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The role of the convention on biological diversity and its protocol on biosafety in fostering the conservation and sustainable use of the world's biological wealth for socio-economic and sustainable development

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Introduction

The Earth's physical and biological systems (land, atmosphere, oceans) are extremely complex and interrelated to the point that a change in even one component of any of the systems affects the other components and even the entire planet. Despite their in-built resilience, these systems are now approaching the point where they may not be able to meet human demands for adequate food, clean water, energy supplies, medicines and a healthy environment. As a result, the world is experiencing a number of global environmental changes: depletion of the stratospheric ozone layer, climate change, loss of biological diversity, land degradation and desertification, pollution of fresh and marine waters and accumulation of persistent organic pollutants. These changes are intensifying and are beginning to have a serious impact on the development goals and needs of a growing human population.

Biodiversity value

Of those changes, the loss of biodiversity is both the most dramatic and the least appreciated. It is generally accepted that the current loss of ecosystems, species and gene pools is faster than at any time since the extinction of the dinosaurs 65 million years ago. What is not generally recognized is how much is at stake (Fig. 1).

The views and opinions in this paper represent the views of the author and do not necessarily reflect those of the Convention on Biological Diversity and its Biosafety Protocol.

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Few people realize, for example, that 40% of the world economy is derived directly from biodiversity (Table 1). The aggregated annual value of ecosystem services worldwide is estimated to be US $18–61 trillion, which is similar to figures resulting from all goods and services that are produced by people. Soil microbial services are estimated at US $33 billion annually and insect pollination of over 40 commercial crops in the United States at US $30 billion per year. In the United States alone, sales of prescription drugs containing ingredients from wild plants amounted to more than US $15 billion in 1990 and genetic traits from wild crop varieties introduced into domestic agricultural crops contributed US $8 billion per year. Total seed-sector activities worldwide is estimated at US $45 billion annually. The market for herbal drugs amounted to US $47 billion in 2000 [1, 2].

Biodiversity loss

These figures provide a clear and compelling economic case for the conservation of biological diversity. However, at present, natural habitats and ecosystems are being destroyed at the rate of over 100 million hectares every year. Some 9 million hectares of forests are lost every year, 50% of the world's wetlands were lost in the past century and 80% of grasslands are suffering from soil degradation. Some 100–150 species are lost every day. If the current destruction rate in forests and coral reefs is maintained, 50% of the Earth's plants and animal species will be gone by the end of the twenty-first century [3–5].

Second only to habitat destruction, invasive alien species represent a major threat to biodiversity, with consequential economic loss (Table 2). One study documents that the economic damage associated with such species in six selected countries totals more than US $336 billion per year and assumes that similar costs of

