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MAIN THEME: FOREST BIOLOGICAL DIVERSITY

Report of the Ad Hoc Technical Expert Group on Forest Biological Diversity

Note by the Executive Secretary

Executive summary

In its decision V/4, the Conference of the Parties, decided to establish an Ad Hoc Technical Expert Group on Forest Biological Diversity to assist the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in its work on forest biological diversity. Pursuant to its mandate, the Group:

(a) Carried out a review of available information on the status and trends of, and major threats to, forest biological diversity, to identify significant gaps in that information;

(b) Identified options and suggested priority actions, time frames and relevant actors for the conservation and sustainable use of forest biological diversity for their implementation through relevant activities;

(c) Provided advice on scientific programmes and international cooperation in research and development related to conservation and sustainable use of forest biological diversity; and

(d) Identified innovative, efficient and state-of-the-art technologies and know-how relating to assessment, planning, valuation, conservation and sustainable use of forest biological diversity.

In its analysis on the status and trends of, and major threats to forest biological diversity, and major gaps in that information the Group concluded that, *inter alia*:

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(a) Deforestation is taking place at a significant rate, especially in the tropical forest biome;

(b) Large-scale degradation of forest quality occurs in many regions and forest types due to human activities, and this is exacerbated by improved access to intact forests;

(c) There is a clear need to better monitor and report on changes in the quality and quantity of the world's forests, from the national to the global level;

(d) There is generally less knowledge with respect to forest biological diversity in tropical forests compared to the other two biomes;

(e) The relationship between biological diversity and ecosystem goods and services is direct, but the exact linkages remain unclear and require research. Critical levels of biological diversity loss and/or change, as well as the human impacts that cause them and which affect forest ecosystem functioning and forest goods and services, are still largely unknown;

(f) Sustainable forest management is generally less profitable in monetary terms than ecologically non-sustainable forest practices.

(g) Local and indigenous communities and, ultimately, nations are likely to be the major losers from the conversion of forested land to other uses and non-sustainable forest practices.

(h) The underlying causes of loss of forest biological diversity are very fundamental and complex and they derive from broader macro-economic, political and social causes, such as poverty, rapid population growth, globalization of trade, unsustainable production and consumption patterns, political unrest, lack of good governance, land rights disputes, and lack of institutional technical and scientific and forest management capacity. Loss of forest biological diversity cannot be stopped and reversed without addressing these and other fundamental problems; as well as by improving our knowledge of biological diversity and developing more sustainable forms of forest management.

(i) There are some positive trends and developments upon which to build, mainly in the area of improving forest policies and sustainable forest management practices, which include biological diversity provisions. Public and consumer awareness is leading to the development of a more serious interest in biological diversity and environmental issues by other stakeholders, including politicians and the private sector. The promotion of certification of forest products, when done properly, can also be an encouraging development to provide incentives for sustainable forest management.

The Group developed recommendations for key actions to maintain and restore forest biological diversity to meet each of the major problems identified by the group. Main principles behind the recommendations were:

(a) Forest issues relate to a range of political, economic, social, cultural, environmental and scientific aspects, which must be dealt with in a coordinated, cross-sectoral and holistic way;

(b) It should be recognized that the conservation of forest biological diversity should be an overall objective of sustainable management of all types of forests by all countries, and not be limited to protected forest areas;

(c) Effective action for forest biological diversity needs to address both the direct and the underlying causes of loss, and this requires a detailed understanding of these causes at both the

international and national levels, since each country has different circumstances and will need a specific approach. Many of the issues can only be addressed globally or regionally;

(d) Effective action will require participation and discussions among all parties with interests in forests, including indigenous peoples.

The Expert Group gave its recommendations for goals, objectives and activities in the framework of three main headings below, under which the following fourteen goals were identified:

(a) Assessment and monitoring:

(i) Develop general classification of forest resources on various scales in order to improve the assessment of the status and trends of forest biological diversity;

(ii) Improve knowledge on and methods of the assessment of the status and trends of forest biological diversity, based on available information;

(iii) Improve understanding of forest ecosystem functioning;

(iv) Develop infrastructure for data and information for forest ecology and test-relevant techniques;

(b) Conservation and sustainable use:

(i) Apply the ecosystem approach;

(ii) Adequately conserve forest genetic resources;

(iii) Address the direct causes of loss of forest biological diversity;

(iv) Restore forest biological diversity in the framework of the ecosystem approach;

(v) Protect, manage and enhance rare and threatened species;

(vi) Protect indigenous peoples traditional cultures and promote the participation of indigenous peoples and local communities in the conservation, management and sustainable use of forest biological diversity;

(vii) Improve the effectiveness of protected area networks in conserving forest biological diversity;

(c) Institutional and socio-economic enabling environment:

(i) Enhance the institutional enabling environment;

(ii) Address economic failures and distortions that lead to decisions that result in loss of forest biological diversity;

(iii) Increase public education and awareness.

Ways and means as well as actors for activities in each of the three main groups of options are also identified.

On the basis of its recommendations, the Group identified several areas that should be given priority in scientific programmes and in the international cooperation on research and development activities. It also recognized several innovative and efficient and state-of-art technologies and know-how

methodologies. They are related to assessment, planning, conservation and sustainable use of forest biological diversity.

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I. INTRODUCTION

1. In its decision V/4, the Conference of the Parties at its fifth meeting, held in Nairobi in May 2000, decided to establish an Ad Hoc Technical Expert Group on Forest Biological Diversity to assist the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in its work on forest biological diversity. The terms of reference of the Expert Group, as contained in the annex to that decision, request the Group to:

(a) Provide advice on scientific programmes and international cooperation in research and development related to conservation and sustainable use of forest biological diversity in the context of the programme of work for forest biological diversity;

(b) Carry out a review of available information on the status and trends of, and major threats to, forest biological diversity, to identify significant gaps in that information;

(c) Identify options and suggest priority actions, timeframes and relevant actors for the conservation and sustainable use of forest biological diversity for their implementation through relevant activities;

(d) Identify innovative, efficient and state-of-the-art technologies and know-how relating to assessment, planning, valuation, conservation and sustainable use of forest biological diversity and provide advice on ways and means of promoting the development and transfer of such technologies.

2. The Group has held two meetings. The first took place in Montreal, Canada, from 27 November to 1 December 2000, with financial support from the Government of Canada. It elected Mr. Ian Thompson (Canada) and Mr. Gordon Patterson (United Kingdom), as Co-Chairs of the Group and Mr N Manokaran (Malaysia) as Rapporteur. Its second meeting took place in Edinburgh, United Kingdom, from 23 to 27 April 2001, with financial support from the Government of the United Kingdom.

3. The Expert Group addressed the issues contained in its terms of reference as requested by the Conference of the Parties and the present report thus provides SBSTTA with (a) a review of information on the status and trends of forest biological diversity (part II of the present report); (b) a set of options and priority actions for conservation and sustainable use of forest biological diversity (part III of the present report), addressing (i) assessment and monitoring; (ii) conservation and sustainable use; and (c) institutional and socio-economic enabling environment.

