activity. IPRs do not pose as great an obstacle to access to new technologies as is often feared. Most of the technologies needed by developing countries to build capacity in these fields are already in the public domain. The obstacle is *not* proprietary rights, despite the attention they receive in international debates.[43]

IPRs should be viewed as a tool for enlarging technological capacity in developing countries. IPR regimes established without due consideration of the need for effective legal, political and economic systems conducive to private business activity and the protection of private property rarely serve their stated ends.[44] IPR protection—tailored to a nation's development needs—can foster advances in technological innovation, but that protection must be coupled with other institutional changes to increase knowledge of public domain technologies, upgrade technical training and provide access to the credit needed to develop new technologies and markets.

Even small countries with limited industrial capacity can move to the frontiers of biotechnology in specific fields by enhancing their human resource capacity. By investing in training, establishing systems that provide ready access to information about both biodiversity and new technologies and seeking ways to add value to genetic resources through screening and characterization, developing countries can turn short-term economic benefits into a long-term development strategy.

International agreements

A central theme of this chapter is that a variety of national and sub-national actions and policies can help biodiversity prospecting contribute to sustainable development. Rather than relying strictly on multilateral agreements, therefore, countries, institutions and individuals can use contracts, institutional design, national legislation and common sense to steer the evolution of biodiversity prospecting institutions. Some have even argued that na-

tional policies and bilateral agreements like that between Merck and INBio are sufficient and that no multilateral action is necessary. In 1992, the US used this argument as one justification for its refusal to sign the Convention.

In fact, multilateral agreements are necessary for several reasons. First, by themselves, bilateral biodiversity-prospecting agreements are likely to result in conservation and development benefits for only a limited number of countries. Countries that are quick to enter the market as suppliers of biodiversity and that have the necessary technical capacity to compete may reap substantial gains. For most developing countries—and the bulk of the world's biodiversity—multilateral mechanisms are needed to provide financial and technical support for biodiversity conservation and technological development.

Second, the value of many of the economic benefits provided by biodiversity—clean water, healthy ecosystems, aesthetic pleasure—is not fully reflected in the market, so market-based strategies like biodiversity prospecting can only complement public sector financial support for conservation. While some of these benefits are strictly local or national, others—like the maintenance of healthy forest and marine ecosystems—are global and justify multilateral action.

Third, multilateral agreements will help increase the benefits that source countries can derive from their genetic resources. As suppliers of biodiversity saturate the market, the price for genetic and biochemical resources will fall. The interests of source countries could be better served if uniform conditions were developed through multilateral agreements to govern access to biodiversity. On the other hand, the ability of source countries to form effective genetic and biochemical resource cartels is probably limited. The demand for biochemical resources for the pharmaceutical industry, for example, is likely to be very elastic in response to price changes. Today's resurgence in natural products research is due in part to the decline in costs resulting from new screening technologies. If the price for access to natural products rises, pharmaceutical firms could respond with increased investment in synthetic chemistry and reduced investment in natural products research. In principle, the establishment of cartels is more likely in the case of genetic resources used in agriculture, but the relatively low value of the seed industry (compared to the pharmaceutical industry) could mean that the costs of creating a cartel, restricting the flow of crop genetic resources and pursuing royalties and payments for these resources might easily exceed the economic benefits. Short of a cartel, though, countries could agree to establish minimum obligations for companies engaging in biodiversity prospecting.

Fourth, multilateral agreements can help level the playing field so that bilateral agreements can be negotiated fairly. Clearly, institutions in develop-

ing countries may have less negotiating experience than multinational corporations. Under a multilateral agreement, mechanisms could be established to provide information, legal advice or the services of an ombudsman to help ensure equitable negotiations.

Many developing countries also lack the ability to effectively regulate access to genetic resources within the country. Without such capacity, laws requiring collecting permits or user fees could easily be circumvented by international collectors. By requiring prior informed consent of the source country for access to biodiversity, the Convention will help shift some responsibility for enforcement to the developed countries. Parties to the Convention, for example, could pass laws requiring that gene or biochemical patent applications within their country include evidence that the material in question was collected with the prior informed consent of the source country.

Finally, an international agreement such as the Convention on Biological Diversity sets the stage for a 'Grand Bargain' whereby developing countries would seek strengthened IPRs so as to profit from their biological resources while the developed world would concede the possibility that each nation may tailor its intellectual property laws to meet its own conservation, development and equity needs. Rather than weakening intellectual property laws—a fear that the US cited when it refused to sign the Convention—this new bargain is likely to strengthen them.

Notes

1. This chapter is excerpted from Reid *et al.*, 1993b.
2. That is, the private returns of conserving the resource are less than social returns.
3. Oldfield, 1984.
4. Farnsworth, 1988.
5. See DiMasi *et al.*, 1991; Collinson and Wright, 1991.
6. McChesney, 1992; DiMasi *et al.*, 1991; Principe, unpublished ms.
7. These five include Taxol, the most promising drug of the decade for treating breast, ovarian and lung cancer. Sears, 1992.
8. This estimate is based on his 1979 calculation (Barton and Christensen, 1988) of the US mark-up of seed sales derived from proprietary protection, extrapolated to the 1990s and to the global market (totalling US$1.5 to 2 billion). With a 5-per cent royalty returning to the suppliers of the genetic material, this would amount to US$75 to US$100 million. See Barton, 1991.
9. Lisansky and Coombs, 1989.
10. Even this figure may be conservative. At a January 1986 workshop involving representatives of American and Swiss pharmaceutical companies involved in plant-based drug development, a consensus was reached that the probability of any plant yielding a *marketable* pharmaceutical (not simply a 'lead') ranged from one in 1,000 to one in 10,000 (Principe, pers. comm., 1993).

11. Clearly, a local crop variety bred by farmers is an 'improved' variety even though it has not been commercialized. Similarly, the investment that a nation makes in conserving wild species or in inventorying and identifying its species arguably results in an 'improvement' in that species analogous to that made by commercial breeders.
12. The costs and benefits of intellectual property regimes have been debated at length. By using the creation of a monopoly right to correct for a market failure, governments create new economic inefficiencies in the hopes of removing more serious ones. In one notable case of abuse of this right, a British subsidiary of Hoffman-La Roche was found to be claiming costs of US$925 and US$2,305 per kilo for materials available in Italy (where no patent protection was available for pharmaceuticals) at US$22.50 and US$50 per kilo, respectively, to justify artificially high drug prices (Boone and Mathieson, 1990).
13. Evenson, 1990.
14. See Brockway, 1988; Juma, 1989.
15. All UPOV members were West European until 1978. Since that time, other countries, including Australia, Czechoslovakia, Canada, Hungary, Israel, Poland, South Africa and the US, have joined, and some developing countries are considering joining.
16. US Supreme Court, 1980, 447 US 303.
17. Roberts, 1992.
18. See Chudnovsky, 1983; Lesser, 1990.
19. See Lesser, 1990; Barton, 1991.
20. Typically, drugs developed from natural products are altered from their natural forms during the drug development process, and these derivatives are also patentable. The trail of patents filed during drug development can help in determining whether wholly or partially synthesized drugs originated from natural precursors.
21. Mooney, 1983; Fowler and Mooney, 1990.
22. NIH *et al.*, 1992, p. 3.
23. Sochaczewski, 1992.
24. Gámez *et al.*, 1993.
25. WRI *et al.*, 1992.
26. A number of companies now recognize the need for conservation in their policies, but generally, support for conservation is contributed through philanthropic foundations associated with the company.
27. Laird, 1993.
28. Sedjo, 1988, 1992.
29. Gollin, 1993a.
30. Sittenfeld and Gámez, 1993.
31. Kokwaro, 1976.
32. Several professional societies are developing ethical guidelines seeking to ensure that the rights of holders of traditional knowledge are respected and that just compensation is provided to local communities for access to such information.
33. Mooney, 1983; Elisabetsky, 1991.
34. Brush, 1991.
35. Fowler and Mooney, 1990.
36. WRI *et al.*, 1992.
37. See Laird, 1993; Janzen *et al.*, 1993.
38. Janzen *et al.*, 1993.

39. Kloppenburg Jr. and Rodriguez, 1992.
40. Sedjo, 1990; Simpson, 1992.
41. Janzen *et al.*, 1993.
42. This difference in treatment might raise red flags under international trade agreements. On the other hand, many countries already have two-tiered user fees for access to national parks, with foreign nationals paying higher fees than local residents.
43. See Juma, 1993.
44. Evenson, 1990.

PART V

IMPLEMENTATION MEASURES

15

Financial mechanisms and biotechnology transfer

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The final text of the Convention on Biological Diversity was agreed upon at a meeting in Nairobi on May 22, 1992. During the same meeting, the delegates agreed on the procedures for adopting the Convention. These procedures are outlined in a document entitled 'Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity: Nairobi Final Act.' In accordance with this document, the United Nations Environment Programme (UNEP) has established an Intergovernmental Committee on the Convention of Biological Diversity consisting of four panels which cover priorities for conservation and sustainable use of biological resources, evaluation of potential economic effects, transfer of technology and financial mechanisms, and elements necessary in the protocols of the Convention on Biological Diversity

This chapter discusses some important issues regarding the third panel—that on technology transfer and financial mechanisms—and points out some of the difficulties ahead. The terms of reference include: 'Development of the policy, strategy and programme priorities, as well as detailed criteria and guidelines for eligibility for access to and utilization of the financial resources, including monitoring and evaluation on a regular basis of such utilization.'[1]

Evaluation of the benefits from biodiversity will be an on-going, evolving process and no definite answers can be given. Because of the complexity of estimating the benefits from use of genetic resources and the possibility of

double counting, there is a strong need for multidisciplinary co-operation which includes both social and natural scientists.

Genetic resources have without doubt been strongly undervalued historically, and the current system of Gross National Product (GNP) accounting excludes the value of genetic resources as a productive force. This gives little incentive to national governments to preserve biodiversity for future generations. Subsequently, it has given rise to a system in which genetic resources have been regarded as common heritage and without commercial value for the supplier.

The International Working Group on the Benefits of Biodiversity appointed by UNEP proposes to develop an agreed accounting system as part of the preparation of country studies on costs, benefits and unfulfilled needs of biodiversity conservation. The Group also proposes to estimate the market asset value of biodiversity stocks by identifying the magnitude of the present value of the expected future income stream obtainable from the sustainable use of these biological resources.[2] The purpose of the valuation exercise is to determine the 'real' value of genetic resources, and enhance economic incentives for biodiversity conservation. The UNEP proposal differentiates between local, national and global benefits from biodiversity.

This chapter is concerned with the global financial implications of the Convention. The intention is not to design an elaborate plan for the management of finances, but rather to point out the main development issues involved in financing the Convention and to discuss the obstacles to fair and equitable financial mechanisms in line with the intentions of the Convention.

The chapter begins with a review of the status of the financial negotiations at the United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro in June 1992, and then discusses the function of the Global Environment Facility (GEF) and its role as a financing mechanism for the global aspects of biodiversity conservation. It then analyses the financial implications of national sovereignty over genetic resources. It starts with the provisions of the Convention and then in general terms discusses the bargaining positions of suppliers and users of genetic resources. Finally, options for operating a system of compensation for access to and use of genetic resources are discussed. It concludes by analysing the dreams and realities of biotechnology transfer.

Financial negotiations during UNCED

Throughout the UNCED process, many means of finding new and additional financial resources were sought and discussed in various fora, as requested in UN resolution 44/228 of 1989. Unfortunately, innovative initiatives such as 'tradable emission permits' and fiscal measures such as carbon dioxide

energy taxes did not provide new sources of finance. The industrialized countries were asked to acknowledge their ecological debt to the South. A compromise was reached in which both the North and South are committed to a common but differentiated responsibility.[3]

The question of finance ended as traditional development assistance, allowing major ideological conflicts about the distribution of natural resources to be avoided. This situation led to the hope that a commitment to the United Nations official development assistance target of 0.7 per cent of GNP could be reached within the agreed time-frame before the end of the decade (Nordic and G-77 proposals). Only four countries (the Scandinavian countries and Holland) have met this target. Since Rio, however, some of these countries have actually begun reducing their levels of official development assistance,[4] and the UK has frozen at the nominal level. This is due to the economic recession, evolving financial constraints and rising levels of unemployment in most of the donor countries.

Rio ended without setting a schedule for reaching the 0.7 per cent target. 'As soon as possible' was all the industrialized countries could commit themselves to. The three major contributors pledged the following amounts: The European Community (EC) promised approximately US$4 billion over a period of 3–5 years; the United States promised US$250 million; Japan promised to raise its financial support for environmental purposes by 50 per cent to approximately US$1.4–1.5 billion annually. This amounts to around US$4 per citizen in Japan and the EC, compared to US$1 per US citizen. The entire amount contributed at UNCED annually equals some US$.75 per inhabitant of the Third World.

One sparkle of light appeared recently when a large majority in the Danish parliament decided to increase development assistance to one per cent and commit another 0.5 per cent of the GNP by the year 2000, solely for UNCED purposes. The additional funds do not bear the condition of basic human needs. This means that these funds can be distributed in countries with particularly low *per capita* income and in middle-income countries as anticipated in the principles of GEF.

Scope and governance of GEF

The World Bank acts as trustee for the funds, administers the investment projects and chairs GEF. The United Nations Development Programme (UNDP) is responsible for technical assistance and is the administrator of the Small Grants Programme, which is a budget line for non-governmental organizations (NGOs). UNEP supplies the environmental expertise for the projects and houses the secretariat of the independent Scientific and Technical Advisory Panel (STAP). STAP consists of 21 scientists and researchers.

GEF began in an experimental three-year pilot phase; a transition follows[5] in order to ensure a smooth passage into the operational phase. The projected budget for the pilot phase is US$1.2 billion, with US$880 million in the core fund and US$345 million as co-financing. It consists of 32 member states, half of which are developing countries, with a US$760 million in a core fund from European donors. Japan and the USA have committed US$150 million each, both with a set of special conditions.[6]

Of the four focal areas, biodiversity projects have in the initial period until May 1992 received proportionally more finance than planned by the Participatory Assembly. The choice of these four focal areas for GEF has been criticized for favouring the interests of the industrialized countries and transnational corporations. The chairman of STAP, Dr. Robert Watson, claimed at the NGO meeting in December 1990, that this choice was the result of a political process and that STAP would have chosen differently.[7]

The search for a financial mechanism suitable for financing the results of the UNCED process, and specifically the global environmental conventions, led in April 1992, to a restructuring of the GEF. This should enable 'the GEF to serve as the funding mechanism for the global environmental conventions and the inclusion within the GEF of desertification and deforestation as they relate to the four focal areas.'[8] The extension of the scope of the GEF can be seen as a concession to many African countries which were promised negotiations for a desertification convention by 1994. It was decided at the Participant Assembly in April 1992 that only partners of the conventions could receive funding. Membership of GEF is not required.

Throughout 1992, the democratic structure suitable for a mechanism which envisions universal membership and manages billions of dollars was discussed. Neither the United Nations General Assembly (one country, one vote) nor the Bretton Woods model (vote proportional to financial contributions) meets the requirements of an efficient, accountable and democratic mechanism based on the principles of transparency and equitability. References have been made to the structure of the Montreal Protocol with an extended model of constituencies complemented with a system of 'double majority' when consensus cannot be reached and a vote is necessary. At the GEF Participant Assembly in Abidjan in December 1992, the tendency was that such an arrangement would best serve the purposes of GEF. Progressive proposals of mixed constituencies (common interests in, for instance, minimizing the consequences of climatic change, or like-minded donors together with parts of the Third World) only led to confusion.

The GEF Participant Assembly in Abidjan focussed its discussions on governance of the on-going restructuring process; it stressed that 'linkages

with the conventions are the axis about which the restructuring of the GEF must turn'.[9] Co-operation between the secretariats of GEF and the Climate Convention, and between their respective technical and scientific advisory panels was discussed in Geneva shortly after the Participant Assembly meeting in Abidjan. There is no doubt about the wishes for strong participation of the parties to the conventions on crucial matters such as making guidelines for projects.

Primacy of the conventions is also a basic principle in the joint NGO proposal for the structure and governance of GEF presented before the GEF Participant Assembly in April 1992. The NGOs propose dispute resolution mechanisms in the event of a conflict between the mandate of the conventions and the GEF.[10] It seems too early to judge the role and influence of the NGOs. The formulations on public participation in the various UNCED documents are, to a certain extent, being taken seriously. An NGO budget line provides funds, although they are very limited. At the decision-making level, NGO meet for consultation preceding the semi-annual Participatory Assemblies. An important criticism is that public participation is dominated by NGOs based in the North.

UNEP has recently taken the initiative at a conference on biodiversity held in Costa Rica to seek co-ordination of the different bilateral and multilateral efforts to promote sustainable development through the creation of national environment action plans. These are now a condition precedent to obtaining funds from the International Development Authority (IDA). GEF participated in the conference and reaffirmed its willingness to assist developing countries in the formulation of their action programmes and strategies under the conventions. This was an attempt to initiate a research programme with the intention of defining a global list of priorities in order to effectively target the various sources of funds. This was strongly opposed by many developing countries, on the basis of national sovereignty. The sensitivity of the subject was proved by the threat by these countries to leave the Convention.

The adequacy of GEF as administrating and funding mechanism for the elements of global significance in the Convention, as for the Framework Convention on Climate Change and potentially for a desertification convention, depends to a great extent on the relations between the parties to the conventions, the PA of GEF and the respective secretariats and advisory panels. It is thus important that the drive towards a more democratic discussion process in the PA continues. PA should seek to work under consensus. Universal membership should be top priority in the final year of the pilot phase, and the alertness of the participating countries should be secured through the use of 'checks and balances'. The independence of the advisory panel of GEF is also a priority.