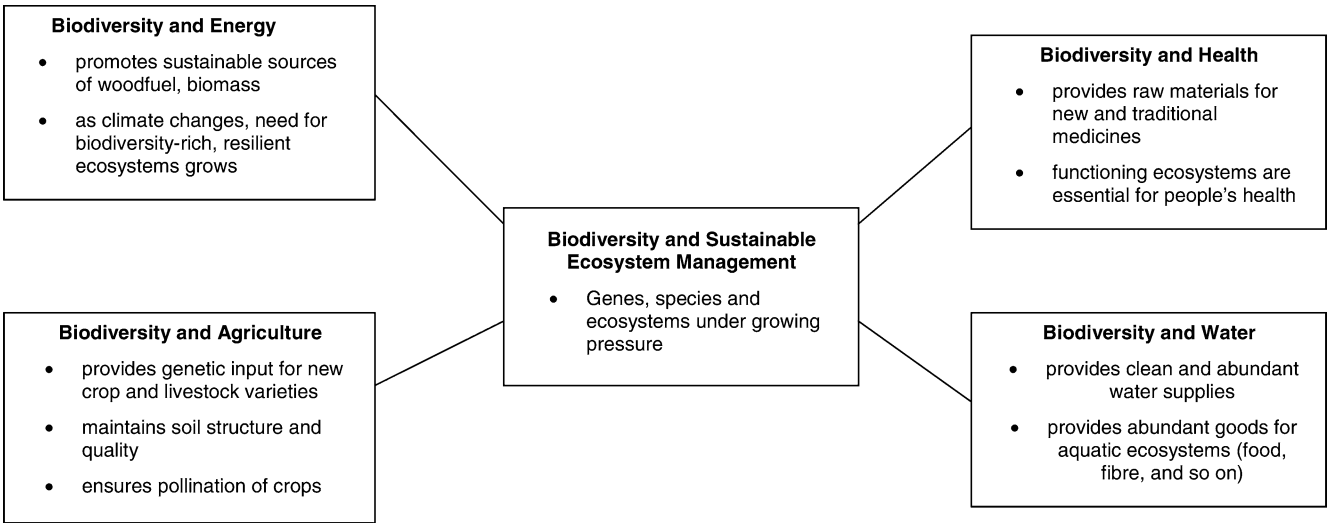

Fig. 1 Examples of the critical role of biodiversity and sustainable ecosystem management in priority areas

Table 1 Putting a price on biodiversity goods and services. Some 40% of the world economy is derived directly from biodiversity

Ecosystem services worldwide	US $18–61 trillion per year
Soil microbial services	US $33 billon per year
Global benefits from coral reefs	US $30 billion per year
Insect pollination of over 40 commercial crops in the United States	US $30 billion per year
Sales of prescription drugs containing ingredients from wild plants (in USA)	US $15 billion in 1990
Genetic traits from wild crop varieties introduced into domestic agricultural crops (in USA)	US $8 billion per year
Total seed-sector activities ordwide	US $45 billion per year
Golbal market for herbal drugs	US $47 billion in 2000

Table 2 Example impacts of alien invasive species

The invasive sea lamprey collapsed lake trout and other native Great Lake fisheries
Introduction of the Nile perch to Lake Victoria, as a prey for local fishermen, ate up all other fish they used to catch
Invasive brown tree snakes have wiped out native forest birds, bats and reptiles to extinction in Guam
Damages worldwide from invasive species were estimated at more than US $1.4 trillion per year

damage worldwide from invasive species would be more than US $1.4 trillion per year [6].

Anthropogenic changes in the atmosphere also threaten to accelerate global rates of extinction [7–9]. According to one scenario, if the current rate of global warming continues, one-third of the planet's species will disappear by 2050 [9].

Reduction of biodiversity, together with the associated traditional knowledge, entails a reduction of options for ensuring more diverse nutrition, enhancing food production, raising incomes, coping with environmental changes and managing ecosystems. Conserving and using biodiversity sustainability is key to feeding the 800 million malnourished people in developing countries.

Primary causes of biodiversity loss

The underlying causes of biodiversity loss are diverse and complex. They include:

1. increasing demand for biological resources as a result of increasing population, economic development and over-consumption
2. failure of people to appreciate the consequences of using inappropriate technology
3. failure of economic markets to recognize the true value of biodiversity or to apply the global values of biodiversity at local levels
4. failure of government policies to recognize and address the problems associated with the over-use of biological resources
5. increasing human migration, travel and international trade

Global response to biodiversity loss

In 1992, the Convention on Biological Diversity emerged from the Rio Summit as a comprehensive framework to

reverse the tide of destruction of biodiversity. The Convention has three goals: the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the use of genetic resources [10]. It attempts to reconcile conservation with economic development. More broadly speaking, the Convention has one simple overriding goal: to maintain the biological foundation on which all human societies depend.

The Convention provides a framework for action and the Parties have, over the years, translated its provisions into programmes of work covering all major types of ecosystems and on cross-cutting issues such as traditional knowledge, access to genetic resources and benefit-sharing, biodiversity and tourism, and incentive measures. They have also developed a number of tools for implementation. In 2000, they adopted the landmark Cartagena Protocol on Biosafety [11], which entered into force in September 2003. In 2002, they adopted a Strategic Plan committing themselves to achieving a significant reduction in the current rate of biodiversity loss by 2010. The Convention now has 188 Parties and the Protocol has 103 Parties.