4. The Group considered the issues of scientific programmes and international cooperation in research and development related to conservation and sustainable use of forest biological diversity, and provides its advice in part IV of the present report. It also sought to identify technologies and know-how related to assessment, planning, valuation, conservation and sustainable use of forest biological diversity and to provide advice on ways and means of promoting the development and transfer of such technologies, as proposed in part V of the present report.

II. STATUS AND TRENDS OF FOREST BIOLOGICAL DIVERSITY AND MAJOR GAPS IN INFORMATION

A. Status and trends of forest biological diversity

5. Forest biological diversity should be quantified and described at multiple scales, from large forest landscapes of several thousand square kilometres, to the genetic level within individual organisms. The

present report refers to forest landscapes, ecosystems, species, and genes, and considers the diversity of structure, function, and composition existing at each level. Scale is also considered in a second sense, including global, regional and local (or national), required to report activities and outcomes that address the issue of maintenance of biological diversity in forests.

6. Determining the current global status of forest biological diversity is somewhat problematic because of difficulties in quantifying biological diversity in a meaningful fashion. Describing biological diversity on the local or national scale for most countries may not be entirely possible, and even in countries that attempt to report on biological diversity, data on indicators are usually not well developed. Further, the extent and rate of change of the world's forests are still unclear, especially at the national level, and long-term trends are distorted by the lack of solid baseline data and inconsistent use of terms. Where forest inventory data do exist, in both the developed and developing world, the information is often outdated, of poor quality and is especially difficult to compare among regions because the data sources, as well as the definitions of forests and forest types, differ. However, much progress has been made and we are in a better position to quantify forest biodiversity than just ten years ago.

7. The present report uses the Food and Agriculture Organization of the United Nations (FAO) definition of forests, which has been set for the monitoring of global changes in forest cover and allows comparison between countries. Although there is not complete global agreement with the FAO definition of "forest", based on those FAO data 3,869 million ha of global forest remain in 2000, but there has been decline in the forest area by ca. 9.4 million ha (0.22 per cent annually) since 1990, of which most was natural forest in the tropics. Preliminary estimates show that net deforestation rates have slightly increased in tropical Africa, remained constant in Central America, and declined slightly in tropical Asia and South America. The establishment of plantation forests and reforestation activities in temperate and boreal forests of some industrialized countries have increased and led to a decline in deforestation rates in those biomes. In the tropical biome, the rate of plantation establishment has increased dramatically during the last decade. However, the Group noted that plantation forestry cannot fully compensate for deforestation of primary forest in terms of biological diversity, especially in the tropics or in temperate regions, where exotic, rapidly growing tree species have most often replaced the original stands. FAO's assessments do not encompass forest quality aspects (e.g. no clear distinction between primary and secondary forests, nor among different types of plantations), making an assessment of the quality of global forests difficult.

Box 1

Possible definition of "forest ecosystem" and "forest biological diversity" proposed by the Group

Forest ecosystem: A forest ecosystem is a dynamic complex of plant, animal and micro-organism communities, and their abiotic environment, interacting as a functional unit, where the presence of trees is essential. Humans, with their cultural, economic, and environmental needs, are an integral part of many forest ecosystems.

Forest biological diversity: Forest biological diversity means the variability among forest living organisms and the ecological processes of which they are part; this includes diversity in forests within species, between species and of ecosystems

8. At the broadest level, forests need to be better categorized to enable a proper global assessment of change in forest biological diversity. At the very least, it is important to distinguish between primary forests, that have not been directly influenced by humans and thus have most of their original biological

diversity, and various types of secondary forests, which have regenerated following cutting or clearing and may support only a portion of the original biological diversity. Plantations are best described as a class of secondary forests, where often the major objective is wood production, although many countries are also using plantation forestry to try to recover previously degraded woodlands. Agroforests should also be considered as a distinct class of forests because, while supporting a portion of local biological diversity, they lack full species complements.

9. Care must be taken in reporting forest cover, relative to biological diversity, by distinguishing among these broad classes of forests, because biological diversity differs in each. There is a need to harmonize forest reporting on the national, regional, and global scales to improve understanding of forest quality change, and also to include within these reports aspects relevant to assessing biological diversity. A key enabling feature required for reporting is the use of comparable forest classification systems that can be aggregated to higher scales, from local or national scales, and that will accurately correlate to changes in forest biological diversity. Essential improvements in collecting and reporting forest data would be, for example, to distinguish between various numerical classes of canopy cover by forest type, and between primary forests, secondary forests, plantation forests and preferably, also between young forests and older forests.

10. On very large scales, there is clear evidence that forest biological diversity is related to total forest area, and small forest fragments retain only a small portion of the normal species complement. Globally, many primary forests have become degraded or deforested, so it is clear that forest biological diversity is rapidly declining, especially in the tropics. The capability of forests to maintain biological diversity has changed over large areas, as primary forests have been deforested or replaced by secondary forests of various qualities as a result of activities such as cutting, land-clearing, deliberate forest fires, fragmentation caused by forest road networks and conversion to agricultural lands, and the homogenization of forest stands. Far fewer intact larger blocks of primary forests now occur, compared to earlier, in all forest biomes.

11. Generally, species richness increases with decreasing latitude, with the highest levels of endemism in the tropics for flora and fauna. Unfortunately, knowledge and documentation of species follow the opposite trend, and many tropical species and processes remain unidentified. An important difference between tropical forests and temperate or boreal forests is the high local richness per unit of area (alpha diversity) in tropical forests and the high endemism, compared to lower alpha diversity in the other two biomes at the stand level. Temperate and boreal forests tend to have greater landscape diversity than tropical forests. Yet in all forest biomes there are areas with very high local diversity, and forest sites with high primary productivity maintain greater diversity than those with low primary productivity. These facts have important implications, which differ among the biomes, for landscape management strategies, including protected area placement and research needs for forests.

12. The number of threatened and endangered forest species seems to correlate with the size and quality of forest habitats, temporal and spatial continuity in the forest landscape, and with the history of forest use. The current extinction rate is far higher (1,000 to 10,000 times) than the rate at which species evolve and is at a historically high level. The majority of animal and plant species that are becoming extinct come from forest ecosystems. Current estimated rates of extinction for most higher life-forms in tropical rainforests are 1-10 per cent of those species in the next 25 years. The main direct causes of extinctions are habitat loss, due to land conversion and fragmentation of habitats, alien species invasions, and over-harvesting of forest resources, including logging. In future, climate change may be a further major factor, interacting with existing problems and contributing to extinctions (see section D below, "Causes of loss of forest biological diversity").