The GEF has so far had some experience in such fields as education, research, institutional strengthening and public awareness of the value of biodiversity. The bulk of the projects are concerned with conservation and sustainable use of biological resources in tropical forests and coastal areas. GEF–financed biodiversity projects have been criticized for being narrowly focussed on conservation as opposed to sustainable use of biological and natural resources. Another criticism of GEF–financed biodiversity projects has been that they do not sufficiently involve local communities and NGOs.[11] It may be too early to criticize GEF, as it is still in its initial stages and many of its projects have not yet started. With the strong presence of the World Bank as implementing and co-sponsoring agency, however, one cannot help but express concern.

In March 1994 the PA adopted the Instrument for Establishment of the Restructured Global Environment Facility. It remains to be seen to what extent the restructured GEF will meet the expectations of the developing countries and respond to the criticisms mentioned above.

Financial aspects of sovereignty over germplasm

One of the key demands for developing countries was establishment of the principle of national sovereignty over biological resources. In the Convention, this principle is repeated frequently and provides the basis for any future negotiations on access to and use of genetic resources.

Articles 15–19 of the Convention determine the conditions for access to genetic resources and mechanisms for compensation for such access. Article 15 establishes three principles for access to genetic resources: national sovereignty over genetic resources; access to genetic resources and prior consent on the basis of mutually agreed terms; compensation. The Convention establishes three mechanisms by which a party can benefit from the use of genetic resources by private corporations or public institutions: participation in research programmes; transfer of technology; sharing of financial benefits.

Many developing countries have abundant biological resources but lack scientific and technological capacity to adequately evaluate and exploit them. According to the first mechanism discussed in the Convention, users of genetic material are obliged to involve Contracting Parties as participants in research programmes using genetic resources. Articles 15 states, 'Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties.' Article 20 provides: 'Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, to provide for effective participation into technological research activities by those Contracting

Parties, especially developing countries, which provide the genetic resources for such research and where feasible in such Contracting Parties.'

Greater involvement of developing countries in research programmes undertaken by industrialized countries is perhaps the easiest of the three obligations to fulfill. It should be noted, however, that the Convention strictly stipulates 'Contracting Parties', that is, national governments, and thus does not apply automatically to the large part of research undertaken by the private sector. The involvement of scientists from developing countries in private sector research programmes in the industrialized countries will only take place after mutual agreement.

The second mechanism deals with transfer of the technology that is used to exploit genetic resources. In Article 16, the principles of transfer of technology are established:

> Each Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of the Convention, undertakes subject to the provisions of this Article to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and does not cause significant damages to the environment.

Articles 16 and 18 deal with technology that can contribute to conservation and sustainable use of genetic resources and biodiversity. These include biotechnology such as diagnostic kits, genetic mapping using techniques including enzyme-linked immunosorbent assay (ELISA), restriction fragment length polymorphism (RFLP), polymerase chain reactions (PCR) and tissue culture methods of rapid reproduction of endangered species. These are related to Article 13, paragraph two:

> Access to and transfer of technology referred to in paragraph 1 above to developing countries shall be provided and/or facilitated under fair or most favourable terms, including on concessional and preferential terms where mutually agreed, and where necessary in accordance with financial mechanism established by articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights.

It should be emphasized again that the Convention places obligations on the Contracting Parties alone, that is, governments in accordance with and respect for existing intellectual property right laws. In most industrialized countries, governments have very limited legal powers to transfer technology which is patented by private companies. If such transfer does not take place in connection with a specific private company's access to and use of

genetic resources, and after mutual agreement, the private sector has little incentive to invest resources in transferring technology. Certainly not the latest research results.

The third mechanism outlined in the Convention is sharing the financial benefits realized from commercial use of the genetic resources. The terms for sharing such benefits are stated in paragraph seven of Article 15 and paragraph two of Article 19:

> Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, in accordance with Articles 16 and 19 and where necessary through the financial mechanism established by Articles 20 and 21 with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.

> Each Contracting Party shall take all practical measures to promote and advance priority access on a fair and equitable basis by contracting parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting Parties. Such access shall be on mutually agreed terms.

From the above articles, it is clear that after the ratification of the Convention, a private company will have to share 'in a fair and equitable way the benefits arising from the commercial and other utilization' with the country which provided the genetic resource. This will be on 'mutually agreed terms'. Obligations of a more general nature lie on each Contracting Party, which through its jurisdiction may place obligations on private companies.

There are three major factors which *a priori* weaken the bargaining position of developing countries. First, obligations to compensate only apply if the genetic resources originate from a particular country. Article 15 paragraph three states: 'For the purpose of this convention, the genetic resources being provided by a Contracting Party, as referred to in this Article and Articles 16 and 19, are only those that are provided by Contracting Parties that are countries of origin of such resources or by parties that have acquired the genetic resource in accordance with this Convention.' From this, it should be apparent that a large portion of the existing genetic material will continue to be freely accessible, as it grows in countries outside country of origin. Potatoes, for example, originally from the Andes Mountains in Peru and Bolivia, are grown in most countries in the world. A major part of the world's diversity of potato varieties, including its wild relatives, today only exist *in situ* in these countries and are of great value for plant breeding. A great deal of diversity has been transferred to other

countries. This will definitely undermine the bargaining position of Peru and Bolivia.

Secondly, there is no obligation to compensate for access to and use of genetic resources collected before the ratification of the Convention, including all genetic material which is currently accessible from genebanks. The European NGO, Genetic Resources Action International (GRAIN), which has been very active throughout the UNCED process, characterizes this as an enormous loophole in the Convention. On the contrary, it is difficult to imagine an international convention with retroactive effect. Moreover, this non-retroactive character of the Convention has been regarded by the private sector as a necessary condition for its acceptance and operation.[12] This was indeed one of the recommendations which came out of the Swedish International Development Authority (SIDA) consultations.

GRAIN's prediction that the non-retroactive character of the Convention will provide a loophole for corporations which seek to avoid paying compensation for access to and use of genetic resources will most probably prove to be true if nothing is done to counteract it. Concurrent with the ratification of the Convention, the genebanks must, in order to maintain their credibility and integrity, refuse to distribute germplasm from Contracting Parties if it is readily available *in situ* in that country. The purpose of this change will of course be to avoid the undermining of the source country's bargaining position.

The Convention recognizes that other international legal obligations will have an impact on the success of efforts. This is in reference to the section on intellectual property rights (IPRs) in Article 16, which states: 'The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.'

A representative of Ciba-Geigy Ltd. has recently argued:

> It will be difficult to fully implement the provisions of the Biodiversity Convention to the benefit of those countries providing genetic resources in the absence of world wide intellectual property rights . . . The country providing genetic resources can only have access to derived technology on preferential terms, compared with all other countries, if applicable IPR systems serve to limit or control the use in other countries. Without IPR systems, every other country will be free to exploit the technology without cost, meaning that the country providing will have a non-preferential position and less financial benefit.[13]

As indicated above, private corporations will be very hesitant to transfer patented technology to developing countries which do not recognize IPRs

and will almost certainly, as part of the mutual agreements, demand that IPRs are respected.

There are two different approaches to building institutions capable of channeling and controlling compensation for access to and use of genetic resources from the appropriate users to the appropriate suppliers by the mutual agreement of all parties involved. It would seem simplest to develop a system that builds on direct mutual agreements between individual users—private companies—and specific suppliers—developing countries. To become operational, such a system would have to be based on the supplier's ability to control the flow of germplasm. This would either entail that each country should develop its own genebanks, or that the suppliers of germplasm command control over its use from the established genebanks. There are great practical problems related to both of these options and any solution would have to encompass the two. One can imagine that such a system would open fierce competition between different suppliers of genetic resources, as most genes are likely to be located in a number of countries.

In the absence of a supplier's ability to control the flow of germplasm, one could instead think in terms of control of the use of genetic resources, to make the companies using genetic resources accountable to the countries of origin. Registration of the flow of genetic resources is bound to become an administrative and technical nightmare, if it is to be based on a thorough account of all access and use. This would be even more so if the biotechnological industry that uses a specific DNA sequence of a given germplasm is included. A DNA sequence with a desired characteristic may be available in a number of different plants, and a growing number of desired sequences are available from databanks and can be reproduced synthetically.

A less administratively demanding approach would be to retain the existing free flow of germplasm but to levy a charge on the access to and use of genetic resources by commercial companies. Registration of access to and use of genetic resources could then be based on thorough accounts of selected representative users and on an extrapolation of the collected data. A system based on registration of users and where the genetic resources originate will have to be developed to determine who is to pay what to whom and who is to benefit. The size of payment could vary for different user groups and could be proportional to turnover and profit.

The registration of genetic resources is analogous to the existing copyright system for books, records, compact discs and computer software. In Denmark, an institution called CopyDan has the mandate of registering the volume of copying of protected material and demanding compensation for the copyright-holder. All Danish institutions are liable to pay US$.15 per A4 photocopy of Danish copyright protected text. As it is impossible to check each individual institution, CopyDan estimates the average use of

photocopying based on a thorough account of copies taken by a selected sample of different types of institutions throughout a year. These institutions are liable to pay the estimated amount to CopyDan. From the collected data, CopyDan then determines the number of copies taken of which authors and copyright-holders and on this basis sends payment of the appropriate amount. While such a system functions reasonably well for use by public institutions, in a well-organized country, it would be much more complicated and demanding to make a similar system function globally for both private and public access to and use of genetic resources.

Transfer of biotechnology

The link between access to plant genetic resources from developing countries and transfer of biotechnology from industrialized countries was an important issue for developing countries and NGOs at UNCED. The South has argued that the concept of common heritage for plant genetic resources has meant in practice the free flow of varieties from the South to the North. The conflict between North and South has been sharpened by changes in industrialized countries with regard to increasing privatization of research and the establishment of IPRs over research results together with the growing importance of biotechnology.

Most developing countries do not recognize IPRs—patents or PBRs—for plant genetic material. The pressure on them to do so, however, is likely to increase significantly as the GATT negotiations come to an end. Regardless of the outcome of these negotiations, developing countries which do not introduce and honour an IPR regime—in terms of paying royalties, licensing fees and so on—more or less identical to that of industrialized countries are likely to face retaliation. The only practical implication of the controversy in GATT is that if the current proposal on IPRs is rejected, the question will remain a bilateral matter and not be accepted as a GATT issue.

The Oslo Keystone Consensus Report 'expresses strong concern about the imposition of intellectual property right for plant genetic material through GATT or bilateral trade negotiations' and recommends 'that every country has the right to decide whether and to what extent' to adopt IPRs.[14] Some portions of the scientific communities have, however, expressed doubt about the importance of IPRs as a constraint to the access to biotechnology. They claim that as most scientific research findings—patented or not—are available from public universities or scientific journals, technological development is a question of a developing country's technological capacity, rather than a question of denied access to transfer of technology due to patent protection.[15] That situation may change, of course, but currently, the potential of public domain technologies is far from fully exploited.

Developing countries now have to re-evaluate the negative implications of introducing IPRs. Whether they decide to do so or not should remain their choice. Regardless of what they decide, IPRs will remain a factor to be dealt with in any assistance involving plant biotechnology. The particular design of assistance activities must be different, however, depending on the particular country in question. Many of these questions should be subject to research before any decisions are made.

Standard norms for concessional and preferential terms for transfer of technology need to be agreed upon through the drafting of protocols and changes to laws and administrative practices since the Convention is now in force. Support for enhancing the biotechnological training and research capacity in developing countries will be an important element of such agreements. Most developing countries, however, are not ready for genetic engineering; the disciplines involved are not mastered, and many practical problems constrain its development, such as its vulnerability to a lack of a single chemical because of bureaucratic obstacles or limited access to foreign currency. Thus, with regard to advanced biotechnologies, the vast majority of Third World countries will remain dependent on industrialized countries. It is, however, important to realize that substantial areas of biotechnology are relatively inexpensive to implement in terms of capital costs and are only knowledge-intensive. Developing countries differ with respect to biotechnology capacity.

It is important to emphasize that biotechnological capacity is more than technical capacity; it includes adequate institutions, legislation, macro-economic environment—issues whose details are beyond the scope of this chapter.

Capacity assessment

There is a need for further development of a much more comprehensive model for biotechnological capacity assessment. It must be founded on the understanding that assessment of biotechnological R&D capacity requires adequate expertise in all fields of science; institutional links integrating this expertise; integration of research into the sphere of production in both industry and local agriculture; co-operation between private and public sectors; adequate legal, administrative and policy-making framework. Each developing country must also determine national needs and decide how much to invest in biotechnology relative to other agricultural R&D, what commodities to invest in and what technologies are appropriate to needs. Current biotechnological R&D is dominated by the private sector in industrialized countries. It is guided by market considerations and thus to a very limited extent directed towards the diverse conditions of small-scale farmers in the Third World who are inaccessible and have limited purchasing power.

The public sector needs to be involved heavily if biotechnology is to be made available in forms useful for major agriculture in developing countries. In most countries, this presupposes donor support, not only to increase their own biotechnology R&D capacity, but also to facilitate access to expertise and research results.

The technological capacity to take advantage of technological development differs greatly, within developing countries. A handful of developing countries are taking a leading position and committing substantial resources to creating R&D programmes and infrastructure. Among these are Argentina, Brazil, China, Cuba, India, Mexico and Thailand. Important lessons can be learned from the mixed experience of these countries by fellow developing countries which are yet to develop fields of biotechnology. Important lessons for countries and donors who want to develop biotechnology research capacity can be learned from the few 'early starters' in terms of the importance of selecting priority areas, concentrating skills and resources and identifying the required infrastructure and personnel.

Plant biotechnological innovations vary according to the level of technical expertise required. Even if the most advanced genetic engineering proves to be relevant for solving agricultural problems, for most developing countries it is only possible to use ready-made systems and, if necessary, adapt them to local needs. Techniques such as embryo transplant are only mastered by the more advanced developing countries of Asia and Latin America. Utilization of high quality enzymes is also widespread in these countries, though the enzymes are imported. The technologies of fermentation, plant tissue culture, biological control agents, microbial inoculation and agricultural diagnostic kits are easily transferable and are either already mastered and used or considered to be appropriate for application.

Development of national biotechnological research capacity in developing countries is not an easy task. Biotechnological science and applied technology are multidisciplinary and interlinked and thus require the establishment of coherent teams of qualified and specialized scientists. Advanced biotechnology cannot be handled if one field of expertise is missing or weak. This is often the case in many developing countries, especially in sub-Saharan Africa, in the basic sciences of microbiology, molecular genetics and process technology.

Biotechnological research is limited by shortage of trained manpower and funds, a backward industrial structure and a deficient infrastructure. The scientific and technological institutions in sub-Saharan Africa are only weakly integrated into the sphere of economic production, and links with private enterprises are often non-existent. The links between small-scale farmers' production systems and publicly funded scientific institutions are

also weak. These institutions continue to be oriented more towards the norms and values of international science than towards developing relevant solutions for low-resource/low-management conditions.

Before embarking on biotechnology R&D, a capacity assessment should be undertaken pertaining to the particular level of technology. It should include adequateness of expertise, institutional linkages, links integrating research and the productive spheres, co-operation between private and public sector institutions, physical and economic infrastructure; legal, administrative and policy-making framework. For each element both existing capacities and potentials for development must be assessed. On this basis, tentative stages can be outlined, through which biotechnology research and capacity may be developed. It is noteworthy that most of the prerequisites are of an institutional character. It is highly pertinent, therefore, for donors in the field of biotechnology to provide both technical and institutional support, in accordance with the results of such capacity assessment.

National and international research

Because of the weak national biotechnological research capacity of many developing countries, the International Agricultural Research Centres (IARCs) could play a crucial role in providing the necessary coherent multidisciplinary teams of qualified specialists in molecular biology, genetics and so on. In recent years, the responsibility and capacity of the Consultative Group on International Agricultural Research (CGIAR) to strengthen national agricultural research systems (NARS) has been an issue of discussion and controversy. This has implications for assessing the role of the CGIAR with regard to agricultural biotechnology in relation to the NARS.

A recent analysis of the changing role of the CGIAR system states that while a number of donors would like to see the CGIAR system play a more active role in strengthening national systems, including administering research assistance, the Technical Advisory Committee (TAC) prefers to maintain the principle that CGIAR centres are primarily research institutes. In order to prevent the weak state of many national systems from hampering the effectiveness of the research from CGIAR centres, TAC is willing to compromise another CGIAR principle, namely, that the CGIAR centres should primarily be responsible for conducting strategic and applied research. It thereby accepts that the eco-regional entities should engage in the adaptive research for which many national systems are currently considered too weak.[16]

The report recommends that rather than engaging in adaptive research and thus being a substitute for national research, the CGIAR system, for example through the International Service for National Agricultural Research (ISNAR), should direct genuine attention to identifying the actual needs for

strengthening the national research systems, and to facilitate donor support to NARS.

Support to biotechnology R&D in developing countries may also, however, be given in the form of support to the CGIAR system and its IARCs. For many poor countries, the only feasible way to enhance weak plant biotechnology research capacities is through improving IARC ability to supplement and support the work of the NARS. This should enable the IARCs to:

- acquire a scientific lead in important fields to retain their role as alternative channels of access to advanced, strategic and applied research results for developing countries;
- be partners—'honest brokers'—to developing countries in accessing private sector research in developed countries;
- help in identifying the needs for strengthening NARS and possibly private enterprises under IARC leadership.