Barriers to action

The Convention has already resulted in a number of achievements but progress in implementation is being slowed by a lack of firm political will and resources and a gross under-estimation of the true value of biodiversity and its importance for socio-economic development and poverty alleviation.

For real progress to be achieved, it is essential to put biodiversity in the forefront of development thinking and poverty-reduction strategies. This means integrating biodiversity concerns into sectoral policies, particularly economic and trade policies. It means eliminating the perverse incentives in agriculture and other sectors and providing positive incentives for conservation and sustainable use, through, among other things, equitable access and benefit-sharing arrangements. It also means ensuring that biodiversity and biosafety concerns are taken into account in all relevant forums. Finally, it requires effective coordination among the multilateral agreements and with trade organizations.

Improving the understanding of the cost of biodiversity loss will help mobilize the political will for the necessary action and understanding the cause of biodiversity loss; and the linkage between global environmental changes will help identify effective response options. This would offer a genuine opportunity for a sustainable future.

The developed countries will have to take the lead in adopting positive policy approaches towards sustainable consumption and production. They will have to take a fresh look at their policies on foreign aid, trade and debt relief. Critically, they should make available additional financial resources and technologies essential for developing countries to break the vicious circle of poverty and environmental degradation.

For their part, the developing countries need to create the conditions whereby stakeholders, particularly local communities, assume greater responsibility over the management of biological resources and benefit from their utilization. They need to give serious consideration to the effects of misuse of resources in defeating the purpose of well intended conservation laws.

Technology transfer and technology co-operation

One of the keys to implementation built into the Convention is technology transfer and co-operation. In this regard, a central role is attached to biotechnology. Many biotechnology techniques are available in the public domain and can be obtained through training programmes and information searches. Other biotechnologies are on offer, often from corporations that usually provide entire packages and discourage their modification and adaptation to local conditions—a key element of successful technology transfer.

Capacity-building efforts are also needed to ensure that a critical mass of people is trained and that their services are retained for extended periods of time. There is also a need to ensure that the necessary infrastructure is in place to maintain and, if possible, further adapt and develop the technologies transferred. In this respect, capacity-building efforts need to promote not only imitative skills but also innovative potential.

The World Summit on Sustainable Development called on Governments, industry, the research community and civil society to engage in partnerships for the development and transfer of technologies that could contribute to a sustainable use of the world's resources. Such partnerships would have to be conducive to investment and technology development as well as their transfer and diffusion. In the case of biodiversity, there is a vast potential for partnerships based on clearly enunciated and mutually agreed trade-offs between access to genetic resources and the sharing of benefits from their utilization.

It is also important to consider the mechanisms that can be put in place to collect and disseminate information on available technologies. Developing countries need to be able to monitor developments and identify technologies that may be useful for the promotion of the objectives of the Convention in their circumstances. They also need information on the means of acquiring them and the terms on which they may be made available.

However, there appears to be a considerable gap between what is being recognized as important and what is being realized. Technology transfer is seriously hampered by a number of factors such as:

1. lack of appropriate regulatory, financial and institutional frameworks

2. lack of absorptive capacity at the national level
3. fear of failure to manage risks associated with new technologies
4. limited market access and hence a lack of incentive for developing countries to invest in technological innovations
5. lack of international technological alliances or partnerships beneficial to biodiversity-rich developing countries
6. lack of knowledge-based institutions on available technologies

Biotechnology and biosafety issues within the framework of the convention

When negotiating the Convention, Governments recognized that biotechnology has the potential to contribute to achieving its three objectives, if developed and used with adequate safety measures for the environment and human health. This recognition was given expression in international law with the adoption of the Cartagena Protocol on Biosafety in January 2000 and its entry into force in September 2003. The concept of biosafety encompasses a range of measures, policies and procedures for minimizing potential risks that biotechnology may pose to the environment and human health. Establishing credible and effective safeguards for genetically modified organisms (GMOs) is critical for maximizing the benefits of biotechnology while minimizing its risks. In this way, the Protocol seeks to meet the needs of consumers, industry and the environment.