13. The number of endangered species, as well as local extinctions of rare species, can be expected to rise because of the time delays ("extinction debt") associated with fragmentation effects, forest loss, and declines in habitat quality. In particular, species requiring specific habitats that may be limiting, or which have large home-ranges, will become increasingly endangered. Some well-known species, such as great apes and large carnivores, are expected to become extinct due to habitat loss, over-exploitation, genetic effects of small populations and illegal hunting, in spite of the general positive attitude towards their conservation and the considerable conservation efforts.

14. While there is information on the genetic diversity of a few animal species and important trees, in general few such data exist. However, it is evident, that genetic diversity will be severely eroded due to forest decline (e.g. local extinctions of small, often unique populations) and that the effects of forest fragmentation and deforestation on genetic diversity have been overlooked.

15. Protected forest areas have increased in recent years, both in number and in area. However, globally forests are neither well protected, nor well represented in protected areas, with less than 8 per cent of the world's forest afforded some kind of protected status. Furthermore, particularly in tropical areas, only a minor portion of all the so-called protected area is actually secure. Most protected areas are small and insufficient to serve as source populations for large vertebrate species; nor do they fully protect regional species or local genetic diversity. The lack of small-scale forest classifications for all countries precludes an assessment of the representativeness of forest types in protected areas. Nevertheless, biological diversity will never be maintained by a network of protected areas alone, and sustainable management of large associated areas will also be required. Protected areas must be considered as part of a continuum of managed areas, from primary protected forest to fibre plantations.

16. Regardless of forest type, various characteristics develop or accumulate with forest age. Different animal and non-woody plant species associate with various stages of forest development because of these features, and so forest communities change over time in the same location. Old forests are an important category of forests, because certain species are optimally or solely associated with such forests. Key indicators for old forests are known for boreal zones and, to a lesser extent, in temperate forests, but are poorly known in tropical forests.

17. A body of scientific theory helps to understand biological diversity, but much remains to be understood. In particular, while biodiversity is clearly related to forest goods and services, the exact mechanistic relationships are not well understood. Further, little testing of indicators has been carried out in terms of their capability as predictors of broader changes in biological diversity, or defining the concept of forest quality and how well it can be predicted by indicators. Finally, there is a clear need to understand critical thresholds of forest change that will produce substantial losses in biological diversity, particularly among key or keystone species.

18. One source of information that has largely been overlooked is the traditional knowledge of indigenous peoples. Indigenous peoples have knowledge that has developed over many generations, but this knowledge has not yet been fully understood nor recognized, because the origin, nature, ways of use and transfer of this knowledge are different from Western "formal" science and scientific practices. In addition, there is often little mutual trust for sharing traditional knowledge, due to the absence of recognition of indigenous peoples and their rights.

19. Total forest cover is a coarse predictor of biological diversity, and much better indicators are needed to properly report status and trends of biological diversity on scales ranging from national to global. Most local forest inventories are conducted to monitor harvestable volumes, rather than to monitor biological diversity. Monitoring of biological diversity and of changes caused by forestry practices is

important in order to assess the effectiveness of management and cumulative change through forest use. Adaptive management, based on consistent monitoring and comparison of biological diversity between primary and secondary forests, is an important part of the ecosystem management protocol. Surrogates for high levels of biological diversity, such as umbrella species, indicator species, key habitats and structural indicators, may help to assess and predict the effectiveness of conservation and forest management programmes. Such surrogates must be carefully selected, based on sound scientific understanding of their properties. Data on rare and threatened forest species alone are insufficient to provide a reliable picture of broader trends in biological diversity. Species that are naturally rare, or have declining populations, represent a special case for knowledge needs and management. Such species must be identified and understood in terms of the processes which affect their populations. Often, national biological diversity databases do not exist and the availability of long-term benchmark data for trends in possible indicators is rare.

20. Aside from the lack of useful indicators, the incomplete and non-standard forest classifications, and the need for improved science, many countries lack the necessary infrastructure to report on biological diversity. An important prerequisite in assessing the status of biological diversity is technology transfer to developing nations, along with equipment and training in the methods required to evaluate biological diversity and natural resources, and to map their distribution.

B. Ecosystem functioning and services

21. Forest ecosystems provide a wide array of goods and services, ranging from marketable commodities such as timber and some non-timber forest resources, to many goods and vital services that do not usually have a market value, including, for example, global climate regulation and watershed protection. These non-market goods and services are important to humans in general on the local, national, regional, and global scales and can often be essential to maintain the way of life of indigenous and local communities.

Box 2

The ecosystem approach

The implementation of the ecosystem approach to forest biological diversity, based on the description and the operational guidance endorsed by the Conference of the Parties in decision V/6, and on the principles recommended for application under the same decision, should substantially help to maintain these non-market goods and services. The ecosystem approach could be considered as a strategy for the integrated management of forests that promotes their conservation and sustainable use in an equitable way. Humans, with their cultural diversity, are an integral component of forest ecosystems. The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of forest ecosystems and the absence of complete knowledge or understanding of their functioning.

According to the ecosystem approach, forest ecosystems should be managed for their intrinsic values and for the tangible benefits they provide to human beings, in a fair and equitable way. Forest ecosystem managers should consider the effects – actual or potential – of their activities on forest ecosystems, to avoid unknown or unpredictable effects on their functioning and, therefore, on their values.

Forest ecosystems should also be understood and managed in an economic context. In particular, costs and benefits in forest ecosystems should be internalized to

the extent feasible. In addition, market distortions that adversely affect forest biological diversity should be reduced and incentives that promote forest biodiversity and sustainable should be aligned.

Finally, the ecosystem approach stresses that forest ecosystems should be managed within the limits of their functioning. Therefore, the conservation of their structure and functioning should be a priority target. This is a prerequisite for keeping their full values, including the goods and services that forests deliver to human beings.

22. Sound forest ecosystem functioning and, therefore, the related forest goods and services depend on the maintenance of a whole range of interactions between biotic and abiotic components. Biologically diverse forests are generally thought to be more resilient and less liable to major outbreaks of pests and diseases. However, understanding the role of biological diversity in the functioning of ecosystems is a relatively new field of research and the linkages between degree of loss of forest biological diversity and the ability of forests to sustain their range of goods and services is not well known. In view of the pending large-scale extinctions, there is an urgent need to improve our understanding in this field. Identification of critical thresholds of impacts for sustaining biological diversity and other goods and services would be valuable in developing management strategies.

23. The dependence of indigenous peoples and local communities on forest ecosystems and biological diversity (and the resulting goods and services) is greater than in the general population. Alterations and loss of ecosystems and forests therefore have a direct negative impact on the survival of indigenous peoples and cultures. Another problem occurs in areas where there is a change in land use of previously forested areas, often triggered by the induced dependence upon non-traditional goods and adaptation to a monetary economy, instead of traditional subsistence methods. In most instances, these changes are accompanied by equal opportunities for sustainable development for indigenous peoples.

24. Each of the three main forest biomes (boreal, temperate, tropical) has characteristic ecological functions, and human impacts may thus have different consequences, both currently and in a historical sense.