There is no doubt that the CGIAR centres do have something to offer in the area of biotechnology; on the other hand, it is difficult to assess the assistance from the CGIAR centres to the national research systems' functions. It remains a crucial question whether biotechnology will change the relationship between the CGIAR system and NARS.

Agricultural research in developing countries will be affected by two recent trends in industrial countries: increasing private sector participation in agricultural research and the narrowing gap between basic science and applied research. Poorer countries normally relying on public channels to obtain new technologies free of charge are likely to find the cost of access to advances in science and technology sponsored by the private sector beyond their means. Thus, IARCs may assume greater importance as means of access for poor developing countries through the development of technology appropriate for resource-poor farmers. More technologically advanced developing countries may be able to negotiate access bilaterally.

If the IARCs are to remain in the forefront of tropical agricultural science, they must develop susbstantive biotechnology programmes. To do this, reallocation of some existing resources and additional targeted funds are necessary.

A recent World Bank paper on agricultural biotechnology recommends that to modify research strategies in favour of biotechnological research and undertake biotechnology projects, the IARCs must create or strengthen:

- in-house expertise to monitor, choose, adapt and utilize new products and processes;
- ability to acquire, on their own or on behalf of developing countries, new technologies from the public or private sector in industrial countries, under suitable licensing or royalty arrangements;

- skills to develop collaborative research programmes with public and private sector enterprises in both industrial and developing countries; (This will require legal and financial skills not commonly available at the centres.)
- capacity to integrate biotechnology into existing programmes, particularly plant breeding support for complementary research;
- biosafety guidelines.[17]

In its statement on genetic resources and intellectual property, a working document adopted at the 1992 mid-term CGIAR meeting in Istanbul, the CGIAR states that while it recognizes both PBRs and the concept of farmers' rights, it remains a fundamental objective of the CGIAR to ensure access to knowledge, technology and materials in the interest of developing countries. Therefore, material at the centres' genebanks will continue to be freely available in accordance with the 1989 CGIAR policy on plant genetic resources. The CGIAR, however, also acknowledges that modern biotechnology is becoming an important tool for the centres. Therefore, they need to collaborate with a wide range of agencies, public and private, increasingly protecting their inventions through IPRs. On the basis of these two possibly conflicting objectives, the following compromise was reached, specifying under which particular conditions a centre might seek intellectual property protection of innovations. It may also do this if it is absolutely necessary. This is in order to ensure access by developing countries to new technologies and products. Intellectual property protection may not be used to generate incomes. On a case-by-case basis and carefully considering advantages, disadvantages, costs and benefits, a centre may still deem it necessary to seek some form of IPR protection of an invention. Such a decision will reflect the centre's own priorities and concerns as well as those of collaborators and partner nations. The decision will be motivated by the need to:

- establish collaborative research with advanced laboratories;
- ensure product development and distribution;
- forestall pre-emptive protection of CGIAR technology by others.

Finally, any IPRs acquired will be exercised without compromising in any manner whatsoever the fundamental position of the CGIAR regarding free access by developing countries to knowledge, technology, materials and plant genetic resources.

It has already been pointed out that co-operation with the private sector is a precondition for developing plant biotechnology research capacity in Third World countries. Therefore, changes must be made in the pattern of assistance to agricultural research which encourage:

- effective assessment of research priorities;
- local investments in agricultural biotechnology;

- equity funding to facilitate risk sharing;
- public/private partnerships;
- support for training in biology.

The CGIAR system may thus come to play an even more important role in the future as a mediator between developing countries and private biotechnological companies in industrialized countries. The CGIAR centres could play the 'honest broker' by assisting developing countries in working directly with private companies.

A strengthening of CGIAR biotechnology capacity, in some cases to the extent of gaining a lead in state-of-the-art biotechnology, is therefore crucial, both for the IARCs to retain their role as independent, alternative channels of access for NARS to technology R&D, and as partners helping NARS to access private sector research results. Much of the technical skills in applying biotechnology to agricultural production problems reside in the private sector in industrialized countries. Developing countries thus need to seek collaborative research and implementation agreements between public and private sectors and across international borders. International development agencies can help by facilitating transfer of information and techniques, and ensuring that the policy design includes measures to make these benefits available to all developing countries.

Notes

1. Nairobi Final Act, Resolution 2(g).
2. UNEP, 1992b, p.11.
3. UN resolution 44/228.
4. Sweden and Norway—though both are still above 0.7 per cent.
5. GEF Participatory Assembly (PA), Abidjan, December 1992.
6. Letter from USAID to GEF administrator, October15, 1992.
7. Shiva, 1992.
8. GEF Chairman's Report, December 1992—GEF, 1992b.
9. GEF Chairman's Summary of December, PA, Dec. 5, 1992—GEF, 1992c.
10. GEF Chairman's Report, December, 1992, annex iv—GEF, 1992b.
11. Written comments from participating governments in Chairman's Report, December, 1992—GEF, 1992b. See also, Abugre, 1992; *The Biotechnology and Development Monitor*, 1992.
12. See *Seedling*, July, 1992, p. 2; Duesing, 1992, p. 20.
13. Duesing, 1992, p. 23.
14. Keystone Center, 1991.
15. Khalil *et al.*, 1992.
16. Ravnborg, 1992.
17. World Bank, 1991; Persley, 1990a, 1990b.

16 National domestication of the Convention on Biological Diversity

J.B. OJWANG

Background

From ancient to modern times humankind has depended for survival and for comfort on extant rich varieties of flora and fauna. Humankind has relied on fauna and flora for food, apparel, shelter, health, mobility and recreation. Less population pressure and a low degree of technological sophistication in ancient times may have allowed for a harmonious co-existence between human beings and the surrounding fauna, flora and microbes. With improvements in technology and the attendant population growth of the post-Industrial Revolution era, non-human life has borne the brunt of unsparing economic exploitation, with the result that the closing years of the 20th century have revealed the destruction of biodiversity as one of the most serious cases of environmental damage. Unless reversed, this will have catastrophic consequences for present and future generations.[1]

So incredibly vast are the numbers of species and genes constituting biodiversity that contemporary research covers but an infinitesimal part. However, important studies have been done on those aspects of the subject which impinge directly on human life. Some basic facts emerging from such studies (and having a bearing on this study) may be summarized here. Biological diversity refers to the variety of living organisms existing at the levels of genetic diversity, species diversity and ecosystem diversity. Such living organisms interact in a complex manner in the environment, co-existing symbiotically, influencing the general environment itself and thus

determining the kinds of resources that humankind may have access to on a continuing basis; they are the main source of raw materials used in agricultural, medicinal and industrial innovation. The natural cycles of biodiversity are affected where there is habitat destruction, habitat fragmentation, introduction of exotic species, climate change, pollution, unsustainable economic activities, the spread of monoculture crops or forest plantations. Biodiversity is unevenly distributed, geographically, the poorer countries of the tropics having vastly more species than the more affluent countries of the higher latitudes—a fact which inverts the burden of and capacity for conservation in relation to available resources. Approximately 2,500 species of vertebrate organisms and some 50,000 higher plant species (this being 20 per cent of the total) are threatened with extinction or survive only in dwindling populations.[2]

Humankind, through wanton environmental degradation, is taking away the natural resources that directly support life. Even more serious are the changes to life on Earth which must take place because of the economic activities being pursued. The increasing levels of greenhouse gases (such as carbon dioxide, methane and chlorofluorocarbons) are destined to cause major climate changes which in turn will destroy the bulk of biodiversity in the course of time. The effect of a significant increase in global temperature, as is being predicted for the next half-century, would 'lead to large impacts on individual organisms, communities, natural ecosystems and global biochemical cycles and have potentially grave impacts on biodiversity.'[3]

The dire realities described above are recognized and addressed in different ways by virtually all the countries and environment-related international organizations of the world. There are numbers of impediments to current international and national endeavours to conserve biodiversity, but an international legal framework for the conservation of biodiversity does exist. A domestic framework of environmental protection is needed to link up with the international set-up.

Treaty law prior to 1992

There are at present more than nine-score multilateral treaties and other international agreements for the protection of the environment[4]—a clear indication of the global concern about accelerating rates of environmental degradation, about the internationalized nature of the crisis, and about the imperatives of co-operation in the tasks of environmental conservation. It is also an expression of hope and trust in the juridical form of the *treaty* as a device of management and control. Of these treaties, approximately 30 per cent deal with biodiversity in full or in part. The fact that such a high proportion of treaties deals with biodiversity underlines the

interconnectedness of the environment. There are large and profound interfaces between the condition of the air, bioresources, soil and water,[5] and all of them go to determine the fact and extent of biodiversity.

The many environmental treaties could, for convenience, be grouped under biodiversity, cultural and natural heritage, environment and development, forest resources, health and safety, marine and coastal resources, marine and river pollution control, nuclear energy and materials, ozone layer, peace and environment, toxic and hazardous substances, transboundary pollution, water resources and working environment. Many of these treaties touch on biodiversity at some point because they address living species and genes, or habitat (the central factors in the existence of biodiversity), or because they are concerned with some economic or social practice, some physical or geochemical condition that affects living organisms or their habitat with good or ill consequences.

Table 3 lists the global treaties prior to 1992. The 13 treaties fall under two separate categories: those which deal squarely with the conservation and prudent management of fauna, flora and habitat (nos. 2, 3, 4, 5, 7, 10, 11); and those which are concerned with wider environmental issues, but which include an aspect of biodiversity (nos. 6, 9, 12, 13).

Table 3 Global treaties before 1992: A sample

Treaty/agreement	Place signed	Date adopted
1. Convention Relative to the Preservation of Fauna and Flora in their Natural State	London	November 8, 1933
2. International Convention for the Regulation of Whaling	Washington, DC	December 2, 1946
3. International Convention for the Protection of Birds	Paris	October 18, 1950
4. International Plant Protection Convention	Rome	December 6, 1951
5. Convention on Fishing and Conservation of the Living Resources of the High Seas	Geneva	April 28, 1958
6. Convention on the High Seas	Geneva	April 29, 1958
7. Convention on Wetlands of International Importance Especially as Waterfowl Habitat	Ramsar	February 2, 1971
8. Convention for the Conservation of Antarctic Seals	London	June 1, 1972
9. Convention Concerning the Protection of the World Cultural and Natural Heritage	Paris	November 23, 1972
10. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Washington, DC	March 3, 1973
11. Convention on the Conservation of Migratory Species of Wild Animals	Bonn	June 23, 1979
12. United Nations Convention on the Law of the Sea	Montego Bay	December 10, 1982
13. International Tropical Timber Agreement	Geneva	November 18, 1983

The Convention Relative to the Preservation of Fauna and Flora in their Natural State was in certain respects the harbinger of international legal protection of biodiversity, even though its coverage was highly selective and its membership greatly limited. Its objective was to preserve the natural fauna and flora of certain parts of the world, particularly of Africa. Under this Convention, the parties were required to ensure control of human settlements in national parks with as little disturbance as possible to the natural fauna and flora; and establishment of intermediate zones around the borders of national parks (Article 4). The safeguards provided for fauna and flora applied throughout the colonial territories then held by some of the states parties. The Convention had an annex with lists of species to be strictly protected, and those to be partially protected. The Convention prohibited certain hunting methods and regulated national and international trade in trophies (Article 10). In practice, the Convention led to the establishment of some of the most famous national parks in Africa: Kagera Park, Uganda (1934); Gorongosa Park, Mozambique (1936); Garamba Park, Zaire (1938); Tsavo Park, Kenya (1948); Kafue Park, Zambia (1950); Serengeti Park, Tanzania (1951).[6] The Convention entered into force on January 14, 1936, and drew only ten parties. It has been substantially superseded by later conventions (such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the African Convention on the Conservation of Nature and Natural Resources, 1968).

The International Convention for the Regulation of Whaling was designed to protect all species of whales from overfishing, and to safeguard for future generations the substantial natural resource represented by whale stocks. It established an International Whaling Commission to co-ordinate measures of conservation and regulation (Article III). The Convention has a schedule which lists whale species and makes rules as to whaling seasons, methods and geographical areas. The Convention entered into force on November 10, 1948, and to date has 45 parties.

The International Convention for the Protection of Birds seeks to protect birds in the wild state. Such protection is to be accorded to all birds during their breeding season, to migrants during return flights to nesting grounds and to species which are in danger of extinction or which are of scientific interest (Article 2). An obligation is placed on each party to prepare a list of birds which may be lawfully killed or captured in its own territory and a list of species of indigenous and migratory birds which may be kept in captivity (Articles 8 and 9). The Convention entered into force on January 17, 1963 and to date has about a dozen parties.

The objective of the International Plant Protection Convention, which entered into force on April 3, 1952, and which has about a hundred states

parties, is to maintain and increase co-operation in the control of pests and diseases of plants and plant products, and to prevent their introduction and spread across national boundaries. Its importance in the regime of biodiversity is that it seeks to maintain healthy growth and flourishing conditions for plants. Under this Convention, the parties undertake to provide legal, technical and administrative arrangements for the protection of plants (Article 1). They also undertake to make regional co-operation arrangements involving the Food and Agriculture Organization (Article 2), and to provide for strict regulation of the import and export of plants and plant products through inspection, prohibition and even destruction of consignments (Article 6). Each party is required to establish a plant protection agency for inspecting areas under cultivation, and consignments in international traffic, to issue certificates relating to phytosanitary conditions and origin, and to carry out research (Article 4). Membership of the revised text of the Convention in 1991 was about seventy states.

The Convention on Fishing and Conservation of the Living Resources of the High Seas has the basic objective of using the medium of international co-operation to solve problems involved in the conservation of the living resources of the high seas. A major consideration is that modern techniques of exploitation expose such living resources to the risk of decimation, in the absence of greater responsibility on the part of states. The Convention places an obligation on all states parties to adopt measures (and to co-operate with other states in the application of such measures) necessary for the conservation of the living resources of the high seas. States whose nationals participate in fishing in the high seas are required to subject such nationals to measures of conservation (Articles 1 and 3). The Convention is directly concerned with the maintenance of biodiversity, and in particular with reference to the relatively scarce fish and marine-life populations of the high seas. The Convention entered into force on March 20, 1966, and to date has a membership of about forty.

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat came into force on December 21, 1975, and has drawn more than fifty parties. A Protocol of Amendment (entailing largely procedural additions) was adopted in Paris on December 3, 1982, and has about forty parties. The Convention seeks to stem the progressive encroachment on and loss of wetlands, especially in view of the fundamental ecological functions of these sites and their economic, cultural, scientific and recreational value. The Convention places a duty on parties to designate at least one national wetland of international importance and to assume responsibilities for the conservation, management and wise use of migratory stocks of wildfowl (Article 2). Parties are required to establish wetland reserves and to co-operate in the exchange of information facilitative of wetland

management (Article 4). Wetlands, under the Convention, are defined as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres' (Article 1(1)). The importance of such sites was previously unknown, and many countries supported drainage operations for opening up new agricultural lands. The position now is that:

> Wetlands contribute to curbing the effects of floods, by temporarily storing large amounts of water; they refill water-tables and help to maintain water quality by fixing polluting substances and sediments. They are thus a vital element in the water cycle. *But their biological role is just as important, for they are highly productive. They are inhabited by very numerous plant and animal species of which many are of considerable importance as food for man. A large number of sea fish, crustaceans and molluscs depend on coastal wetlands such as estuaries, coastal marshes, lagoons or mangroves, for at least part of their life-cycle, for they spawn, grow or simply come to die there.*[7]

The Convention for the Conservation of Antarctic Seals seeks to promote and achieve the protection, scientific study and rational use of Antarctic seals; it also aims to maintain a satisfactory balance in the ecological system of the Antarctic. The Convention was adopted out of a general concern about the vulnerability of Antarctic seals to commercial exploitation. It applies to seas south of 60°S latitude, to five species of seals and to all southern fur seals. The Convention includes an annex specifying measures that may be taken by the parties, but it is open to them to take other measures with respect to the conservation, scientific study and rational and humane use of seal resources. Such other measures may prescribe matters such as permissible catch, species, seasons, areas, limits to sex, size and age (Article 3). The Convention entered into force on March 11, 1978, and to date has just over a dozen parties.

CITES seeks to protect certain endangered species from over-exploitation by means of a system of import/export permits. It is concerned with animals and plants, alive or dead, as well as any recognizable parts or derivatives of such plants or animals (Article 7). Appendix I to CITES sets out the species in respect of which trade is to be stringently controlled; Appendix II lists species that are likely to become endangered unless trade in them is regulated; Appendix III gives the parties discretion to submit to the secretariat particulars of species to be included in the protected category (but a species can be withdrawn from the protected list (Article 16)). The role of CITES in the conservation of biodiversity is selective—being concerned only with those particular species seen to be endangered. Such an approach has a tendency of protecting only the more remarkable

members of the animal and plant kingdoms. It does not address damage to such species outside the framework of international trade. The Convention entered into force on July 1, 1975, and to date has drawn more than a hundred parties.

The Convention on the Conservation of Migratory Species of Wild Animals seeks to protect those species of wild animals that migrate across national boundaries. By this Convention, the parties protect migratory species from becoming endangered (Article II(2)), and they undertake to promote, co-operate in and support research relating to migratory species (Article II (3)(a)). Appendix II is to include migratory species which have an unfavourable conservation status and require international agreements for their management. The Convention entered into force on November 1, 1983, and currently has 30 parties.