However, it should be noted that the politics of biotechnology cover a broader set of issues about the purposes of genetic modification, ownership of the technology, setting of priorities, the distribution of benefits and risks and the degree of scientific uncertainty that exists regarding the potential impacts of genetic modification and regulatory climate governing the safe development and application. Reconciling these conflicting concepts is problematic. A key component to the formulation of accepting environments for GMOs or living modified organisms (LMOs) is the establishment of adequate national and international regulatory frameworks.

Since the first genetically modified tomato became available in shops in the United States in 1994, dozens of food crops and animals have been modified for greater commercial value, higher yield, improved nutrition, or resistance to pests and disease. However, its benefits are accompanied by controversy. Proponents argue that biotechnology will boost food security for the world's growing population by raising sustainable food production and benefit the environment by reducing the need for more farmland, irrigation and pesticides. For many people, however, this rapidly advancing science raises a tangle of health, environmental, social, ethical, and regulatory issues. Because modern biotechnology is still so new, they say, much is unknown about how its products may behave and evolve, and how they may interact with other species and little is known about their socio-economic impacts particularly for the poor.

Scientists do not have a clear view of the full ecological impact of GMOs. There is, however, a broad consensus that, while modern biotechnology may have great potential, it must be developed and used with adequate safety measures, particularly for the environment.

To promote biosafety, the Protocol reflects a fundamental concept known as the ''precautionary approach'', contained in Principle 15 of the 1992 Rio Declaration on Environment and Development, which states that, ''where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation''. The Protocol is applicable to the transboundary movement, transit, handling and use of all LMOs (the term used by the Protocol) that may have adverse effects on the environment and human health. It deals primarily with LMOs intended for introduction into the environment and genetically modified agricultural commodities.

Key elements of the Protocol include: notification of intended shipments of LMOs, an advance informed agreement (AIA) procedure for decision-making on whether to permit import, risk assessment and management, information-sharing and a Biosafety clearing-house for information exchange on LMOs; provisions on handling, transport, packaging and identification of LMOs, a compliance regime, rules on liability and redress and an action plan for capacity-building and public participation [11]. However, the decision-making procedure by countries of import and the documentation requirements for the identification of LMOs is of particular importance given their potential trade implications.

The AIA procedure under the Protocol requires exporters of LMOs intended for direct release into the environment to provide detailed information on the organism in question and to seek prior approval of importing nations before the first transboundary movement takes place. Importing nations are to undertake risk assessment before making a decision; and in so doing, they can invoke the precautionary approach. This means that a Government may decide not to permit a particular LMO to be imported across its borders, even if there is insufficient scientific evidence about the LMOs potential adverse effects. It also gives importing countries the right to take into account socio-economic concerns (provided they are ''consistent with their international obligations''). Such concerns might include the risk that imports of genetically engineered foods may replace traditional crops, undermine local cultures and traditions or reduce the value of biodiversity to indigenous communities. In principle, it is up to the Parties to the Protocol to determine the level of protection for biodiversity or human health that they wish to achieve.

The documentation requirements under the Protocol vary depending on whether the LMOs are destined for contained use or intended for intentional introduction into the environment or are intended for direct use as food or feed or for processing (agricultural commodities).

The Protocol exempts certain types of LMOs either from the entire agreement or from specific provisions. It does not cover pharmaceuticals for humans addressed by other international agreements and organizations or products derived from LMOs, such as cooking oil from genetically modified corn or paper from LMO trees. Exempted from the AIA procedure are LMOs in transit, LMOs destined for contained use and LMOs intended for direct use as food or feed or for processing (''agricultural commodities'', which represent the vast majority of internationally traded LMOs). As science continues to advance rapidly, Governments will formally review the effectiveness of the Protocol and its procedures every five years—with an eye to revising and improving the agreement if required.