25. The boreal forest biome is characterized by low species richness and by extreme contrasts in the functional attributes of important species for ecosystem processes. So the loss of a key species may have significant impacts on an ecosystem. Large-scale human activities, such as extensive logging and those that cause global climate change, may have a dramatic impact on overall ecosystem functioning and forest goods and services. Boreal forests represent 49 per cent of the total vegetation and soil carbon contained in the three biomes, and so play a key role in global climate regulation.

26. Biological diversity in temperate forests is determined primarily by human-induced changes in land use and forestry practices, as well as by the site quality. Greatest diversity is reached in undisturbed, natural forests and on sites with highest fertility. Human-induced land conversion, fragmentation and air pollution can cause loss of biological diversity and ecosystem function, and climate change is likely to interact with these factors to cause further unpredictable changes. Many temperate forests, especially in Europe, have been fragmented, exploited and managed for many centuries as part of cultural landscapes, and some form of continued management will be required to maintain characteristic biological diversity and a desirable range of ecosystem goods and services. Some forest types and habitats have been particularly heavily destroyed or degraded (e.g. riparian forests). Only a very small amount of primary temperate forests remains and old growth characteristics and structures, such as dead wood, are usually under-represented in the majority of secondary and plantation forests. Overall, the temperate biome is currently an important terrestrial net carbon sink.

27. The main characteristics of tropical forest ecosystems are their high biological richness and high endemism and, unlike boreal forest ecosystems, the number of species greatly exceeds the number of key ecological processes. This situation gives the ecosystem an apparent stability. Tropical forests are also characterized by the very slow pace of their development, which presents a difficulty in studying their ecological processes. The consequences of species loss through human activity may be delayed and even possibly offset by redundancies in functional relationships. Tropical forest soils are vulnerable to rapid degradation and erosion after logging/forest clearing, because almost all organic matter is maintained in the vegetation. Unsustainable use in tropical forests results in the loss of key animal species, which act as vectors for reproduction and dispersal of forest trees, and loss of key structural attributes such as lianas and epiphytes, which could have long-lasting effects on biological diversity and its related goods and services. But there is also some evidence that secondary tropical forests can be carefully managed to sustain traditional products as well as some of the biological diversity and other environmental services found in primary forest. Tropical forests hold 37 per cent of forest carbon but, because of deforestation and land use changes, the tropical forest biome is currently a net source of carbon dioxide to the atmosphere.

28. Restoration of forest biological diversity in degraded forests and deforested lands is an issue of growing importance in both the developed countries and the developing world. Most studies of forest biological diversity have focused on natural forests. However, in the future there is a need to focus more on the potential, on the regional and landscape scales, for synergy from combining management of different forests, including primary, secondary, agro-forests and forest plantations, to achieve a specified range of goods and services. Where plantation forests are created on former agricultural lands, rather than as a direct replacement for natural forest, it has the potential to restore at least some of lost forest biological diversity and other goods and services, especially where native species of local origin are used. Plantations can also help reduce the pressure on natural forests for exploitation for fuel wood and timber. The rate of restoration of forest biological diversity in different situations is poorly understood and research should be increased in this area. Although considerable diversity may develop in a few decades, full restoration to levels of forest biological diversity approaching those found in primary forests may take centuries.

C. Valuation of forest products and ecosystem services

29. There is a spatial and temporal mismatch between those who bear the costs of deforestation, forest change, and biological diversity loss, and those who receive the benefits. Much of this mismatch is related to lack of value attached to forest goods and services and the higher priority that is given to short-term benefits, as opposed to long-term sustainable returns from forests.

30. Forest values include:

(a) *Direct use values:* values arising from consumptive and non-consumptive uses of the forest, e.g. timber and fuel, extraction of genetic material, tourism;

(b) *Indirect use values*: values arising from various forest services, such as protection of watersheds and the storage of carbon;

(c) *Option values*: values reflecting a willingness to pay to conserve the option of making use of the forest, even though no current use is made of it;

(d) *Future option values:* values of learning about future benefits that would be precluded by loss of forest resources (e.g., values related to the existence of chemical active principles not discovered yet);

(e) *Non-use values* (also known as existence or passive use values): these values reflect a willingness to pay for the forest in a conserved or sustainable use state. However, the willingness to pay is unrelated to current or planned use of the forest;

(f) *Intrinsic values* such as moral or ethical value, spiritual, religious and cultural value.

31. A focus on those values that can be quantified in economic terms can be justified by the fact that forest conservation ultimately has to compete with alternative uses of forest land. Whereas the latter have reasonably clear and identifiable market values, many forest values are currently non-marketed. In a market-oriented world, therefore, forest conservation, which provides few immediate economic benefits, can easily lose out to the market values of alternative land uses, such as agriculture or plantations, unless goods and services are valued in these analyses or long-term conservation becomes more attractive because of positive incentives.

32. Stakeholder analysis shows that indigenous and local communities are likely to be the major losers from the conversion of forested land to other uses. They could, however, be beneficiaries of processes designed to capture values in markets, although there are serious reservations about whether introducing real markets should be contemplated for indigenous communities, where the introduction of the market economy without appropriate adaptation measures might threaten their way of life. In many parts of the world, the issue of forest use is also very much related to discussions about the rights over land, forested areas and natural resources. Thorough stakeholder analysis at all levels, from local to global, would be a valuable basis for ensuring that the interest and potential contributions of different key groups and organizations are appropriately and fully taken into account.

33. Sustainable forest management is, in the short term, generally less profitable in monetary terms than ecologically unsustainable forest practices, so that, in order to be favoured in the market, non-timber benefits from sustainable forests must exceed this loss of profit. Analysis of economic values of forest goods and services, including timber, fuelwood, non-timber forest resources, genetic information, recreation and amenity, watershed protection, climate buffering and non-use values suggests, first, that the dominant values are carbon storage and timber. Second, these values are not additive, since carbon is lost through logging. Third, conventional (unsustainable) logging is more profitable than sustainable timber management. Fourth, other values do not compete with carbon and timber, unless the forests have some unique features or are subject to potentially heavy demand due to proximity to towns. Unique forests (either unique in themselves or as habitat for unique species) have high values. Forests near towns have high values because of recreational possibilities and the use of non-timber forest products and fuelwood. Fifth, non-use values for "general" forests are very modest.

34. There is an urgent need for more research to validate these conclusions and also to establish the direct economic value of biological diversity other than for genetic information. Techniques for economic valuation to deal with all forest goods and services need further development, such as choice modelling methods.

35. This analysis suggests that immediate effort should focus on removing those economic incentives which currently encourage forest loss and degradation. The development of markets for forest goods and services will be important, especially for carbon storage and sequestration and, on a more local scale, for tourism and sale of genetic material. Establishing clear, enforceable and transferable property rights for

individuals or communities is likely to be an important precondition for sustainable long-term conservation and use. Mechanisms are also needed to ensure that the situation of those who receive the benefits from forest goods and services is altered in some way that will compensate those who bear the costs. Some encouraging examples are now being developed. However, the limitations of market mechanisms also need to be explored and recognized in relation to the needs of stakeholders, for example indigenous and local communities. Market mechanisms must complement other mechanisms, including legislation, regulation, certification, capacity-building, and addressing wider underlying causes (see the following sub-section).