The conservation of biodiversity is contained in four global treaties, which focus on more than just the environment. The Convention on the High Seas seeks to codify the rules of international law relating to the high seas. It also protects marine life with its prohibitions on pollution of the high seas which are the habitat of some marine life (Articles 24 and 25). This Convention entered into force on September 3, 1962, and to date has drawn about sixty parties.

The Convention Concerning the Protection of the World Cultural and Natural Heritage seeks to establish an effective system of collective protection of cultural and natural heritage of outstanding universal value. *Natural heritage* is defined as

> natural features consisting of physical and biological formations or groups of such formations which are of outstanding universal value from the aesthetic or scientific point of view; geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals or plants of outstanding universal value from the point of view of science or conservation; natural sites or precisely delineated areas of outstanding universal value from the point of view of science, conservation or natural beauty (Article 2).

States parties undertake to ensure that effective and active measures are taken for the protection and conservation of the cultural and natural heritage situated in their territories (Article 5). The Convention establishes the World Heritage Committee, which is to receive from the parties inventories of property forming part of the cultural and natural heritage, and situated in their respective territories, that are suitable for inclusion in the protected list (Article 11(1)). On the basis of such submissions, the committee is to keep an up-to-date 'World Heritage List' which includes some of the most spectacular sites in the world: Grand Canyon, Everglades and Yellowstone National Parks in the United States; Galapagos Islands in

Ecuador; Simien National Park in Ethiopia; Serengeti National Park and Ngorongoro Crater in Tanzania. Apart from their remarkable character as national heritage, such sites may be expected to be the home of unique flora, fauna and micro-organisms, which benefit from the protection afforded under the Convention. The Convention, therefore, provides a framework for the conservation of natural as well as man-made phenomena.[8] The Convention entered into force on December 17, 1975, and currently has more than a hundred parties.

The United Nations Convention on the Law of the Sea has a broad objective—that of setting up a comprehensive legal regime for the sea—but it also devotes a number of its articles to the conservation of the living resources of the sea. It provides: 'The coastal state, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation.'[9] The Convention also places restrictions on pollution of the seas,[10] a further element in favour of the growth of biodiversity. This Convention has not yet entered into force but already has some fifty parties.

The International Tropical Timber Agreement seeks to provide a framework for co-operation and consultation between countries producing and those consuming tropical timber, to promote the expansion and diversification of international trade in tropical timber and the improvement of structural conditions in the timber market. The Agreement also encourages members to support and develop industrial tropical timber reforestation, forest management activities, national policies aimed at sustainable utilization and conservation of tropical forests and their genetic resources, and the maintenance of ecological balance in the regions concerned (Article 1 (f) (h)). The Agreement entered into force on April 1, 1985, and to date has about fifty parties.

Limitations of information about or of sensitization to the complex issues of biodiversity during most of the 20th century may have led to relative inactivity in promoting an international legal framework for regulation. The period from 1950 is marked by a growing interest within the international community in the use of law as an approach to the conservation of biodiversity. It appears that 46 per cent of the treaties were primarily concerned with the economic value of biodiversity—that is, economic activity would be endangered unless a regulatory framework was put in place for ensuring the steady supply of the species in question. Most of the species affected by the regulatory measures were marine and coastal species. In this category are treaties 2, 5, 6, 8, 12 and 13 (Table 3). Only 39 per cent of the earlier treaties were concerned with the conservation of nature and biodiversity, either as an end in itself or for the

scientific reasons relating to the unity of nature's processes. Most of the species affected were terrestrial species. In this category are treaties 3, 4, 7, 9 and 11 (Table 3). The remaining 15 per cent of the pre-1992 treaties had critical elements of *both* of the other categories. The main beneficiaries of protection were terrestrial species. The treaties are nos. 1 and 10.

For most of the treaties, participation by states has been limited. This is unfortunate, considering the importance of large-scale international co-operation in the scheme of objects defined by the treaties. The only exceptions are treaties 4, 9 and 10, each of which has attained at least a hundred memberships.

Owing to the very nature of the treaty-making process, which brings together numbers of participants with some special interests in a specific agenda, it is not surprising that there rarely is a common machinery of co-ordination between one treaty and another. In some respects, the treaties considered above necessarily contain overlaps in subject matter. For example, the subject originally covered by the Convention Relative to the Preservation of Fauna and Flora in their Natural State (1933) is now the subject of other treaties, even though there was no formal repeal of that Convention, and there is significant overlap (especially as regards biodiversity) between the Convention on the High Seas (1958) and the United Nations Convention on the Law of the Sea (1982). This dislocation in the operational design of the treaties is accentuated by significant differences in level of participation and the secretariat arrangements for each treaty.

Subject to their various limitations (as already indicated), the global treaties have served as the main device for the regulation of broad-based environmental matters, such as those represented by biodiversity. However, a far larger number of regulatory arrangements, for the environment in general and biodiversity in particular, have been made under regional treaties (see Table 4).

In the category of multilateral regional biodiversity treaties, there are more than two dozen treaties with a general environmental focus. Some three dozen have a specific species-conservation focus—the relevant species being fish and other marine resources (over 20), birds (one), plants (three) and animals (six). (See Table 5 for a sample.)

The obligations of the regional treaties are attached mainly to parties in particular ecological zones, and no doubt, such undertakings create a laudable normative framework for the conservation of biodiversity. This object has benefited significantly under the Regional Seas Programme (RSP), which has been promoted by the United Nations Environment Programme (UNEP) since the early 1970s. The RSP is concerned with marine conservation, and at present has already realized eleven projects.

Table 4 Some regional treaties with general environmental focus

Treaty	Place signed	Date adopted
1. African Convention on the Conservation of Nature and Natural Resources	Algiers	September 15, 1968
2. Convention on the Conservation of the Living Resources of the South-East Atlantic	Rome	October 23, 1969
3. Treaty for Amazonian Co-operation	Brasilia	July 3, 1978
4. Convention on the Protection of the Marine Environment of the Baltic Sea Area	Helsinki	May 3, 1980
5. Regional Convention for the Conservation of the Red Sea and the Gulf of Aden Environment	Jeddah	February 14, 1982
6. Benelux Convention on Nature Conservation and Landscape Protection	Brussels	June 8, 1982
7. Convention for the Protection of the Natural Resources and Environment of the South Pacific Region	Noumea	November 24, 1986

Table 5 Some regional treaties with specific species-conservation focus

Treaty	Place signed	Date adopted
1. Agreement Concerning Measures for Protection of the Stocks of Deep-Sea Prawns (*Pendalus borealis*), European Lobsters (*Homarus vulgaris*), Norway Lobsters (*Nephrops norvegicus*) and Crabs (*Cancer pagurus*)	Oslo	March 7, 1952
2. Plant Protection Agreement for the South-East Asia and Pacific Region	Rome	February 27, 1956
3. International Convention for the Conservation of Atlantic Tunas	Rio de Janeiro	May 15, 1966
4. Benelux Convention on the Hunting and Protection of Birds	Brussels	June 16, 1970
5. Convention for the Conservation and Management of the Vicuna	Lima	December 20, 1979
6. Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific	Wellington	November 23, 1989

Just as the global biodiversity conservation treaties represent a positive approach to the problem of environmental degradation, so do the regional treaties facilitate a realistic micro enterprise focussed upon ecological zones. However, both categories of treaties share the weakness that they involve crucial resources that apply in economic productivity, and the operative political systems are not always able to translate the requirements of the treaties into sacrosanct positive law. Notions of national sovereignty, which link up with considerations of economic and political self-interest, also tend to weaken the application of international environmental norms.[11] Moreover, as Malcolm Forster has noted, the conservation of biodiversity does not fit into the mould of general international law—at least with regard to *enforcement*:

> If, in the field of international trade, for example, State A imposes on the products of State B an import duty which B regards as being in contra-

> vention of the international agreements which regulate trade between them, State B may adopt as a counter measure similar duties on goods being imported from A. *This crude but effective device is rarely available in the conservation field.* If the United Kingdom . . . wishes to encourage or browbeat Brazil into protecting Amazonian rain forests, it will hardly further the UK's objective of promoting habitat conservation to threaten that, for every hectare of Amazonian rain forest destroyed in Brazil, the UK will fell a hectare of ancient woodland in its own country![12]

Besides, the developing countries, which occupy most of the lower latitudes where biodiversity abounds, have serious difficulties in providing the basic economic and administrative infrastructure that will facilitate the effective operation of the conservation treaties. In addition, the underdevelopment in these countries tempts them to condone compromises to international conservation norms. As Ogolla observes:

> The state of underdevelopment in Africa and the imperative of rapid economic transformation that flows from it not only undermines the political will to initiate, implement and enforce appropriate environmental policies and laws but also implies limited resources (human, financial and technical) for the effective implementation of environmental laws. Thus, water and air pollution by industry is tolerated because of the imperative of rapid industrialization, the need to earn foreign exchange, and the desire to create and maintain employment for growing populations. Further, *the encroachment of agriculture and human settlements on vital biodiversity habitats is tolerated simply because it may not be politically expedient to take action against violators.*[13]

The Convention on Biological Diversity, 1992

Adede observes that the growth of international environmental law has two basic phases. The first phase deals mainly with 'first generation issues': pollution of water, air and soil resulting from industrial activities, poverty and underdevelopment. The second phase (which has come to the fore especially since the United Nations Conference on the Human Environment held in Stockholm in 1972) deals with 'second generation' environmental issues: global warming, acid rain, depletion of the stratospheric ozone layer, loss of biodiversity, sustainable development.[14]

The second generation issues form the centrepiece of the work of the Brundtland Commission, published in the report, *Our Common Future*, in 1987, but the concrete global step in addressing those issues has taken form with the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, the forum of initial signature of the Convention.[15]

UNCED's concern was 'to promote the integration of environment and development policies, through effective international agreements and in-

struments especially taking into account the needs and concerns of the developing countries.'[16] Such are new ideas in international relations. Because of their broad sweep, it was impossible for the UNCED agenda to be a narrow, legalistic one; it was, in effect, an agenda for *change in human behaviour*. To quote Adede:

> The *Earth Summit* in Rio . . . [was] about environment and development. But there is a primary emphasis on development and economic change. For it is through the development process that we carry out activities with impact upon the environment. It is also through fundamental changes in our economic behaviour, in lifestyles and in management or development processes that we can effect the positive synthesis between the environment and development that will produce life that is sustainable, both in economic and environmental things. The challenge is that we have to make the necessary efforts towards the transition to sustainable development.[17]

The UNCED may be regarded as the third landmark in the recent development of international environmental law, counting from the Stockholm Conference (1972), followed by the Brundtland Report (1987). But for the law of biodiversity, UNCED is a triple landmark: firstly it has coincided with the inauguration of the Convention on Biological Diversity, a major addition to the pre-existing body of global and regional environmental law (already discussed); secondly, it has coincided with the adoption of Agenda 21, a detailed plan of action adopted by UNCED, for now and long into the 21st century (and which has a full chapter on biodiversity); and thirdly, UNCED coincided with the adoption of the United Nations Framework Convention on Climate Change.[18]

The Convention on Biological Diversity took arduous negotiations to finalize. While the developing countries of the lower latitudes have in most cases lived in extreme poverty, they have at the same time housed the bulk of the world's biodiversity. The main economic advantages of this endowment have accrued to the industrialized countries because of their monopoly on sophisticated technology. More recently, the developing countries have become increasingly sensitized to issues of international economic arrangements that operate against them. They are particularly concerned about the manner in which such arrangements touch on the true economic significance of their genetic resources. This development has had a bearing, firstly, on the global interest in the maintenance of biodiversity, secondly on the sensitive economic interests of the developed countries and thirdly on doctrinal orientations regarding property rights—especially in relation to the transfer of environmental technology from the developed to the developing countries.[19] Developed countries have generally treated their property rights as regards technology as entirely

sacrosanct, yet much of the material base of such technological advances has come from species and genes emanating from developing countries. When developing countries express reservations on issues of this kind, the *general legitimacy* of entrenched legal concepts and procedures of the affluent countries is brought into question; the matter becomes overwhelmingly one of international *equity*, which ought to be negotiated on the basis of objective fact and of empathy. This is the essential puzzle that formed the background to the Convention.[20]

The Convention has a long preambular section in which it cites, *inter alia*, the Contracting Parties'

- consciousness of the intrinsic value of biodiversity, and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biodiversity and its components;
- consciousness of the importance of biodiversity for evolution and for maintaining the life-sustaining systems of the biosphere;
- recognition that states are responsible for conserving biodiversity and for using their biological resources in a sustainable manner;
- concern at the current reality and rate of erosion of biodiversity from anthropogenic sources;
- recognition that it is vital to anticipate and restrain the causes of loss of biodiversity at source;
- recognition of the absolute importance of conserving biodiversity *in situ;*
- acknowledgement of the importance of *ex situ* conservation measures, preferably in the country of origin;
- recognition of the experience and knowledge (relevant to conservation) gained from a close dependence of many indigenous communities upon biological resources;
- recognition of the vital role of women in the conservation and sustainable use of biodiversity;
- recognition of the importance of regional and global co-operation among states and intergovernmental organizations as well as non-governmental organizations, in the conservation of biodiversity and the sustainable use of its components;
- recognition that economic and social development and poverty eradication are the first and overriding priorities of developing countries;
- acknowledgement of the need for an international sharing in genetic resources and technologies, as a formula for better production of food and health needs;

- determination to conserve and sustainably use biodiversity in the interests of present and future generations.

These citations of principle and purpose convey the message which determines the content of this important Convention, which has 166 signatures and came into force in December 1993.

The main body of the Convention has three kinds of provisions: those which carry specific legal responsibilities, those which prescribe general political and moral obligations, and those which provide institutional arrangements for the operation of the Convention. The first type of provision must be regarded as a basic element in any national law such as may be enacted, as it gives the framework and scope for positive law. The second category need not expressly form part of the domestic law as it is largely in the domain of *policy*, but its spirit should imbue all administrative or diplomatic arrangements made in respect of the Convention. The third category is intrinsically international and need not be the subject of domestic law. It is evident that this chapter should be largely confined to the first category of provisions. The other categories will be referred to only where they closely relate to the specific mandate of the Convention that lends itself to domestic legislation.

Article 3 attempts to reconcile proprietary doctrine with conservation obligations: 'States have . . . the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of areas beyond their national jurisdiction.' Subject to this general principle (which derives from ordinary international law[21]), each Contracting Party is required to 'make domestic arrangements for the conservation and sustainable use of biodiversity, or to adapt existing strategies, plans or programmes and integrate these into relevant sectorial or cross-sectorial policies.[22]

The Convention proceeds on the basis that effective national protection of biodiversity is not possible in the absence of research and essential information. Therefore each party is required to identify components of biodiversity important for its conservation and sustainable use; use sampling and other techniques to monitor these components, and acquire and monitor information on the kinds of activities which have adverse impacts on the conservation and sustainable use of biodiversity. As an approach to the discharge of these obligations, the Convention calls for the establishment of procedures requiring environmental impact assessment of proposed projects which are likely to have significant adverse effects on biodiversity. When the necessary information has been acquired by this method, the states parties are required to take appropriate redressive measures.[23]

An obligation is placed on the Contracting Parties to pursue *in situ* conservation, by such means as (Article 8):

- establishing special protected areas;
- formulating guidelines for the management of such protected areas;
- managing and regulating biodiversity even outside the protected areas;
- protecting ecosystems and natural habitats, and maintaining viable populations and species in their natural surroundings;
- ensuring environmentally sound use of areas adjacent to protected areas;
- rehabilitating degraded ecosystems and promoting the recovery of threatened species;
- restraining organisms modified through biotechnology from invading and disrupting the natural environment of biodiversity;
- suppressing alien species which threaten ecosystems, habitats and species;
- accommodating the imperatives of conservation of biodiversity within the requirements of short-term use of resources;
- conserving knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biodiversity, and promoting the application and equitable sharing of these;
- putting in place legislative and regulatory measures for the protection of threatened species and populations.

The Contracting Parties undertake to complement measures of *in situ* conservation with *ex situ* conservation arrangements. They are required in this regard (*inter alia*) to:

- maintain facilities for research and *ex situ* conservation in respect of plants, animals and micro-organisms;
- adopt measures for the recovery and rehabilitation of threatened species and their return to their natural habitats;
- regulate the mode of collection for *ex situ* conservation so as not to disrupt the ecosystem (Article 9b–d).

On the domestic level, the Convention also requires a different category of legal provisions—those which will facilitate co-operation with other states, and generally favour the growth of an atmosphere conducive to the conservation and sustainable use of biodiversity. In this category are legal provisions regulating access to genetic resources, governing the sharing of benefits from research and development, regulating terms of transfer of technology, and of indigenous technology, and reconciling operative intellectual property law with the Convention's obligations.[24]

Domesticating the Convention

Article 22(1) of the Convention states: 'The provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, *except where the exercise of those rights and obligations would cause a serious damage or threat to biological diversity.*' The emphasis is added where this statement gives the impression that the inter-governmental negotiating team were of the view that some of the existing treaties might compromise the conservation goals of the Convention; in which event the rights provided for under the earlier treaties would stand qualified. Such qualification would affect only those countries which were parties to earlier conventions as well as to the Convention.

As already noted, the earlier conventions have approached the subject of species conservation from a *sectorial* standpoint; they occur at random points in time, and there is no general co-ordination for their schemes of operation. This characteristic sets them apart from the Convention, the conception of which greatly benefited from recent scientific studies, as well as current experience in matters of international co-operation. The square focus of the Convention on all issues critical to the conservation of biodiversity and its overwhelming support by practically all states of the world place it in a special class as one international norm that will deserve unexceptional global implementation. The success of this endeavour would satisfy any omissions such as may have existed in earlier conservation treaties.