The politics of biotechnology

The politics of biotechnology are often played out in international trade. A central element is the extent to which the various international regimes and approaches that deal with LMOs use a scientifically sound basis for decision-making. Critics warn that the Protocol will result in new trade barriers and that the precautionary approach will obscure the boundaries between scientific assessments and political decision-making and strengthen the prerogative of importing nations to ban LMOs imports. Key LMOs exporters will want to ensure that World Trade Organization (WTO) obligations apply to trade disputes concerning LMOs. The essential difference in outlook is whether it should be assumed that GM crops are as safe as non-GM crops unless proven otherwise, or whether they should be considered risky unless proven to be safe.

Differences in views are largely due to the lack of appreciation of the basic elements and the role of risk assessment, precaution and socio-economic considerations in decision-making by the countries of import. Risk assessment under the Protocol is to be carried out in a scientifically sound manner, using recognized risk-assessment techniques to evaluate and characterize the potential risks of LMOs to biodiversity. A common problem with risk assessment is the low ability or failure to detect a relationship between exposure and harm, given the various sources of uncertainty. Complete knowledge of the environmental effects of introducing LMOs is therefore unlikely. However, the precautionary approach reflects a particular aversion to risk in the face of uncertainty. Decision makers inevitably base their decisions, in part, on their values or their attitudes to risk, or on those of the constituencies they represent and their desire for a prudent approach to new products or technologies. Risk assessments and the precautionary approach therefore have different roles to play in the decision-making process and are in no way incompatible. Decision makers may also base their decisions on the likely socio-economic impacts of the new product.

As indicated earlier, in reaching a decision on import, a Government may decide on the basis of precaution not to permit a particular LMO to be imported, even if there is insufficient scientific evidence about its potential adverse effects. Countries are also entitled to take into account socio-economic considerations arising from the impact of LMOs on the conservation and sustainable use of biological diversity in determining whether to approve the import of an LMO provided that their actions are consistent with their international obligations. On the other hand, under the WTO General Agreement on Tariffs and Trade and the agreements on Sanitary and Phytosanitary (SPS) measures and Technical Barriers to Trade (TBT) measures, reasons used to justify restrictions on trade are strictly limited, temporarily, and must be based on scientific risk assessments.

Need for increased dialogue, information sharing and co-operation among relevant bodies

There is a need to establish enabling political environments for addressing issues at the interface of trade and biodiversity in relevant forums in a more concrete and transparent manner. These issues include: biodiversity values, patentability of life forms,; the protection of the knowledge, innovations and practices of indigenous and local communities associated with genetic resources, continued access to genetic resources and the equitable sharing of benefits from their use. Equally, there is a need to address the interplay between the Biosafety Protocol's precautionary approach and the WTO SPS science-based approach; the packaging and identification provisions of the Protocol and the WTO Agreement on TBT and the question of the use of socio-economic consideration in decision-making on LMO imports.

The Protocol can only ensure that the global use of biotechnology is safe if each and every country actively promotes biosafety at the national level. National policy makers and legislators have a critical role to play in establishing and strengthening laws and standards for reducing the potential risks of LMOs. But Governments cannot achieve biosafety on their own: they need the active involvement and co-operation of other stakeholders; in particular agricultural and health-care research institutes, the biotechnology industry, civil society, individual citizens and non-governmental organizations. Because biotechnology is such a revolutionary science and has spawned such a powerful industry, it has great potential to reshape the world around us. A wide array of stakeholders and countries are engaged in the issue. The people involved in biosafety often have widely differing values and expectations. Only a continuing debate that is transparent and respectful can ensure that all points of view are reflected in the final outcome.

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