D. Causes of loss of forest biological diversity

36. Since there is a clear relationship between deforestation and loss of biological diversity, in order to identify and propose measures aiming to halt and reverse the loss of global forest biological diversity, the direct and underlying causes of forest decline should be addressed. Effective local action will specifically require a detailed understanding of the causes of loss of forest biological diversity.

37. Due to the current national and global policy and economic frameworks and mechanisms, it is presently cheaper to log forests in an unsustainable way than to manage them sustainably. This factor has been identified in the present report as one of the primary causes for the high rate of deforestation and forest degradation, and therefore for the current loss of forest biological diversity.

38. Forest decline and/or loss of associated biological diversity result from many direct causes, some of which are natural but are aggravated by humans, such as climate change. The most important factors are human-induced causes, including conversion to agricultural land, dismantling of agro-forestry systems, overgrazing, unmitigated shifting cultivation, unsustainable forest management including poor logging practices, over-exploitation of timber, illegal logging, fuelwood and charcoal, over-exploitation of non timber forest resources - including bush meat and other living organisms - introduction of alien and/or invasive plant and animal species, infrastructure development (road building, hydro-electrical development, improperly planned recreational activities, urban sprawl), mining and oil exploitation, forest fires caused by humans, and pollution.

39. The underlying causes of forest decline are the forces that determine, through complex causation chains, the actions of the primary actors. They originate in some of the most basic social, economic, political, cultural and historical features of society. They can be local, national, regional or global, transmitting their effects through economic or political actions, such as trade or incentive measures. They are both numerous and interdependent and the approaches to deal with them are country-specific and will therefore vary among countries. In analysing the increasing literature available on the subject, in particular the recommendations and proposals for actions of the Intergovernmental Panel on Forests (IPF), the Intergovernmental Forum on Forests (IFF) and the work of the Centre for International Forestry Research (CIFOR), the following main underlying causes of forest decline were identified:

(a) *Broader macroeconomic, political and social causes,* such as population growth and density, globalization, poverty, unsustainable production and consumption patterns, ill-defined and implemented structural adjustment programmes, political unrest and wars;

(b) *Institutional and social weaknesses,* such as lack of good governance, lack of secure land tenure and uneven distribution of ownership, loss of cultural identity and spiritual value, lack of institutional, technical, and scientific capacity, lack of information, of scientific knowledge and the use of local knowledge, in particular lack of awareness of the value of forest biological diversity for provision of goods and services;

(c) *Market and economic policy failures,* such as under-valuation of forest biological diversity goods and services; perverse incentives; and subsidies;

(d) *Other policy failures*, such as ill-defined development programmes, ill-defined or unenforced regulatory mechanisms, lack of clear environmental policies and of environmental impact assessments.

E. Policy developments

40. Conservation and forest-related policies have, most often, failed to significantly reduce forest decline. This is primarily due to the inability to address the underlying causes of deforestation and forest degradation. In many countries, the weakness of conservation and sustainable management efforts is largely due to poor governance, lack of political will, lack of clear land tenure and land use rights, lack of adequate valuation of forest biodiversity, lack of appropriate local and global economic environments, insufficient implementation capacity, lack of financial or human resources and of environmentally sound technologies.

41. Some positive elements are also evident, mostly in the area of forest policies and forest management practices. These have partly resulted from a series of international (IPF, IFF, United Nations Forum on Forests (UNFF)) and regional forest processes and initiatives around the world, addressing the development of sustainable forest management. National forest programmes are increasingly being developed as a means to address forest sector issues in a holistic manner, taking into account other relevant sectors which impact on forests. The importance of national forest programmes has been confirmed and stressed by IPF, IFF and UNFF. Due to increasing public awareness of biological diversity issues and of the goods and services forest ecosystems produce, there is increasing support for sustainable forest management among consumers, politicians and industry. A substantial section of the timber trade seems to be prepared to take environmental issues seriously and to make real efforts to change its practices. Although such positive trends do not yet seem to have substantially influenced the loss of forest biological diversity, it is possible to note some of them that may contribute in some way to the maintenance of forest biological diversity:

(a) Development of national forest programmes;

(b) Increased number and area of protected forest areas;

(c) Development of improved ecological forest management and forestry practices, including landscape ecological planning procedures, identification and preservation of key biotopes and other key elements in the forest landscape, "Reduced-impact logging", and "Close-to-nature forestry";

(d) Mechanisms to illustrate sustainable forest practices such as demonstration forests (e.g. International Model Forests Network initiatives);

(e) Many initiatives on criteria and indicators for sustainable forestry;

(f) Independent certification of sustainable forest management and related labeling of forest products originating from well-managed forests.

42. There is also an increase in the willingness to accept issues related to the rights, needs and participatory possibilities of indigenous people and local communities in the context of forest conservation and management. This positive development includes donor institutions' interest in collaborating directly with indigenous and local communities, policy revision by many relevant actors, and increased acceptance

of traditional knowledge and collaborative management in forest conservation and management. However, these changes have happened largely at the international level and often have not been sufficiently incorporated into national policies.

43. Difficulties in addressing relevant socio-economic issues in the context of forest biological diversity are also related to poor knowledge. Present knowledge concerning the use and valuation of non-timber forest products and services, the cultural and spiritual values of forests, or the development of the rights, needs and participatory possibilities by indigenous people is sparse or receives inadequate attention.

F. Conclusions

44. The Expert Group has drawn a number of key conclusions from the review of information summarized in sections A to E above:

(a) Forest issues relate to a range of political, economic, social, cultural, environmental and scientific aspects, which must be dealt with in a coordinated, cross-sectoral and holistic way;

(b) Assessing the current global status of forest biological diversity in quantitative as well as qualitative terms is problematic, because of the difficulties quantifying biological diversity. An immediate need exists to categorize and substantially improve the understanding of biological diversity, with a view to measuring trends, particularly on regional scales;

(c) The rate of deforestation has been at a high level for many centuries, however the losses over the past decades have been particularly rapid and therefore worrisome, with most current deforestation occurring in tropical forests;

(d) Large-scale degradation of forest quality occurs in all regions and forest types due to human activities, and this is exacerbated by improved access to intact forests;

(e) The number of extinct and endangered forest species, already at historically high levels, can be expected to rise due to an existing "extinction debt" and the continued habitat loss, fragmentation, invasive species and over-exploitation. The evidence also clearly shows that an "extinction debt" exists, i.e. many extinctions will happen in the future as a result of the deforestation and degradation which have already occurred;

(f) Plantations have a role to play in conserving and enhancing forest biological diversity, but cannot compensate for deforestation of primary forest and consequent loss of particularly rich biological diversity;