Hence, there is justification for this preoccupation with the national scope for the implementation of the provisions of the Convention. This is the reason for the present attempt to map out a scheme for domestic legislation in fulfilment of the provisions of the Convention. Large-scale compliance with the requirements of the Convention will significantly advance the cause of species conservation. The machinery for such compliance should ideally be built into the *constitutional-framework* of the states parties so as to make it part of routine governmental obligation.[25] While it is true that states in most cases merely undertake (by their acts of signature and ratification, and sometimes by declaration) to abide by a treaty as a matter of general public commitment, for such a critical subject having to do with numerous situations of daily management, it is essential that the states parties should enact domestic laws governing the subject. Thus an attempt is made here to summarize (from facts emerging from the study, and from the provisions of the Convention) the critical elements that should go into domestic legislation.

Elements of a model law

Model legislation which reflects the spirit of the Convention should guide itself through directive principles set out in a preamble. The subject matter calls for commitment and purpose, on a scale transcending the laconic provisions of statute. The preamble should draw on the general historical context in which the Convention was adopted. It should contain three to five statements, which recall the objects of biodiversity conservation, underline the grave dangers attendant on loss of species, and reaffirm the desirability of incorporating the principles of the Convention into domestic law and the regular constitutional process.

The body of the statute should comprise six basic parts, namely: (i) a preliminary section; (ii) a section on biodiversity research; (iii) a section on *in situ* conservation; (iv) a section on *ex situ* conservation; (v) a section on administration of the legislation; (vi) a section on general matters.

Part I (on preliminary matters) of the statute should deal with such matters as the description of title, plan for entry into force and interpretation. Under interpretation, recurring terms such as *biological diversity*, *ex situ conservation*, *in situ conservation* should be defined, for ease of use.

Part II (on biodiversity research) should set out the research tasks on biodiversity which have to be regularly conducted, specifying agencies and indicating how findings are to be fed into the policy and administrative machinery of the state. Research tasks should include the following:

- taxonomic studies on the country's fauna, flora and microbes;
- compilation of comprehensive inventories on the country's fauna, flora and microbes;
- investigation of national distribution patterns for fauna, flora and microbes;
- assessments and forecasts of the viability of biological species;
- proposition of measures for the conservation of biodiversity;
- studies on endangered species and recommendation for rehabilitatory action;
- research on ecosystems and habitat, and assessment of their stability and viability;
- recommendations for restoring depleted habitat and ecosystems;
- genetic research on flora, fauna and microbes;
- recommendations on ways of stabilizing and enhancing gene varieties;
- biotechnology research;
- maintenance of herbaria and genebanks for research purposes;
- compilation of annual research reports, for general information and for necessary administrative and legislative action.

Part III (on *in situ* conservation) should place a duty on the executive authority to establish special protected areas in the country, in accordance with conservation needs expressed in annual research reports. Protected areas of this kind should include forest areas, wetlands, national parks and marine parks. Guidelines should be set out for the management of such protected areas and for dealing with any threats to them. The guidelines should provide for the role of environmental impact assessment for all projects that are likely to have an adverse impact on existing conservation measures. They should provide for environmentally sensitive use of land and other resources in the neighbourhood of protected areas. They should provide for the prudent management of biodiversity even in areas that lie outside conservation areas, for example, through restriction of agriculture, prospecting and mining. They should provide for the control of any artificially raised species, or alien species, so that they do not infiltrate the natural species and ecosystems and disrupt their normal balances. The guidelines should impose an obligation to rehabilitate degraded ecosystems and to restore their habitat and species diversity. The guidelines should provide for the conservation of indigenous or local experience and knowledge, with regard to the harmonious co-existence of human beings, other species and habitat.

Part IV (on *ex situ* conservation) should prescribe obligations for the recovery and rehabilitation of threatened species. It should also deal with the methods that may be applied in the collection of species for *ex situ* conservation.

Part V (on administration) should provide for the role of a government authority and any public agency in the handling of research findings and in the performance of the various obligations created. It should indicate the working relationship between different public agencies that may be set up for the fulfillment of obligations of species and habitat conservation.

Part VI (on general provisions) should deal with such matters as the relationship between this statute and other statutes; it should impose prohibitions on certain kinds of conduct, prescribe penalties; protect national species and gene repositories against adulteration or unauthorized access.

The foregoing sketch of the elements of a model law does not pretend to be exhaustive; it proposes some direction for the kind of domestic legislation that may enable a state party to systematically pursue the goals prescribed. The sketch does not, moreover, claim to be the sole approach to biodiversity legislation aimed at domesticating the Convention. Indeed, those countries which have relatively more sophisticated biological research infrastructure may prefer separate sectorial legislation (for example, on species, genes, habitat), to the integrated model being proposed here. The model proposed might serve developing countries best.

Problems and prospects

As already argued, a domestic law on the pattern described will give states parties the capacity to vindicate their political will (as supporters of the Convention), by applying their efficacious constitutional machinery to perform the required actions. With a ready domestic capacity to secure action on the obligations of the Convention, its highly positive project can be given effect quickly to the great advantage of environmental security in general and of biodiversity in particular.

However, the facility of ready use of the domestic constitutional machinery will not dispel all the problems that marked the negotiation process of the Convention. The *poverty* question repeatedly raised by the developing countries (who house the dominant proportion of biodiversity) remains; these countries are likely to encounter major difficulties in perfecting the essential researches that will yield the data necessary for the effective management of biodiversity. Even if they had the best research results, most developing countries would be unable to raise the funding necessary for conservation programmes. Moreover, the best intentions of these countries are likely to be undermined by the temptation to turn some of their elements of biodiversity to direct economic advantage so as to meet basic needs of their people and to maintain their machinery of governance.

In theory, the developed countries should not encounter such difficulties; they should be able to adopt domestic legislation and to use it to give overwhelming vindication to the objectives of the Convention. In practice, it remains true that the norms embodied in the Convention have an 'external' provenance (the global negotiation forum) which has not in all cases taken account of domestic economic (and attendant political) pressures. The domestic situation in these countries will be the first preoccupation of the national constitutional machinery (which thrives on the hackneyed principle of *national sovereignty*). This entails the internal autonomy of each state and its right to manage domestic matters and handle foreign and international affairs with an incontestable prerogative over its self-interest, national attributes and national preferences. Such a signification has a negative impact on international goals which, as Ralph Pettman observes, 'have, for the moment at least, been conspicuously trumpeted by a doctrine [sovereignty] so ruthless and so easy to apply'.[26] Other candid perspectives on sovereignty now view it as deserving of a more benign re-orientation. Michael Akehurst has written:

> In so far as "sovereignty" means anything in addition to "independence", it is not a legal term with any fixed meaning, but a wholly emotive term. Everyone knows that States are powerful, but the emphasis on sovereignty exaggerates their power and encourages them to abuse it; above all, *it*

> *preserves the superstition that there is something in international co-operation as such which comes near to violating the intrinsic nature of a "sovereign" State.*[27]

Tagged to the restrictive notions of sovereignty is the practice of adherence to legal doctrines that would limit the possibilities of technological assistance to poor countries, making it uncertain that the developing countries truly will benefit from the environmental technology of the developed countries, as envisaged by the Convention.

There is also a problem arising from fundamental notions of liberalism, still cherished in the social and political life obtaining in the developed countries. These notions are built around *self*, and individual good; they form the very core of the ideology of the operative political systems. Though one must acknowledge the enlightenment and the good faith of the governments of these countries, which have been so instrumental in the conception and negotiation of environmental treaties such as the Convention, one must recognize the contradictions that will mark attempts to *share* with developing countries. The logic is self-evident from the words of Mark Sagoff:

> Those who support a cost-benefit approach to social regulation . . . consider the welfare of the individual to be the major desideratum of public policy. They often appeal for support to individualistic concepts that are central to the institutions of a liberal society, such as private property, personal freedom, and individual choice. Environmentalists . . . would base social regulation on shared or public values, which may express not our wants and preferences as individuals but our identity, character and aspirations as a community. *Environmentalism may seem, then, to involve a sort of communitarianism that is inconsistent with principles traditionally associated with a liberal state.*[28]

It thus must be observed that even the best domestic law will be unlikely to lead to the best results in the conservation of biodiversity, unless there is, firstly, the willingness to overcome the short-sightedness of doctrine and ideology, and secondly, a substantial amount of international co-operation aimed at resolving the scourge of poverty.

Notes

1. de Klemm, 1990, pp. 4–5.
2. de Klemm, 1990, pp. 1–5; Groombridge, 1992, pp. 40–51, 154–155, 192–327, 329–406, 407–438; UNCED, Agenda 21, paras. 15.1, 15.2; Porter and Brown, 1991, pp. 130–133; WCED, 1987, pp. 147–167. de Klemm, p. 4, cautions that 'These figures are, however, almost certainly under-estimated, for they concern only species whose conservation status is known . . . Certain observers maintain that a rate of extinction of 50,000 species per year will be

attained in the near future. According to others . . . 15 to 20 per cent of our species will already have disappeared by the year 2000, and this trend can only be exacerbated subsequently.'

3. Groombridge, 1992, p. 254.
4. See Kiss, 1983; Rummel-Bulska and Osafo, 1991; UNEP, 1991a. See also, Ojwang, 1993; Ekins, 1991, pp. 243–268.
5. Ekins, 1991.
6. See de Klemm, 1990.
7. de Klemm, 1990, p. 33 (emphasis added).
8. de Klemm, 1990, pp. 37–39.
9. Article 61(2). See also: Article 62 on utilization of the living resources; Article 63 on stocks occurring within the exclusive economic zones of two or more coastal states or both within the exclusive economic zone and in an area beyond and adjacent to it; Article 64 on highly migratory species; Article 65 on marine mammals; Article 66 on anadromous stocks; Article 67 on catadromous species; Article 118 on co-operation between states in the conservation and management of living resources; Article 119 on conservation of the living resources of the high seas; Article 120 on marine mammals.
10. Articles 211–222.
11. Caldwell, 1984; Porter and Brown, 1991.
12. Forster, 1991, p. 15 (emphasis added).
13. Ogolla, 1991, p. 99 (emphasis added).
14. Adede, 1992, pp. 88–105.
15. The Convention was adopted at Nairobi, by the intergovernmental negotiating team, on May 22, 1992; it was opened for signature at Rio de Janeiro on June 5, 1992. Rio was also the forum of signature for the United Nations Framework Convention on Climate Change (adopted at New York on May 9, 1992); it was opened for signature on June 4, 1992.
16. Adede, 1992, p. 101.
17. Adede, 1992, p. 101.
18. See note 15.
19. Ntambirweki, 1991, pp. 20–37.
20. Groombridge, 1992, p. 576; Burhenne-Guilmin, 1991, p. 103; Hileman, 1992, pp. 7–17.
21. Brownlie, 1973, pp. 179–189.
22. Article 6 (a), (b).
23. Article 7 (a), (b), (c), (d) and Article 14(a).
24. Articles 15, 15(7), 16(3), 16(5) and 18(4).
25. Ojwang, 1993; Ojwang, 1992.
26. Pettman, 1979, p. 38.
27. Akehurst, 1982, p. 16 (emphasis added).
28. Sagoff, 1988b, p. 147; see also, de Klemm, 1990, pp. 11–15.

Conclusion

CALESTOUS JUMA AND VICENTE SÁNCHEZ

This chapter brings to a close a rich and detailed analysis of the complex issues surrounding the creation of the regime of biodiplomacy which involves international negotiations and agreements on how to manage the earth's living resources. The Convention on Biological Diversity, which came into force in December 1993, represents a major aspect of biodiplomacy. The Convention has established a new international regime for governing the utilization and conservation of genetic resources.

The regime is delicately balanced on four pillars: conservation of biological diversity, regulated access to genetic resources, access to and transfer of technology and international equity, one of which—biodiversity conservation--is the subject matter of numerous other international regimes. The three sub-regimes of regulated access to genetic resources, access to and transfer of technology and the sharing of the benefits of biotechnology are being developed and form the basis for continued international negotiation.

National sovereignty and access to genetic resources

The Convention was negotiated while the world was undergoing major geopolitical and economic changes. The changes in East-West relations affected the way negotiators perceived the main issues. While in the past, East-West relations dominated international negotiations, the situation was different during the negotiations for this convention. The ideological vacuum created by the collapse of the Eastern bloc created new opportunities for the developing countries to be more assertive and to articulate their interests more forcefully. These opportunities have not always been adequately taken advantage of because developing countries have very often been divided in their interests and attitudes regarding before several issues,

particularly technical ones. Likewise, donors have basically had only one interlocutor to discuss with and one front to cope with at any given time.

Another important factor was the role that various countries had ascribed to biotechnology. A number of industrialized and developing countries had identified biotechnology as a new area of global competitiveness and source of economic benefits.[1] They were therefore unwilling to make any concessions that might be seen as undermining their competitiveness and potential economic gains. Most of these countries were in the early stages of the development of their biotechnology programmes and did not want to prejudice their implementation.

The differences in wealth of biodiversity among developing countries were and are likely to be sources of disagreement and hindrances to the possibilities of reaching common positions. This made the negotiation difficult and, at times, too slow. The limited knowledge on the endowment of genetic resources in each country compounded the problem.

Until the signing of the Convention, genetic resources were considered a common heritage of mankind. In practice, this view helped to maintain a situation under which the more technologically-advanced countries benefited from the 'open access' to genetic resources in the developing countries. The common heritage argument is based on the view that the resources occur naturally and are not the product of human effort. This view was articulated in the International Undertaking on Plant Genetic Resources of the Food and Agriculture Organization (FAO) adopted in 1983, a position that the Undertaking has now abandoned.

Negotiations for the Convention changed the perceptions on the issue and shifted the debate in favour of the assertion of national sovereignty. The developing countries opposed the 'common heritage' approach because resources under state jurisdiction cannot belong to an open access regime since the states concerned were responsible for their management. Articles 3 and 15 of the Convention embody this principle. Article 3 restates the rule of state responsibility for activities within the jurisdiction of a state, while Article 15(1) recognizes '. . . the sovereign rights of states over their natural resources, [as well as the fact that] the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.'

But Article 15(2) enjoins Contracting Parties 'to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of [the] Convention'. This may have laid to rest the matter had all negotiating states, and especially the major contenders on the issue, accepted the formulation of Article 15, but the concept of sovereignty also

requires that states take responsibility to conserve the resources under their jurisdiction as such measures reflect the fact that the resources are a common concern of mankind.

While the Convention recognizes the notion of national sovereignty over biological or natural resources, it also stresses the fact that the conservation of such resources is a common concern of humankind. In this respect, every party to the Convention has an obligation to safeguard these resources. Plant genetic resources found in tropical countries were previously to some extent regarded as a 'common heritage of mankind' which should be available to researchers and foreign companies without restriction.

However, by the early 1980s, developing countries increasingly felt that it was unjust to allow, for example, multinational corporations to obtain free genetic resources in order to develop patented products that were then sold at high prices, with no benefit for those who owned the resources. Furthermore, some developing countries have been forced to buy improved varieties based on genetic resources that originated from their territories.

By the time the negotiations on the Convention began in 1990, developing countries were firmly opposed to the 'common heritage of mankind' position. Instead, they sought to link the access which multinational corporations had to genetic resources in the South to the access which developing countries had to products developed in the North from those genetic materials; they argued that access to genetic resources should be a matter for 'mutual agreement between countries'. The developing countries therefore moved, successfully, to place access to plant genetic resources under the principle of sovereign control of states, thus forcing corporations to negotiate with the state itself for access to the resources.

The success of that strategy was reflected in the Convention in the adoption of Article 15 which recognizes the 'sovereign rights of states over their natural resources' and gives national governments 'authority to determine access to genetic resources' within their territories on 'mutually agreed terms'. The Article also calls for 'sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources.'

Previously, there were fewer economic incentives for developing countries to undertake biodiversity conservation efforts because they had no way of capturing any significant proportion of the economic benefits derived from these resources. The above provisions are therefore aimed at providing economic incentives for developing countries to conserve those resources. The developed countries are major beneficiaries of genetic

resources found in developing countries because they are better equipped to explore for valuable resources, develop new technologies based on them and commercialize the products. The Convention provides a framework that may strengthen the power of developing countries to negotiate for benefits from biological diversity. However, it will be up to individual nations to take appropriate legislative and regulatory steps to achieve these benefits. From a conservation standpoint, unless developing countries see such benefits from these resources, the political will to conserve them will be less than might otherwise be the case.

There is a need to carefully examine and analyse the Convention's provisions on regulated access to biological resources at the national level because some of them may prove difficult to implement, and a certain degree of harmonization of legislation of the Contracting Parties might be relevant. New legislation, administrative measures and practices, such as registers of biological resources, will need to be formulated in various countries to enable the implementation of the provision.

Developed countries have been known to obtain biological resources from developing countries, modify them and apply for intellectual property rights (IPRs) for the modified product. In light of the requirement in the Convention that 'access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources', there is a need to introduce measures which require that applicants for patents provide proof that the biological material in respect of which IPRs are being sought by them were legally acquired. The requirement for prior consent implies that a developed country's access to genetic resources should be considered illegal if it has not been consented to by the developing country.