(g) There is a clear need to better monitor and report changes in the quality and quantity of the world's forests, from the national to the global level;

(h) Data on rare and threatened forest species alone are insufficient to provide a reliable picture of broader trends in biological diversity. Surrogates for biological diversity, such as umbrella species, indicator species, key habitats and structural indicators, may help to assess and predict the effectiveness of conservation and forest management programmes and should be included in sustainable forest management criteria and indicator lists;

(i) There is generally less knowledge with respect to forest biological diversity in tropical forests compared to the other two biomes;

(j) Adequate attention needs to be given to the principles, methods and ways and means for the potential use of traditional knowledge of indigenous peoples and local communities as a valuable tool for forest biodiversity management;

(k) Protected forest areas have increased in recent years in both number and area. However, globally, forest types are neither well protected nor well represented in protected areas. The pattern of protected forest areas remains uneven, especially in terms of distribution and the representativeness of many forest types. The effectiveness of the protection provided in protected areas remains a major problem;

(l) It should be recognized that the conservation of forest biological diversity should be an overall objective of sustainable management of all types of forests by all countries, and not be limited to protected forest areas;

(m) The relationship between biological diversity and ecosystem goods and services is direct, but the exact linkages remain unclear and require research. Critical levels of biological diversity loss and/or change, as well as the human impacts that cause them and which affect forest ecosystem functioning and forest goods and services, are still largely unknown;

(n) The implementation of the ecosystem approach should be the overarching framework for sustainably managing forests. In particular, the ecosystem approach requires adaptive management to deal with the complex and dynamic nature of forest ecosystems and the absence of complete knowledge or understanding of their functioning. As a consequence, forest ecosystem managers should consider the effects – actual or potential – of their activities on forest ecosystems and take into account that forest ecosystems should be managed within the limits of their functioning. In this respect, conservation of forest structure and functioning should be a priority target;

(o) To help to implement the ecosystem approach, research must address an understanding of the effects of forest management on biological diversity on all scales, from genes to landscapes, to provide a basic understanding of the role of biological diversity in forest functions and processes. Monitoring of forest biological diversity and of the changes caused by forest management is important in order to assess the effectiveness of management strategies and the cumulative change of forest use;

(p) Restoration of forest biological diversity in degraded forests and deforested lands is an issue of growing importance in both the developed countries and the developing world. There is a need to focus more on the potential for synergy from combining different forest categories, including primary and secondary natural forests, agro-forests and new forest plantations, to achieve a specified range of forest biological diversity and related goods and services. The means to restore forest biological diversity in different situations are poorly understood and research should be increased in this area;

(q) Current economic incentives often encourage forest loss and degradation and are therefore disincentives to sustainable forestry;

(r) Sustainable forest management is generally less profitable in monetary terms than ecologically non-sustainable forest practices. Local and indigenous communities and, ultimately, nations are likely to be the major losers from the conversion of forested land to other uses and non-sustainable forest practices;

(s) There is a need for more effective participation of the inhabitants of forests, indigenous peoples and local communities in all processes related to forest use and management. A stakeholder

analysis at all levels, from local to global, would be a valuable basis for discussions and decisions on forest biological diversity use and its management;

(t) Effective action for forest biological diversity needs to address both the direct and the underlying causes of loss, and this requires a more detailed understanding of these causes at both the international and national levels, since each country has different circumstances and will need a specific approach. Many of the issues can only be addressed globally or regionally;

(u) The underlying causes of loss of forest biological diversity are very fundamental and complex and they derive from broader macro-economic, political and social causes, such as poverty, rapid population growth, globalization of trade, unsustainable production and consumption patterns, political unrest, lack of good governance, land rights disputes and lack of institutional technical and scientific capacity. Loss of forest biological diversity cannot be stopped and reversed without addressing these and other fundamental problems; as well as improving our knowledge of biological diversity and developing more sustainable forms of forest management;

(v) Many of the threats to forest biological diversity emanate from non-forest sectors, such as agriculture, land use, industry, energy and others. The development of cross-sectoral linkages, e.g. through a consistent development of national biodiversity strategies and national forest programmes, possibly within the framework of national sustainable development strategies, is therefore very important;

(w) Present knowledge concerning the use and valuation of non-timber forest products, the cultural and spiritual values of forests, or concerning the developments of rights and participatory possibilities by indigenous people is sparse and needs more adequate attention.

45. There are some positive trends and developments upon which to build, mainly in the area of improving forest policies and sustainable forest management practices, which include biological diversity provisions. Public and consumer awareness is leading to the development of a more serious interest in biological diversity and environmental issues by other stakeholders, including politicians and the private sector. The promotion of certification of forest products, when done properly, can also be an encouraging development to provide positive incentives for sustainable forest management.

III. OPTIONS AND PRIORITY ACTIONS FOR CONSERVATION AND SUSTAINABLE USE

A. Key actions and priorities to improve conservation and sustainable use of forest biological diversity

46. As a result of the review summarized in chapter II above, the Expert Group identified some key guiding principles to structure its recommendations. These are grouped under three main headings:

(a) Assessment and monitoring;

(b) Conservation and sustainable use;

(c) Institutional and socio-economic enabling environment.

1. Assessment and monitoring

47. Biological diversity is a scaled consideration, ranging from genes of individual organisms, to large forest landscapes, to global biological diversity. Therefore, classification, monitoring, and reporting must

occur on all scales and must involve all stakeholders (in particular the indigenous and local forest communities and not only the scientific community) to place forest biological diversity in proper contexts.

2. Conservation and sustainable use

48. Conservation and, where appropriate, enhancement of forest biological diversity should be an important aspect of conservation and sustainable use of all types of forests. This applies to the whole range of forest categories, from protected primary forests, secondary forests, plantations, agro-forests to other ecosystems that include elements of forest biological diversity.

49. The development and implementation of the ecosystem approach, as described in decision V/6 of the Conference of the Parties, should be the guiding principle to achieve the conservation and sustainable use of forest biological diversity and it should be applied to the full continuum of forests, from protected areas to plantations. Application of the ecosystem approach to forest management should be based on both science and adaptive experience.

50. Critical levels of biological diversity loss/change that affect forest ecosystem functioning, and, in turn, the goods and services provided by forests are still largely unknown among forest types. This uncertainty emphasizes the value of applying the precautionary approach. As stated in the Preamble of the Convention on Biological Diversity, lack of full certainty should not be used as a reason for postponing measures to avoid or minimize the threat of significant reduction or loss of biological diversity.

3. Institutional and socio-economic enabling environment

51. To identify and propose measures to halt and reverse global forest biological diversity loss, both the direct and the underlying causes of forest decline must be addressed.

52. Political and economic decisions taken in forestry and other forest-related sectors should safeguard forest biological diversity and result in a fair distribution of associated costs and benefits among resource users.