For that requirement to be given effect, the developing country needs to enact a prohibition on other countries' access to its genetic resources without prior approval. The wording of the Convention suggests, nevertheless, that the mere fact that no legislation regulating the access is in existence implies that access is prohibited. At the same time, the developed country should enact legislation stating that access to and importation of genetic resources without a licence from the developing country is illegal. To demand approval of access to genetic resources from a country which itself does not restrict other countries' access to its genetic resources would be absurd. It would be even more absurd if importing genetic resources under such circumstances were to be considered illegal. Therefore, early and efficient fulfillment of the requirement of prior consent in turn requires simultaneous and harmonized legislation among developed and developing countries where such legislation has not already been adopted. The initiative must, however, come from the developing

countries, for, if they make access to their genetic resources by developed countries subject to approval, this will be a condition for restricting the importation of genetic resources by developed countries.

Specific areas that require attention include introduction of regulations governing the collection of biological resources. Contracts between the collectors, national authorities and the suppliers of biological resources can help ensure that the exchange of biological resources generates immediate as well as long-term benefits for the countries containing the resources. Since the developing countries are not always in a position to correctly assess the potential value of genetic resources in the initial stages of exploitation (particularly due to lack of information), it will be important to devise contracts for access to genetic resources carefully, negotiating the terms for actual commercial exploitation when greater information about the potential value of the resource is available.

The Preamble to the Convention recognizes the 'close and traditional dependence of many indigenous and local communities embodying traditional life-styles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components.' Such contracts should, therefore, in addition, include the requirement to equitably share benefits with indigenous peoples and local communities. The Convention has been criticized for containing only recommendations on this matter instead of enforceable provisions.

Other measures such as monitoring councils composed of members of local communities and indigenous peoples need to be introduced. Developing countries should urgently establish programmes that would strengthen inter-country co-operation in research and development and collective bargaining with the industrialized countries.

The area of regulating access to genetic resources forms a key aspect of the Convention. A number of ways can be considered to strengthen this aspect of the Convention. The first is consideration for negotiating a protocol on the matter based on some of the principles that have already been developed in instruments such as the FAO International Undertaking on Plant Genetic Resources. Another option is to formulate a model law which can be used by various countries to adopt domestic laws. Given the urgent need for legislation on this matter, it may be preferable to start with the formulation of a model law. This, however, should not preclude discussion for a protocol on the subject.

One of the issues that will continue to generate international controversy is the fate of genetic resources collected prior to the coming into force of the Convention. The genetic resources, especially those in international

genebanks, are of great interest to both the industrialized countries and the developing nations. This is partly because many of the emerging biotechnologies are associated with these collections and partly because some of them are part of a genetic heritage that may not be easily found in nature. It is understood that the Convention, like other international treaties, cannot be applied retroactively.

But concerns over past collection require that the issue of *historical justice* be addressed. Genetic resources, by the very fact that they have a historical and evolutionary character, should be viewed in a manner that reflects past practices. This issue will continue to generate controversy despite the fact that international law cannot be applied retroactively. Given the fact that historical justice is being demanded in other fields requires the international community to think innovatively about the issue. Dealing with past collections of genetic resources might be a place to start.

Technology, capacity-building and equity

Although the Convention does not make express provision for a trade-off between access to genetic resources and access to transfer of technology, it establishes a clear link between the supply of genetic resources (by developing to developed countries) and access to and transfer of technology (from developed to developing countries), which makes use of those resources. This link can be utilized to enable the suppliers of biological resources, on the one hand, and suppliers of sources of technology, on the other, to benefit from collaborative ventures. One way to achieve this is to establish partnerships under which nations or institutions bring together their genetic and technological resources in collaborative ventures. This approach would allow the industrialized countries to gain access to biological resources while enhancing the technological competence of the developing countries.[2]

Under such a venture, the developing country would not have to give away evaluated and characterized genetic material to a foreign enterprise (presumably that of a developed country) interested in further development and eventual commercialization of derived products. The foreign enterprise would bring into the partnership its advanced technological know-how—especially in the field of biotechnology. Both the evaluated and characterized genetic material of the developing country and the technological know-how of the foreign enterprise would be considered 'background information' belonging to each contributor, while any new or improved material or product generated through the collaboration would become 'foreground knowledge' to benefit and be shared by both partners.

The ability of the developing countries to benefit from their biological resources will depend largely on the extent to which they integrate biotech-

nology development into their development strategies. Each developing country needs to determine its national needs and decide how much to invest in biotechnology development in relation to other development activities. There is, however, a need to give priority to biotechnology development as a strategic sector that would enable the developing country to derive economic benefits from the conservation of biological resources. This should include specific measures that build on the technological competence already available in the country as well as the acquisition of foreign technology.

Technological development need not be an expensive process that relies on external input and massive financial resources, contrary to popular belief in developing countries. This belief stems from a limited perception of technology transfer as the flow of equipment, skills, managerial competence and technical specifications from developed to developing countries, in relation to the production of goods. Developing countries should rather perceive technology transfer as the accumulation of technological capacity—the ability to generate and manage technical change, including the related skills, knowledge and experience as well as institutional structures and networks.[3]

The relevance of each technology to the conservation and sustainable use of biodiversity needs to be carefully assessed in technology transfer arrangements, with special attention to the need to build on indigenous technologies and prior knowledge. Such technology assessments should take into account the impacts of technological development upon biological resources.

The institutions necessary to manage biosafety are still nascent in most developing countries. The ability of these countries to effectively implement the biosafety provisions of the Convention will depend largely on their institutional capacity in the field. There is, therefore, a need to incorporate biosafety considerations into biotechnology development programmes. Following the signing of the Convention, the United Nations Environment Programme (UNEP) convened a panel of experts to look into the need for formulating a protocol on biosafety. The majority of the panel members 'agreed that the purpose of strengthening international cooperation in the field of biotechnology and biosafety could best be served by the adoption of a legally binding instrument . . .'[4] But there was a minority of panel members 'concluded that the need for a protocol . . . [had not been] demonstrated by the inquiry undertaken by [the panel] and that this political decision should be made by the Conference of the Parties on the basis of further analysis of need, as well as difficulties in defining the scope and operational modalities.'[5] The conclusions of the panel show that formulating such a protocol will require protracted negotiations. What

is evident, however, is that the public in most countries is yet to be convinced about the safety of biotechnology and credibility of the scientific community as source of assurances about the safety of biotechnology processes and products.

The developing countries are not merely suppliers of raw materials, but are also important sources of technology often embodied in indigenous knowledge. This, together with their biological resources, should form a basis for forging equitable partnerships within and between countries. Such partnerships can promote the fair distribution of benefits derived from the use of indigenous knowledge and biological resources.

To ensure equitable partnerships among and within countries, an ombudsman or legal council office as well as arbitration mechanisms should be established for example as part of the Convention secretariat to support rural communities, indigenous peoples and national efforts to defend their rights under the Convention or the relevant national legislation.

The role of basic research in the acquisition and development of biotechnology has often been understated. Developing countries need to build up research and institutional capacity in the biological and information sciences, especially in molecular biology, genetics, taxonomy and population biology. Such training should also be extended to parataxonomists. There is a need to formulate a protocol on research and training which would provide guidelines on collaborative research, equitable sharing of benefits and handling of biological resources.

The implementation of the Convention will need to draw from a wide range of experiences in the field of biodiversity conservation as well as other fields. Efforts to undertake case studies on current and past practices could be a source of ideas for formulating implementation measures. These studies will be of relevance to the Conference of Parties. It is important therefore that governments, donor agencies and other institutions provide financial and other support to enable research institutions to generate information that could be used by the Conference of Parties.

The development of information networks as part of the infrastructure for research and development is critical to the process of technological development. Efforts should be made to strengthen this process and improve the policy and administrative environment for trans-border data flow.

Developing countries can also enhance their ability to derive benefits from biological resources by seeking new ways to add value to their biological resources. The value of such raw materials is relatively low. Value can be added by establishing or encouraging institutions to undertake identification, collection and screening of biological resources for their economic value. This will enable the developing countries to

share the benefits of biotechnological research and strengthen their scientific, technological and institutional capacity. Such technological capacity could be applied in the development of other sectors of the economy.

Intellectual property protection

Developing countries have often argued that IPRs are the main obstacles to access to biotechnology. While this may be true to some extent, it is important to note that most of the technologies presently needed by the developing countries are in the public domain, either in the formal or informal sectors. The formal sector includes all public sector research institutions while the informal sector includes all local communities which generate and maintain knowledge related to biodiversity. The required technology can, therefore, be acquired through conventional programmes such as training, information exchange and access to patent information. Since the Convention respects IPRs, it provides an opportunity for developing countries to have access to patent information through industrial property offices. There is, however, a need to review the appropriateness of the existing and proposed IPR systems and to assess their impact on the conservation of biodiversity.

It is, nevertheless, necessary to indicate that there seems to be an ambiguity in many developing countries when it comes to having a clear position on IPRs. Some countries have recently instituted strict intellectual property laws or strengthened the ones they have had for some years. Furthermore, the General Agreement on Tariffs and Trade (GATT) Uruguay Round negotiations did not oppose proposals for the strengthening of intellectual property regimes. The explanation given by some—both developed and developing—that different government units are in command of trade negotiations and environmental ones (such as the Convention), is not acceptable because there should be policy consistency.

Rights of indigenous peoples and local communities

Indigenous peoples and local communities—especially women in these groups—are the custodians of much of the world's biological resources. Since such a role entails considerable knowledge of genetic resources and their uses, the issue of indigenous knowledge is an important part of the rights of these communities.

There are inequalities between institutions that safeguard IPRs and those that protect the rights of indigenous peoples and local communities. This imbalance weakens the ability of indigenous peoples and local communities to derive benefits from conserving biological resources and

to assert rights over the resources in their areas. There is a need to introduce at the national level legal measures that recognize the role and rights of indigenous peoples and local communities as well as the relevant institutional competence in conserving biological resources and improving local varieties. There is a need to put greater emphasis on supporting and rewarding the work carried out by local communities and indigenous peoples to maintain agrobiodiversity.

One way to strengthen the provisions on indigenous knowledge is to formulate a protocol covering cultural property protection and other rights of indigenous peoples. A working group dealing with how existing instruments for the protection of intellectual and cultural property can be extended to protection of knowledge and biological resources of indigenous and traditional peoples should be set up by the Convention secretariat. It should also suggest how additional instruments could be established to ensure such protection. In addition, the institutional capacity of indigenous peoples to manage their own affairs needs to be strengthened.

Economic and financial issues

Ensuring that biodiversity benefits are fairly distributed requires a more detailed understanding of the value of biodiversity. Conventional economic approaches cannot adequately deal with this matter, although environmental and ecological economics provide new perspectives as to the valuation of biodiversity and other environmental assets. Such valuation of biodiversity would assist in the identification of costs, benefits and unmet needs for conservation.

The Convention not only acknowledges the intrinsic value of biodiversity, but it also recognizes the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of living resources. It will take more than the refinements of current economic tools to improve the methods of valuing genetic resources. There has been a tendency to assume that all the values of biodiversity should be expressed in quantitative terms. Important aspects of biodiversity such as ecological services (which include improvement of air and water quality, hydrological circulation, soil generation, nutrient recycling, waste assimilation, crop pollination and pest control) are too complex to be reduced to quantitative calculations.[6] The issue of valuing biodiversity should therefore include the task of ensuring that qualitative values are given greater attention in policy-making processes.

A number of donors are starting to support research-related aspects of the Convention. These activities are of critical importance to the efforts of research institutions to elaborate the various aspects of the Convention. It is important that they receive sustained support. In return, the outputs of

these institutions should be availed to the governmental agencies responsible for implementing the Convention and carrying out further negotiations on the Convention, as well as to NGOs and other institutions.

The existing financing mechanisms for the Convention require reforms to make them more transparent, democratic and universal in their governance. The resources available through these mechanisms cannot meet current conservation needs, and there is an urgent need to identify innovative measures of mobilizing additional finances at national and international levels. Furthermore, the text of the Convention mentions 'incremental costs' as the *sine qua non* condition to grant funds for activities stemming from its implementation. Whereas the concept of *incremental costs* is relatively easy to apply to the Montreal Protocol (from where it originated) and the Framework Convention on Climate Change (where it is being extended) which deal largely with 'technical responses', it cannot be easily used in the field of biodiversity. Other approaches will need to be formulated to deal with biodiversity.

Relationship with other regimes

The Convention's main elements overlap deal with the mandate of numerous other regimes. For example, issues related to *in situ* conservation are also the subject matter of over forty other international treaties.[7] The other treaties, many of which deal with specialized issues such as endangered species and migratory birds, form an important part of global conservation efforts. Co-ordination between these treaties and agreements with the Convention could provide a strong basis for facilitating biodiversity conservation. It is necessary to look into ways of creating greater co-ordination between the major treaties and agreements dealing with biological diversity. An inter-treaty co-ordination mechanism could be created to establish areas of convergence and conflict and look into ways of harmonizing the operations of the treaties.

Another area of potential conflict is the relationship between the Convention and rules of international trade. There are two areas of concern regarding the Convention and trade rules. The first relates to the potential impacts of trade rules on the implementation of the Convention. Already, some GATT rulings involve biodiversity. There is greater potential for conflict in this area, especially as developing countries increase investment in resource-based export activities. The other area that requires attention is the possible impact of the Convention on international trade. As countries such as the United States start to define biodiversity conservation as a safety issue, it is likely that greater restrictions could be imposed on international trade in the name of maintaining national security.

The fact that the issues covered by the Convention are also the subject matter of other treaties may encourage countries to pursue conservation efforts through previously-existing arrangements while adopting a 'free-riding' approach to the Convention.

There are no specific provisions in the Convention to preclude the exchange of biological resources between Contracting Parties and non-Parties. Such exchange would allow countries to benefit from the implementation of the Convention without joining it. There is a need for Parties to introduce national measures that preclude 'free-riding' by non-Parties and to subsequently seek a multilateral arrangement through a relevant amendment to the Convention.

Popular participation and regime implementation

While it is recognized that NGOs did not play a major role during the negotiations for the Convention, their diversity and varied competence are critical to its implementation. NGOs must be involved in the implementation of the Convention at the international, regional, national and local level. Their activities should be seen as essential and complementary to governmental measures. The Conference of Parties should provide a framework for the active involvement of NGOs, indigenous peoples, local community representatives and other independent participants. An NGO liaison office should be established to support NGO involvement in the activities of the Convention.

Conclusion

The Convention is largely a framework agreement whose implementation will need to be pursued in the context of national legislation and institutional mechanisms for adequate environmental managements, as well as in all specific programmes, projects and protocols. Such specific efforts may focus on issues such as biosafety (which is the subject of protocol consideration) or regions (which have specific conservation challenges). For example, dealing with the conservation of biological diversity in Lake Victoria or in a large section of the Amazon will require the concerted efforts of the countries of the region and partners in the industrialized countries.

The ecosystems approach to implementing the Convention may also provide greater opportunities for the role of bilateral and limited multilateral support from the industrialized countries. There may be a need for protocols dealing with species along the lines of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Another way forward would be to establish strong links between

the Convention and other treaties already dealing with specific species instead of negotiating new ones.

Other approaches for implementing the Convention include efforts to develop model laws on specific issues such as regulated access to biological diversity. On the whole, many of the activities needed to implement the Convention are already being carried out in may different forms and institutions at the national and international levels. It will, however, take considerable efforts in co-ordination—nationally and internationally—to bring these activities in line with the provisions of the Convention.

The argument that the developing countries must have additional resources to start conserving biological diversity is only partially true as is the one that the industrialized countries have been hit by recession and therefore cannot transfer financial resources to the developing countries. There are many things that can be started immediately, including a better and more efficient use of resources in the developing and developed countries. Also in the midst of their recession, developed countries have found it possible to put together financial packages for other purposes which will most probably render larger benefits in the short term.

So it seems that the priorities identified in UNCED and the commitments made at Rio seem to have dropped in importance. For those whose main task it is to conserve biodiversity as the real basis for sustainable development, the coming into force of the Convention holds some promise. However, a lot more needs to be done. Real action needs to be taken at the national, regional and international level.

The Convention represents the beginning of a new way of looking at global issues which radically changes the way international negotiations are conducted. Most future negotiations will need to take into account the imperatives of biodiversity conservation and use. This volume is just one in a series of efforts to elaborate the key elements of *biodiplomacy*.

Notes

1. Juma, 1989.
2. See, for example, Reid *et al.*, 1993.
3. Juma and Mugabe, forthcoming.
4. UNEP, 1993d, p. 12.
5. UNEP, 1993d, p. 12.
6. UNEP, 1993b, p. 3.
7. OTA, 1987.

APPENDIX

CONVENTION ON BIOLOGICAL DIVERSITY

RIO DE JANEIRO, 5 JUNE 1992

Preamble

The Contracting Parties,

Conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components,

Conscious also of the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere,

Affirming that the conservation of biological diversity is a common concern of humankind,

Reaffirming that States have sovereign rights over their own biological resources,

Reaffirming also that States are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner,

Concerned that biological diversity is being significantly reduced by certain human activities,

Aware of the general lack of information and knowledge regarding biological diversity and of the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures,

Noting that it is vital to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at source,

Noting also that 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,

Noting further that the fundamental requirement for the conservation of biological diversity is the *in-situ* conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings,

Noting further that *ex-situ* measures, preferably in the country of origin, also have an important role to play,

Recognizing the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components,

Recognizing also the vital role that women play in the conservation and sustainable use of biological diversity and affirming the need for the full participation of women at all levels of policy-making and implementation for biological diversity conservation,

Stressing the importance of, and the need to promote, international, regional and global cooperation among States and intergovernmental organizations and the non-governmental sector for the conservation of biological diversity and the sustainable use of its components,

Acknowledging that the provision of new and additional financial resources and appropriate access to relevant technologies can be expected to make a substantial difference in the world's ability to address the loss of biological diversity,

Acknowledging further that special provision is required to meet the needs of developing countries, including the provision of new and additional financial resources and appropriate access to relevant technologies,

Noting in this regard the special conditions of the least developed countries and small island States,

Acknowledging that substantial investments are required to conserve biological diversity and that there is the expectation

of a broad range of environmental, economic and social benefits from those investments,

Recognizing that economic and social development and poverty eradication are the first and overriding priorities of developing countries,

Aware that conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing world population, for which purpose access to and sharing of both genetic resources and technologies are essential,

Noting that, ultimately, the conservation and sustainable use of biological diversity will strengthen friendly relations among States and contribute to peace for humankind,

Desiring to enhance and complement existing international arrangements for the conservation of biological diversity and sustainable use of its components, and

Determined to conserve and sustainably use, biological diversity for the benefit of present and future generations,

Have agreed as follows:

Article 1. Objectives

The objectives of this Convention, to be pursued in accordance with its relevant provisions, 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, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

Article 2. Use of Terms

For the purposes of this Convention:
"*Biological diversity*" means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

"*Biological resources*" includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.