53. Creating an enabling legal, policy, economic, and institutional environment to address the causes of forest biological diversity loss is a fundamental and urgent prerequisite for the conservation and sustainable use of forest biological diversity. The Convention on Biological Diversity should place increased emphasis on this matter in its work programme, and each country should engage in a process to establish an enabling environment that is conducive to the conservation and sustainable management of forest biological diversity. The process should be specific to the country, the land-use and the context. Key actions necessary to establish such an enabling environment can be summarized as follows: (a) increase political will; (b) provide adequate institutional, human and financial resources; (c) ensure adequate involvement at all stages of indigenous peoples and local communities in forest management; (d) ensure integration of forest biological diversity conservation and sustainable use into all relevant sectors; (e) secure a permanent forest estate and an adequate land tenure and forest use system; (f) provide a national and global economic environment conducive to the conservation and sustainable use of forest biological diversity; and (g) establish and enforce appropriate legislation.

B. Developing recommendations for action

54. While much effort will be required to reverse the current trend of loss of forest biological diversity, there are a number of key initiatives that can be readily accomplished, given sufficient will and effort. In this respect the Expert Group at its second meeting extensively discussed the issue of options and priority actions for conservation and sustainable forest use, as requested by the Conference of the Parties. It

divided its work in three main areas (a) assessment and monitoring; (b) conservation and sustainable use; and (c) socio-economic and institutional enabling environment. The overall outcome of its work is developed in the matrices prepared by the Expert Group, which regrouped and prioritized objectives and activities to identify a set of realistic options. These priority objectives and activities are presented in section III C below.

55. The Group stressed that activities relevant to a socio-economic and institutional enabling environment are a fundamental and urgent prerequisite for the conservation and sustainable use of forest biological diversity. The Group also emphasized the importance of implementing the ecosystem approach in sustainable forest management and, to that end, requested that guidance be provided to relevant actors to make the ecosystem approach easily applicable to the forest sector.

56. The Group took into due consideration the IPF and IFF proposals for action, as well as the proposed multi-year programme of work of the UNFF and the UNFF plan for action. The recommended actions will help to implement the many IPF/IFF proposals for actions relevant for the conservation and sustainable use of forest biodiversity.

57. In its scientific assessment, the Group indicated that there is sufficient evidence to suggest that there has been, and continues to be, widespread loss of forest biological diversity over time, but that the rate of loss has increased to a level where urgent action is required by Governments. Although the relationship between biological diversity and forest function is not yet fully clear, the understanding is sufficient to indicate that goods and services provided by forests are in jeopardy in many parts of the world. While the Group recognized some positive efforts in various parts of the world, there is a distinct need to address, as quickly as possible, the underlying and direct causes of forest loss and degradation, in order to halt the decline in forest biological diversity.

58. To halt this decline, to prevent further loss, and to reverse it, the Group underlined the need to identify and quantify targets that would concretely address loss of forest biological diversity and stressed that, without targets, action is unlikely to occur. Governments and international organizations need to provide direction and develop clear targets to enable the agenda to move forward. Such targets could be agreed at the global level, as well as at the regional and national levels, and should benefit from appropriate incentives. Targets should be incorporated into national forest and related non-forest programmes, including energy, transport, infrastructure development, education, and agriculture, and participatory monitoring systems for those set targets should be encouraged. Targets could be approached with respect to the framework of the three main areas of options developed by the group and presented below: (a) assessment and monitoring; (b) conservation and sustainable use; and (c) institutional and socio-economic enabling environment.

C. Options and priority actions

1. Assessment and monitoring

59. GOAL 1: Develop general classification of forest resources on various scales in order to improve the assessment of the status and trends of forest biological diversity.

Objective 1: Review and adopt a harmonized global to regional forest classification system that can be mapped, based on harmonized and accepted forest definitions and addressing key forest biological diversity elements.

Activities:

(a) Review and adopt a minimum forest classification for forest types, compatible with remote-sensing technologies, that includes broad indicators of biological diversity that be taken into account in all international regional forest-related programmes, plans and activities;

(b) Increase the frequency of forest resource inventory to at least every five years;

(c) Review and adopt standard forest definitions to be used in global reporting to scale of forest types.

Objective 2: Develop national forest ecosystem classification systems and maps.

Activities:

(d) Review existing national forest ecosystem classification systems and maps;

(e) Develop and apply national forest ecosystem classification systems and maps that include key components of forest biological diversity to be used in assessment reports on forest types.

60. GOAL 2: Improve knowledge on and methods for the assessment of the status and trends of forest biological diversity, based on available information.

Objective 1: Advance the development and implementation of international, regional and national criteria and indicators for forest biological diversity.

Activities:

Develop, select and quantify international, regional and national indicators for forest biological diversity, taking into account, as appropriate, existing work and processes*, as well as the knowledge held by indigenous and local communities. Such criteria and indicators should be used for assessment reporting at five-year intervals.

61. GOAL 3: Improve understanding of forest ecosystem functioning.

Objective 1: Conduct key research programmes on forest ecosystem functioning.

Activities:

(a) Develop and support focused research to improve understanding of the relationship between forest biological diversity and ecosystem functioning, taking into account forest ecosystem components, structure, functions, and processes to improve predictive capability;

(b) Develop and support research to understand critical thresholds of forest biological diversity loss, paying particular attention to key and/or rare forest species;

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* Such as the Helsinki process for boreal, temperate and Mediterranean-type forests in Europe; the Montreal process for temperate and boreal forests outside Europe; the Tarapoto proposal for the Amazon forest; the UNEP/FAO-initiated processes for dry-zone Africa and the Near East in arid and semi-arid areas; and the "Lepaterique" process for Central America initiated by FAO and the Central American Commission for Environment and Development (CCAD)

(c) Develop and support research on restoration of forest ecology and test relevant techniques.

62. GOAL 4: Develop infrastructure for data and information management for accurate assessment and monitoring of global forest biological diversity.

Objective 1: Enhance and improve the technical capacity to monitor forest biological diversity and to develop associated databases as required on a global scale.

Activities:

Develop and implement a strategy and a plan of action to provide infrastructure and training in developing countries, in order to monitor forest biological diversity and develop the associated databases.

***Ways and means for, and actors in activities related to assessment and monitoring*:**

Ways and means:

(a) Expert meetings under the Convention on Biological Diversity;

(b) Programmes and activities of international/regional/national agencies, research institutes, non-governmental organizations, indigenous and local community organizations and the private sector.

Actors:

(a) Parties and Governments; the Secretariat of the Convention on Biological Diversity;

(b) International, regional and national forest-related organizations, agencies and institutes;

(c) Non-governmental organizations;

(d) Indigenous peoples and local communities;

(e) Private sector.

2. Conservation and sustainable use

63. GOAL 1: Apply the ecosystem approach.

Objective 1: Develop, test, demonstrate and transfer practical methods for applying the ecosystem approach to forest ecosystem management to conserve forest biological diversity, both inside and outside protected forest areas.