"*Biotechnology*" means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.

"*Country of origin of genetic resources*" means the country which possesses those genetic resources in *in-situ* conditions.

"*Country providing genetic resources*" means the country supplying genetic resources collected from *in-situ* sources, including populations of both wild and domesticated species, or taken from *ex-situ* sources, which may or may not have originated in that country.

"*Domesticated or cultivated species*" means species in which the evolutionary process has been influenced by humans to meet their needs.

"*Ecosystem*" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

"*Ex-situ conservation*" means the conservation of components of biological diversity outside their natural habitats.

"*Genetic material*" means any material of plant, animal, microbial or other origin containing functional units of heredity.

"*Genetic resources*" means genetic material of actual or potential value.

"*Habitat*" means the place or type of site where an organism or population naturally occurs.

"*In-situ conditions*" means conditions where genetic resources exist within

ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

"*In-situ conservation*" means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

"*Protected area*" means a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.

"*Regional economic integration organization*" means an organization constituted by sovereign States of a given region, to which its member States have transferred competence in respect of matters governed by this Convention and which has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to it.

"*Sustainable use*" means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

"*Technology*" includes biotechnology.

Article 3. Principle

State have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Article 4. Jurisdictional Scope

Subject to the rights of other States, and except as otherwise expressly provided in this Convention, the provisions of this Convention apply, in relation to each Contracting Party:

(a) In the case of components of biological diversity, in areas within the limits of its national jurisdiction; and
(b) In the case of processes and activities, regardless of where their effects occur, carried out under its jurisdiction or control, within the area of its national jurisdiction or beyond the limits of national jurisdiction.

Article 5. Co-operation

Each Contracting Party shall, as far as possible and as appropriate, cooperate with other Contracting Parties, directly or, where appropriate, through competent international organizations, in respect of areas beyond national jurisdiction and on other matters of mutual interest, for the conservation and sustainable use of biological diversity.

Article 6. General Measures for Conservation and Sustainable Use

Each Contracting Party shall, in accordance with its particular conditions and capabilities:

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, *inter alia*, the measures set out in this Convention relevant to the Contracting Party concerned; and
(b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Article 7. Identification and Monitoring

Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Articles 8 to 10:

(a) Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I;
(b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;
(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and
(d) Maintain and organize, by any mechanism data, derived from identification and monitoring activities pursuant to subparagraphs (a), (b) and (c) above.

Article 8. *In-situ* Conservation

Each Contracting Party shall, as far as possible and as appropriate:

(a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
(b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
(c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;
(d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;
(f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia*, through the development and implementation of plans or other management strategies;
(g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;
(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species;
(i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;
(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;
(k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;
(l) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and
(m) Cooperate in providing financial and other support for in-situ conservation outlined in sub-paragraphs (a) to (l) above, particularly to developing countries.

Article 9. *Ex-situ* Conservation

Each Contracting Party shall, as far as possible and as appropriate, and predominantly for the purpose of complementing *in-situ* measures:
(a) Adopt measures for the *ex-situ* conservation of components of biological di-

versity, preferably in the country of origin of such components;
(b) Establish and maintain facilities for *ex-situ* conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources;
(c) Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions;
(d) Regulate and manage collection of biological resources from natural habitats for *ex-situ* conservation purposes so as not to threaten ecosystems and *in-situ* populations of species, except where special temporary *ex-situ* measures are required under subparagraph (c) above; and
(e) Cooperate in providing financial and other support for *ex-situ* conservation outlined in subparagraphs (a) to (d) above and in the establishment and maintenance of *ex-situ* conservation facilities in developing countries.

Article 10. Sustainable Use of Components of Biological Diversity

Each Contracting Party shall, as far as possible and as appropriate:

(a) Integrate consideration of the conservation and sustainable use of biological resources into national decision-making;
(b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity;
(c) Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements;
(d) Support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced; and
(e) Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources.

Article 11. Incentive Measures

Each Contracting Party shall, as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity.

Article 12. Research and Training

The Contracting Parties, taking into account the special needs of developing countries, shall:

(a) Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components and provide support for such education and training for the specific needs of developing countries;
(b) Promote and encourage research which contributes to the conservation and sustainable use of biological diversity, particularly in developing countries, *inter alia*, in accordance with decisions of the Conference of the Parties taken in consequence of recommendations of the Subsidiary Body on Scientific, Technical and Technological Advice; and
(c) In keeping with the provisions of Articles 16, 18 and 20, promote and cooperate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources.

Article 13. Public Education and Awareness

The Contracting Parties shall:

(a) Promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes; and
(b) Cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programmes, with respect to conservation and sustainable use of biological diversity.

Article 14. Impact Assessment and Minimizing Adverse Impacts

1. Each Contracting Party, as far as possible and as appropriate, shall:

(a) Introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures;
(b) Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;
(c) Promote, on the basis of reciprocity, notification, exchange of information and consultation on activities under their jurisdiction or control which are likely to significantly affect adversely the biological diversity of other States or areas beyond the limits of national jurisdiction, by encouraging the conclusion of bilateral, regional or multilateral arrangements, as appropriate;
(d) In the case of imminent or grave danger or damage, originating under its jurisdiction or control, to biological diversity within the area under jurisdiction of other States or in areas beyond the limits of national jurisdiction, notify immediately the potentially affected States of such danger or damage, as well as initiate action to prevent or minimize such danger or damage; and
(e) Promote national arrangements for emergency responses to activities or events, whether caused naturally or otherwise, which present a grave and imminent danger to biological diversity and encourage international cooperation to supplement such national efforts and, where appropriate and agreed by the States or regional economic integration organizations concerned, to establish joint contingency plans.

2. The Conference of the Parties shall examine, on the basis of studies to be carried out, the issue of liability and redress, including restoration and compensation, for damage to biological diversity, except where such liability is a purely internal matter.

Article 15. Access to Genetic Resources

1. Recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.
2. Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention.
3. For the purpose of this Convention, the genetic resources being provided by a Contracting Party, as referred to in this Article and Articles 16 and 19, are only those that are provided by Contracting Parties that are countries of origin of such resources or by the Parties that have acquired the genetic resources in accordance with this Convention.
4. Access, where granted, shall be on mutually agreed terms and subject to the provisions of this Article.
5. Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party.
6. Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties.
7. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, and in accordance with Articles 16 and 19 and, where necessary, through the financial mechanism established by Articles 20 and 21 with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Sharing shall be upon mutually agreed terms.

Article 16. Access to and Transfer of Technology

1. Each Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention, undertakes subject to the provisions of this Article to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.
2. Access to and transfer of technology referred to in paragraph 1 above to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed, and where necessary, in accordance with the financial mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. The application of this paragraph shall be consistent with paragraphs 3, 4 and 5 below.
3. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that Contracting Parties, in particular those that are developing countries, which provide genetic resources are provided access to and transfer of technology which makes use of those resources, on mutually agreed terms, including technology protected by patents and other intellectual property rights, where necessary, through the provisions of Articles 20 and 21 and in accordance with international law and consistent with paragraphs 4 and 5 below.
4. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, with the aim that the private sector facilitates access to, joint development and transfer of technology referred to in paragraph 1 above for the benefit of both governmental institutions and the private sector of developing countries and in this regard shall abide by the obligations included in paragraphs 1,2 and 3 above.
5. The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.

Article 17. Exchange of Information

1. The Contracting Parties shall facilitate the exchange of information, from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of developing countries.
2. Such exchange of information shall include exchange of results of technical, scientific and socio-economic research, as well as information on training and surveying programmes, specialized knowledge, indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16, paragraph 1. It shall also, where feasible include repatriation of information.

Article 18. Technical and Scientific Co-operation

1. The Contracting Parties shall promote international technical and scientific cooperation in the field of conservation and sustainable use of biological diversity, where necessary, through the appropriate international and national institutions.
2. Each Contracting Party shall promote technical and scientific cooperation with other Contracting Parties, in particular developing countries, in implementing this Convention, *inter alia*, through the development and implementation of national policies. In promoting such cooperation, special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building.

3. The Conference of the Parties, at its first meeting, shall determine how to establish a clearing-house mechanism to promote and facilitate technical and scientific cooperation.
4. The Contracting Parties shall, in accordance with national legislation and policies, encourage and develop methods of cooperation for the development and use of technologies, including indigenous and traditional technologies, in pursuance of the objectives of this Convention. For this purpose, the Contracting Parties shall also promote cooperation in the training of personnel and exchange of experts.
5. The Contracting Parties shall, subject to mutual agreement, promote the establishment of joint research programmes and joint ventures for the development of technologies relevant to the objectives of this Convention.

Article 19. Handling of Biotechnology and Distribution of its Benefits

1. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, to provide for the effective participation in biotechnological research activities by those Contracting Parties, especially developing countries, which provide the genetic resources for such research, and where feasible in such Contracting Parties.
2. Each Contracting Party shall take all practicable measures to promote and advance priority access on a fair and equitable basis by Contracting Parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting Parties. Such access shall be on mutually agreed terms.
3. The Parties shall consider the need for and modalities of a protocol setting out appropriate procedures, including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity.
4. Each Contracting Party shall, directly or by requiring any natural or legal person under its jurisdiction providing the organisms referred to in paragraph 3 above, provide any available information about the use and safety regulations required by that Contracting Party in handling such organisms, as well as any available information on the potential adverse impact of the specific organisms concerned to the Contracting Party into which those organisms are to be introduced.

Article 20. Financial Resources

1. Each Contracting Party undertakes to provide, in accordance with its capabilities, financial support and incentives in respect of those national activities which are intended to achieve the objectives of this Convention, in accordance with its national plans, priorities and programmes.
2. The developed country Parties shall provide new and additional financial resources to enable developing country Parties to meet the agreed full incremental costs to them of implementing measures which fulfil the obligations of this Convention and to benefit from its provisions and which costs are agreed between a developing country Party and the institutional structure referred to in Article 21, in accordance with policy, strategy, programme priorities and eligibility criteria and an indicative list of incremental costs established by the Conference of the Parties. Other Parties, including countries undergoing the process of transition to a market economy, may voluntarily assume the obligations of the developed country Parties. For the purpose of this Article, the Conference of the Parties, shall at its first meeting establish a list of developed country Parties and other Parties which voluntarily assume the obligations of the developed country Parties. The Conference of the Parties shall periodically review and if necessary amend the list. Contributions from other countries and sources on a voluntary basis would also be encouraged. The implementation of these commitments shall take into account the need for adequacy, predictability and timely flow of funds and the importance of burden-sharing among the contributing Parties included in the list.

3. The developed country Parties may also provide, and developing country Parties avail themselves of, financial resources related to the implementation of this Convention through bilateral, regional and other multilateral channels.
4. The extent to which developing country Parties will effectively implement their commitments under this Convention will depend on the effective implementation by developed country Parties of their commitments under this Convention related to financial resources and transfer of technology and will take fully into account the fact that economic and social development and eradication of poverty are the first and overriding priorities of the developing country Parties.
5. The Parties shall take full account of the specific needs and special situation of least developed countries in their actions with regard to funding and transfer of technology.
6. The Contracting Parties shall also take into consideration the special conditions resulting from the dependence on, distribution and location of, biological diversity within developing country Parties, in particular small island States.
7. Consideration shall also be given to the special situation of developing countries, including those that are most environmentally vulnerable, such as those with arid and semi-arid zones, coastal and mountainous areas.

Article 21. Financial Mechanism

1. There shall be a mechanism for the provision of financial resources to developing country Parties for purposes of this Convention on a grant or concessional basis the essential elements of which are described in this Article. The mechanism shall function under the authority and guidance of, and be accountable to, the Conference of the Parties for purposes of this Convention. The operations of the mechanism shall be carried out by such institutional structure as may be decided upon by the Conference of the Parties at its first meeting. For purposes of this Convention, the Conference of the Parties shall determine the policy, strategy, programme priorities and eligibility criteria relating to the access to and utilization of such resources. The contributions shall be such as to take into account the need for predictability, adequacy and timely flow of funds referred to in Article 20 in accordance with the amount of resources needed to be decided periodically by the Conference of the Parties and the importance of burden-sharing among the contributing Parties included in the list referred to in Article 20, paragraph 2. Voluntary contributions may also be made by the developed country Parties and by other countries and sources. The mechanism shall operate within a democratic and transparent system of governance.
2. Pursuant to the objectives of this Convention, the Conference of the Parties shall, at its first meeting, determine the policy, strategy and programme priorities, as well as detailed criteria and guidelines for eligibility for access to and utilization of the financial resources including monitoring and evaluation on a regular basis of such utilization. The Conference of the Parties shall decide on the arrangements to give effect to paragraph 1 above after consultation with the institutional structure entrusted with the operation of the financial mechanism.
3. The Conference of the Parties shall review the effectiveness of the mechanism established under this Article, including the criteria and guidelines referred to in paragraph 2 above, not less than two years after the entry into force of this Convention and thereafter on a regular basis. Based on such review, it shall take appropriate action to improve the effectiveness of the mechanism if necessary.
4. The Contracting Parties shall consider strengthening existing financial institutions to provide financial resources for the conservation and sustainable use of biological diversity.

Article 22. Relationship with Other International Conventions

1. The provisions of this Convention shall not affect the rights and obligations of any Contracting Party deriving from any existing international agreement, except where the exercise of those rights

and obligations would cause a serious damage or threat to biological diversity.
2. Contracting Parties shall implement this Convention with respect to the marine environment consistently with the rights and obligations of States under the law of the sea.

Article 23. Conference of the Parties

1. A Conference of the Parties is hereby established. The first meeting of the Conference of the Parties shall be convened by the Executive Director of the United Nations Environment Programme not later than one year after the entry into force of this Convention. Thereafter, ordinary meetings of the Conference of the Parties shall be held at regular intervals to be determined by the Conference at its first meeting.
2. Extraordinary meetings of the Conference of the Parties shall be held at such other times as may be deemed necessary by the Conference, or at the written request of any Party, provided that, within six months of the request being communicated to them by the Secretariat, it is supported by at least one third of the Parties.
3. The Conference of the Parties shall by consensus agree upon and adopt rules of procedure for itself and for any subsidiary body it may establish, as well as financial rules governing the funding of the Secretariat. At each ordinary meeting, it shall adopt a budget for the financial period until the next ordinary meting.
4. The Conference of the Parties shall keep under review the implementation of this Convention, and, for this purpose, shall:

(a) Establish the form and the intervals for transmitting the information to be submitted in accordance with Article 26 and consider such information as well as reports submitted by any subsidiary body;

(b) Review scientific, technical and technological advice on biological diversity provided in accordance with Article 25;

(c) Consider and adopt, as required, protocols in accordance with Article 28;

(d) Consider and adopt, as required, in accordance with Articles 29 and 30, amendments to this Convention and its annexes;

(e) Consider amendments to any protocol, as well as to any annexes thereto, and, if so decided, recommend their adoption to the parties to the protocol concerned;

(f) Consider and adopt, as required, in accordance with Article 30, additional annexes to this Convention;

(g) Establish such subsidiary bodies, particularly to provide scientific and technical advice, as are deemed necessary for the implementation of this Convention;

(h) Contact, through the Secretariat, the executive bodies of conventions dealing with matters covered by this Convention with a view to establishing appropriate forms of cooperation with them; and

(i) Consider and undertake any additional action that may be required for the achievement of the purposes of this Convention in the light of experience gained in its operation.

5. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State not Party to this Convention, may be represented as observers at meetings of the Conference of the Parties. Any other body or agency, whether governmental or non-govemment, qualified in fields relating to conservation and sustainable use of biological diversity, which has informed the Secretariat of its wish to be represented as an observer at a meeting of the Conference of the Parties, may be admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Conference of the Parties.

Article 24. Secretariat

1. A secretariat is hereby established. Its functions shall be:

(a) To arrange for and service meetings of the Conference of the Parties provided for in Article 23;

(b) To perform the functions assigned to it by any protocol;

(c) To prepare reports on the execution of its functions under this

Convention and present them to the Conference of the Parties;

(d) To coordinate with other relevant international bodies and, in particular to enter into such administrative and contractual arrangements as may be required for the effective discharge of its functions; and

(e) To perform such other functions as may be determined by the Conference of the Parties.

2. At its first ordinary meeting, the Conference of the Parties shall designate the secretariat from amongst those existing competent international organizations which have signified their willingness to carry out the secretariat functions under this Convention.

Article 25. Subsidiary Body on Scientific, Technical and Technological Advice

1. A subsidiary body for the provision of scientific, technical and technological advice is hereby established to provide the Conference of the Parties and, as appropriate, its other subsidiary bodies with timely advice relating to the implementation of this Convention. This body shall be open to participation by all Parties and shall be multidisciplinary. It shall comprise government representatives competent in the relevant field of expertise. It shall report regularly to the Conference of the Parties on all aspects of its work.

2. Under the authority of and in accordance with guidelines laid down by the Conference of the Parties, and upon its request, this body shall:

(a) Provide scientific and technical assessments of the status of biological diversity;

(b) Prepare scientific and technical assessments of the effects of types of measures taken in accordance with the provisions of this Convention;

(c) Identify innovative, efficient and state-of-the-art technologies and know-how relating to the conservation and sustainable use of biological diversity and advise on the ways and means of promoting development and/or transferring such technologies;

(d) Provide advice on scientific programmes and international cooperation in research and development related to conservation and sustainable use of biological diversity; and

(e) Respond to scientific, technical, technological and methodological questions that the Conference of the Parties and its subsidiary bodies may put to the body.

3. The functions, terms of reference, organization and operation of this body may be further elaborated by the Conference of the Parties.

Article 26. Reports

Each Contracting Party shall, at intervals to be determined by the Conference of the Parties, present to the Conference of the Parties, reports on measures which it has taken for the implementation of the provisions of this Convention and their effectiveness in meeting the objectives of this Convention.

Article 27. Settlement of Disputes

1. In the event of a dispute between Contracting Parties concerning the interpretation or application of this Convention, the parties concerned shall seek solution by negotiation.

2. If the parties concerned cannot reach agreement by negotiation, they may jointly seek the good offices of, or request mediation by, a third party.

3. When ratifying, accepting, approving or acceding to this Convention, or at any time thereafter, a State or regional economic integration organization may declare in writing to the Depositary that for a dispute not resolved in accordance with paragraph 1 or paragraph 2 above, it accepts one or both of the following means of dispute settlement as compulsory:

(a) Arbitration in accordance with the procedure laid down in Part 1 of Annex II;

(b) Submission of the dispute to the International Court of Justice.

4. If the parties to the dispute have not, in accordance with paragraph 3 above, accepted the same or any procedure, the dispute shall be submitted to conciliation in accordance with Part 2 of Annex II unless the parties otherwise agree.

5. The provisions of this Article shall apply with respect to any protocol except as otherwise provided in the protocol concerned.

Article 28. Adoption of Protocols

1. The Contracting Parties shall cooperate in the formulation and adoption of protocols to this Convention.
2. Protocols shall be adopted at a meeting of the Conference of the Parties.
3. The text of any proposed protocol shall be communicated to the Contracting Parties by the Secretariat at least six months before such a meeting.

Article 29. Amendment of the Convention or Protocols

1. Amendments to this Convention may be proposed by any Contracting Party. Amendments to any protocol may be proposed by any Party to that protocol.
2. Amendments to this Convention shall be adopted at a meeting of the Conference of the Parties. Amendments to any protocol shall be adopted at a meeting of the Parties to the Protocol in question. The text of any proposed amendment to this Convention or to any protocol, except as may otherwise be provided in such protocol, shall be communicated to the Parties to the instrument in question by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate proposed amendments to the signatories to this convention for information.
3. The parties shall make every effort to reach agreement on any proposed amendment to this Convention or to any protocol by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a two-third majority vote of the Parties to the instrument in question present and voting at the meeting, and shall be submitted by the Depositary to all Parties for ratification, acceptance or approval.
4. Ratification, acceptance or approval of amendments shall be notified to the Depositary in writing. Amendments adopted in accordance with paragraph 3 above shall enter into force among Parties having accepted them on the ninetieth day after the deposit of instruments of ratification, acceptance or approval by at least two thirds of the Contracting Parties to this Convention or of the Parties to the protocol concerned, except as may otherwise be provided in such protocol. Thereafter the amendments shall enter into force for any other Party on the ninetieth day after that Party deposits its instrument of ratification, acceptance or approval of the amendments.
5. For the purposes of this Article, "Parties present and voting" means Parties present and casting an affirmative or negative vote.

Article 30. Adoption and Amendment of Annexes

1. The annexes to this Convention or to any protocol shall form an integral part of the Convention or of such protocol, as the case may be, and, unless expressly provided otherwise, a reference to this Convention or its protocols constitutes at the same time a reference to any annexes thereto. Such annexes shall be restricted to procedural, scientific, technical and administrative matters.
2. Except as may be otherwise provided in any protocol with respect to its annexes, the following procedure shall apply to the proposal, adoption and entry into force of additional annexes to this Convention or of annexes to any protocol:

(a) Annexes to this Convention or to any protocol shall be proposed and adopted according to the procedure laid down in Article 29;

(b) Any Party that is unable to approve an additional annex to this Convention or an annex to any protocol to which it is Party shall so notify the Depositary, in writing, within one year from the date of the communication of the adoption by the Depositary. The Depositary shall without delay notify all Parties of any such notification received. A Party may at any time withdraw a previous declaration of objection and the annexes shall thereupon enter into force for that Party subject to subparagraph (c) below;

(c) On the expiry of one year from the date of the communication of the adoption by the Depositary, the annex shall enter into force for all Parties to this Convention or to any protocol concerned which have not submitted a notification in accordance with the provisions of subparagraph (b) above.

3. The proposal, adoption and entry into force of amendments to annexes to this Convention or to any protocol shall be subject to the same procedure as for the proposal, adoption and entry into force of annexes to the Convention or annexes to any protocol.

4. If an additional annex or an amendment to an annex is related to an amendment to this Convention or to any protocol, the additional annex or amendment shall not enter into force until such time as the amendment to the Convention or to the protocol concerned enters into force.

Article 31. Right to Vote

1. Except as provided for in paragraph 2 below, each Contracting Party to this Convention or to any protocol shall have one vote.

2. Regional economic integration organizations, in matters within their competence, shall exercise their right to vote with a number of votes equal to the number of their member States which are Contracting Parties to this Convention or the relevant protocol. Such organizations shall not exercise their right to vote if their member States exercise theirs, and vice versa.

Article 32. Relationship between this Convention and Its Protocols

1. A State or a regional economic integration organization may not become a Party to a protocol unless it is, or becomes at the same time, a Contracting Party to this Convention.

2. Decisions under any protocol shall be taken only by the Parties to the protocol concerned. Any Contracting Party that has not ratified, accepted or approved a protocol may participate as an observer in any meeting of the parties to that protocol.

Article 33. Signature

This Convention shall be open for signature at Rio de Janeiro by all States and any regional economic integration organization from 5 June 1992 until 14 June 1992, and at the United Nations Headquarters in New York from 15 June 1992 to 4 June 1993.

Article 34. Ratification, Acceptance or Approval

1. This Convention and any protocol shall be subject to ratification, acceptance or approval by States and by regional economic integration organizations. Instruments of ratification, acceptance or approval shall be deposited with the Depositary.

2. Any Organization referred to in paragraph 1 above which becomes a Contracting Party to this Convention or any protocol without any of its member States being a Contracting Party shall be bound by all the obligations under the Convention or the protocol, as the case may be. In the case of such organizations, one or more of whose member States is a Contracting Party to this Convention or relevant protocol, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under the Convention or protocol, as the case may be. In such cases, the organization and the member States shall not be entitled to exercise rights under the Convention or relevant protocol concurrently.

3. In their instruments of ratification, acceptance or approval, the organizations referred to in paragraph 1 above shall declare the extent of their competence with respect to the matters governed by the Convention or the relevant protocol. These organizations shall also inform the Depositary of any relevant modification in the extent of their competence.

Article 35. Accession

1. This Convention and any protocol shall be open for accession by States and by regional economic integration organizations from the date on which the

Convention or the protocol concerned is closed for signature. The instruments of accession shall be deposited with the Depositary.

2. In their instruments of accession, the organizations referred to in paragraph 1 above shall declare the extent of their competence with respect to the matters governed by the Convention or the relevant protocol. These organizations shall also inform the Depositary of any relevant modification in the extent of their competence.

3. The provisions of Article 34, paragraph 2, shall apply to regional economic integration organizations which accede to this Convention or any protocol.

Article 36. Entry Into Force

1. This Convention shall enter into force on the ninetieth day after the date of deposit of the thirtieth instrument of ratification, acceptance, approval or accession.

2. Any protocol shall enter into force on the ninetieth day after the date of deposit of the number of instruments of ratification, acceptance, approval or accession, specified in that protocol, has been deposited.

3. For each Contracting Party which ratifies, accepts or approves this Convention or accedes thereto after the deposit of the thirtieth instrument of ratification, acceptance, approval or accession, it shall enter into force on the ninetieth day after the date of deposit by such Contracting Party of its instrument of ratification, acceptance, approval or accession.

4. Any protocol, except as otherwise provided in such protocol, shall enter into force for a Contracting Party that ratifies, accepts or approves that protocol or accedes thereto after its entry into force pursuant to paragraph 2 above, on the ninetieth day after the date on which that Contracting Party deposits its instrument of ratification, acceptance, approval or accession, or on the date on which this Convention enters into force for that Contracting Party, whichever shall be the later.

5. For the purposes of paragraphs 1 and 2 above, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by member States of such organization.

Article 37. Reservations

No reservations may be made to this Convention.

Article 38. Withdrawals

1. At any time after two years from the date on which this Convention has entered into force for a Contracting Party, that Contracting Party may withdraw from the Convention by giving written notification to the Depositary.

2. Any such withdrawals shall take place upon the expiry of one year after the date of its receipt by the Depositary, or on such later date as may be specified in the notification of the withdrawal.

3. Any Contracting Party which withdraws from this Convention shall be considered as also having withdrawn from any protocol to which it is party.

Article 39. Financial Interim Arrangements

Provided that it has been fully restructured in accordance with the requirements of Article 21, the Global Environment Facility of the United Nations Development Programme, the United Nations Environment Programme and the International Bank for Reconstruction and Development shall be the institutional structure referred to in Article 21 on an interim basis, for the period between the entry into force of this Convention and the first meeting of the Conference of the Parties or until the Conference of the Parties decides which institutional structure will be designated in accordance with Article 21.

Article 40. Secretariat Interim Arrangements

The secretariat to be provided by the Executive Director of the United Nations Environment Programme shall be the secretariat referred to in Article 24, paragraph 2, on an interim basis for the period between the entry into force of this

Convention and the first meeting of the Conference of the Parties.

Article 41. Depositary

The Secretary-General of the United Nations shall assume the functions of Depositary of this Convention and any protocols.

Article 42. Authentic Texts

The original of this Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts and equally authentic, shall be deposited with the Secretary-General of the United Nations.

IN WITNESS WHEREOF the undersigned, being duly authorized to that effect, have signed this Convention.

Done at Rio de Janeiro on this fifth day of June, one thousand nine hundred and ninety-two.

Annex I

Identification and Monitoring

1. Ecosystems and habitats: containing high diversity, large numbers of endemic or threatened species, or wilderness; required by migratory species; of social, economic, cultural or scientific importance; or which are representative, unique or associated with key evolutionary or other biological processes;
2. Species and communities which are: threatened; wild relatives of domesticated or cultivated species; of medicinal, agricultural or other economic value; or social, scientific or cultural importance; or importance for research into the conservation and sustainable use of biological diversity, such as indicator species; and
3. Described genomes and genes of social, scientific or economic importance.

Annex II

Part 1

Arbitration

Article 1

The claimant party shall notify the secretariat that the parties are referring a dispute to arbitration pursuant to Article 27. The notification shall state the subject-matter of arbitration and include, in particular, the articles of the Convention or the protocol, the interpretation or application of which are at issue. If the parties do not agree on the subject matter of the dispute before the President of the tribunal is designated, the arbitral tribunal shall determine the subject matter. The secretariat shall forward the information thus received to all Contracting Parties to this Convention or to the protocol concerned.

Article 2

1. In disputes between two parties, the arbitral tribunal shall consist of three members. Each of the parties to the dispute shall appoint an arbitrator and the two arbitrators so appointed shall designate by common agreement the third arbitrator who shall be the President of the tribunal. The latter shall not be a national of one of the parties to the dispute, nor have his or her usual place of residence in the territory of one of these parties, nor be employed by any of them, nor have dealt with the case in any other capacity.
2. In disputes between more than two parties, parties in the same interest shall appoint one arbitrator jointly by agreement.
3. Any vacancy shall be filled in the manner prescribed for the initial appointment.

Article 3

1. If the President of the arbitral tribunal has not been designated within two months of the appointment of the second arbitrator, the Secretary-General of the United Nations shall, at the request of a party, designate the President within a further two-month period.
2. If one of the parties to the dispute does not appoint an arbitrator within two months of receipt of the request, the other party may inform the Secretary-General who shall make the designation within a further two-month period.

Article 4

The arbitral tribunal shall render its decisions in accordance with the provisions of this Convention, any protocols concerned, and international law.

Article 5

Unless the parties to the dispute otherwise agree, the arbitral tribunal shall determine its own rules of procedure.

Article 6

The arbitral tribunal may, at the request of one of the parties recommend essential interim measures of protection.

Article 7

The parties to the dispute shall facilitate the work of the arbitral tribunal and, in particular, using all means at their disposal, shall:

(a) Provide it with all relevant documents, information and facilities; and

(b) Enable it, when necessary, to call witnesses or experts and receive their evidence.

Article 8

The parties and the arbitrators are under an obligation to protect the confidentiality of any information they receive in confidence during the proceedings of the arbitral tribunal.

Article 9

Unless the arbitral tribunal determines otherwise because of the particular circumstances of the case, the costs of the tribunal shall be borne by the parties to the dispute in equal shares. The tribunal shall keep a record of all its costs, and

shall furnish a final statement thereof to the parties.

Article 10

Any Contracting Party that has an interest of a legal nature in the subject-matter of the dispute which may be affected by the decision in the case, may intervene in the proceedings with the consent of the tribunal.

Article 11

The tribunal may hear and determine counterclaims arising directly out of the subject-matter of the dispute.

Article 12

Decisions both on procedure and substance of the arbitral tribunal shall be taken by a majority vote of its members.

Article 13

If one of the parties to the dispute does not appear before the arbitral tribunal or fails to defend its case, the other party may request the tribunal to continue the proceedings and to make its award. Absence of a party or a failure of a party to defend its case shall not constitute a bar to the proceedings. Before rendering its final decision, the arbitral tribunal must satisfy itself that the claim is well founded in fact and law.

Article 14

The tribunal shall render its final decision within five months of the date on which it is fully constituted unless it finds it necessary to extend the time-limit for a period which should not exceed five more months.

Article 15

The final decision of the arbitral tribunal shall be confined to the subject-matter of the dispute and shall state the reason on which it is based. It shall contain the names of the members who have participated and the date of the final decision. Any member of the tribunal may attach a separate or dissenting opinion to the final decision.

Article 16

The award shall be binding on the parties to the dispute. It shall be without appeal unless the parties to the dispute have agreed in advance to an appellate procedure.

Article 17

Any controversy which may arise between the parties to the dispute as regards the interpretation or manner of implementation of the final decision may be submitted by either party for decision to the arbitral tribunal which rendered it.

Part 2

Conciliation

Article 1

A conciliation commission shall be created upon the request of one of the parties to the dispute. The commission shall, unless the parties otherwise agree, be composed of five members, two appointed by each Party concerned and a President chosen jointly by those members.

Article 2

In disputes between more than two parties, parties in the same interest shall appoint their members of the commission jointly by agreement. Where two or more parties have separate interests or there is a disagreement as to whether they are of the same interest, they shall appoint their members separately.

Article 3

If any appointments by the parties are not made within two months of the date of the request to create a conciliation commission, the Secretary-General of the United Nations shall, if asked to do so by the party that made the request, make those appointments within a further two-month period.

Article 4

If a President of the conciliation commission has not been chosen within two months of the last of the members of the commission being appointed, the Secretary-General of the United Nations shall, if asked to do so by a party, designate a President within a further two-month period.

Article 5

The conciliation commission shall take its decisions by majority vote of its members. It shall, unless the parties to the dispute otherwise agree, determine its own procedure. It shall render a proposal for resolution of the dispute, which the parties shall consider in good faith.

Article 6

A disagreement as to whether the conciliation commission has competence shall be decided by the commission.

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BIODIPLOMACY

Genetic Resources and International Relations

Vicente Sánchez and Calestous Juma

The fate of the world's living resources has been a controversial theme in international relations for over two decades. The resources have been seen both as a common heritage of humankind and as sovereign property of nations. The debate has been resolved through protracted negotiations that resulted in the 1992 Convention on Biological Diversity.

The Convention has established a new international regime for governing the utilization and conservation of genetic resources. This Convention delicately balances on four main pillars: conservation of genetic resources, technological development, regulated access to genetic resources and international equity. The issue, however, is how to implement the Convention.

Biodiplomacy: Genetic Resources and International Relations is a detailed analysis of the main features of the Convention. With contributions from the leading authorities in biodiplomacy, the volume outlines specific ways of how to implement the Convention. *Biodiplomacy* is an essential handbook for those interested in the sustainable use of the world's living resources. It was prepared for governmental and inter-governmental officials, diplomats, researchers, journalists and graduate students.

Dr. Vicente Sánchez is former Chairman of the Inter-governmental Negotiating Committee for the Convention on Biological Diversity and Chilean Ambassador to Kenya. Ambassador Sánchez was educated at the University of Chile and Harvard University in medicine, sociology and anthropology. He has written widely on sustainable development.

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