Activities:

(a) Develop guidance for applying the ecosystem approach in forest ecosystems, and clarify the conceptual basis of the ecosystem approach;

(b) Identify key structural ecosystem elements to be used as indicators for decision-making by developing decision–support tools on a hierarchy of scales;

(c) Develop and implement guidance to help the selection of suitable forestry practices for specific forest ecosystems;

(d) Develop methods for multi-stakeholder participation in ecosystem-level planning and management;

(e) Develop an international network of forest areas for piloting and demonstrating the ecosystem approach, incorporating suitable examples from the International Model Forests Network.

64. GOAL 2: Adequately conserve forest genetic diversity.

Objective 1: Develop effective information systems and strategies for *in situ* and *ex situ* conservation and sustainable use of forest genetic diversity, and support countries in their implementation and monitoring.

Activities:

(a) Develop, harmonize and test methods for assessment of forest genetic resources, including the identification of priority species, populations and genes;

(b) Improve understanding of patterns of genetic diversity and its conservation in situ, in relation to forest management landscape-scale forest change and climate variations;

(c) Produce guidance for countries to assess the state of their forest genetic resources, and to develop and evaluate strategies for their conservation, both *in situ* and *ex situ*;

(d) Develop policies at the national level to access address forest genetic resources in a holistic way, including issues of access to, transfer of and benefit-sharing from the use of forest germplasm, in collaboration with the Panel of Experts on Access and Benefit-sharing of the Convention on Biological Diversity;

(e) Follow up developments in new biotechnologies and ensure their applications are compatible with the maintenance of forest biological diversity, and develop and enforce regulations for controlling the use of genetically modified organisms (GMOs) in accordance with the Cartagena Protocol on Biosafety of the Convention on Biological Diversity;

(f) Develop a holistic framework for the conservation and management of forest genetic resources at global level.

65. GOAL 3: Address the direct causes of loss of forest biological diversity.

Objective 1: Prevent losses of forest biological diversity caused by the introduction or spread of alien invasive species and genotypes.

Activity:

Reinforce, develop and implement strategies at regional and national level to prevent and mitigate the impacts of invasive alien species and genotypes, including risk assessment, strengthening of quarantine regulation, and containment or eradication programmes.

Objective 2: Prevent losses caused by unsustainable harvesting of timber and non-timber forest resources.

Activities:

(a) Develop and implement systems to assess the impact of harvesting timber and other resources on forest biological diversity and associated ecosystem goods and services, including identification of critical thresholds of impact;

(b) Develop and enforce laws and guidelines (applicable to the private sector) on sustainable harvesting of timber and non-timber resources as part of sustainable forest management policies and laws;

(c) Develop, promote and monitor the effectiveness of voluntary timber certification schemes;

(d) Address the lack of private sector compliance with sustainable logging practices.

Objective 3: Mitigate the impacts of climate change.

Activities:

(a) Increase understanding of predicted impacts of climate change on forest biological diversity.

(b) Develop coordinated response strategies and action plans at global, regional and national levels.

Objective 4: Mitigate the impacts of desertification.

Activity:

Develop an understanding of the impacts of desertification on forest biological diversity and the interactions between loss of forest biological diversity and desertification; recommend that forest biological diversity issues be adequately addressed in the work of the United Nations Convention to Combat Desertification.

66. GOAL 4: Restore forest biological diversity in the framework of the ecosystem approach.

Objective 1: Restore forest biological diversity in degraded secondary forests and in forests established on former forestlands and other landscapes, including plantations.

Activities:

(a) Create international, regional and national databases and case studies on the status of degraded forests, deforested, restored and afforested lands;

(b) Develop and test systems and practices for restoration and development of forest biological diversity in accordance with the ecosystem approach;

(c) Promote and support the implementation of systems and practices for restoration, with training and demonstration activities.

67. GOAL 5: Protect, manage and enhance rare and threatened species.

Objective 1: Ensure that the management of an ecosystem provides for the conservation and enhancement of rare and threatened species.

Activities:

(a) Determine status and conservation needs of rare and endangered species and of management impacts;

(b) Develop conservation strategies for rare and threatened species for global or regional application, and practical systems of adaptive management at national level.

68. GOAL 6: Protect indigenous peoples traditional cultures and promote the participation of indigenous peoples and local communities in the conservation, management and sustainable use of forest biological diversity.

Objective 1: Assist indigenous and local communities in developing adaptive community-management systems to conserve forest biological diversity, which are based on traditional forest use systems.

Activities:

(a) Assist indigenous people and local communities to generate opportunities, markets and incentives for sustainable use practices;

(b) Assist indigenous people and local communities to resolve land rights and land use disputes;

(c) Develop adaptive practices, based on traditional knowledge.

69. GOAL 7: Improve the effectiveness of protected area networks in conserving forest biological diversity

Objective 1: Ensure adequate and effective protected area networks.

Activities:

(a) Assess the representativeness and adequacy of protected areas relative to forests types and identify gaps and weaknesses;

(b) Revise networks, selecting additional areas with stakeholder participation in order to complete the representation of natural forest types with ecologically viable size and linkage;

(c) Develop and implement methods to assess the efficacy of protected forest areas.

***Ways and means for, and actors in activities related to conservation and sustainable use*:**

Ways and means:

(a) Programmes and activities of forest-related international/regional/national conventions, agencies, research institute, non-governmental organizations and the private sector;

(b) Multi-stakeholder participation;

(c) Increasing transparency in institutions and in transactions;

(d) Developing monitoring and feedback mechanisms;

(e) Disseminating information through research results, guidelines and case studies and use of demonstration projects;

(f) Environmental impact assessments;

(g) Establishing education and public awareness programmes;

(h) Establishing capacity-building programmes.

Actors:

(a) Parties and Governments; Secretariat of the Convention on Biological Diversity;

(b) International, regional and national forest-related organizations, agencies and institutes;

(c) Non-governmental organizations;

(d) Indigenous peoples and local communities;

(e) Private sector.

3. Institutional and socio-economic enabling environment

70. GOAL 1: Enhance the institutional enabling environment.

Objective 1: Parties, Governments and organizations to integrate biological diversity conservation and sustainable use into forest and other sector policies and programmes.

Activities:

(a) Parties to formulate and adopt sets of priority targets for forest biological diversity to be integrated into national forest programmes, national sustainable development strategies and national biological diversity strategies and action plans;

(b) Donor bodies to incorporate forest biological diversity and sustainable use principles and targets into forest and related non-forest programmes, including energy, transport, infrastructure development, education and agriculture;

(c) Parties and donor bodies to implement strategies and provide adequate financial human and technical resources;

(d) Develop harmonized regional policies on forests, including trade, in order to avoid externalization of national problems;

(e) Develop strategies for effective enforcement of sustainable forest management and protected area regulations, including adequate resourcing and involvement of indigenous and local communities.

Objective 2: Improve the understanding of the various causes of forest biological diversity losses.

Activities:

Each Party to make/contribute to and disseminate an analysis, carried out in a transparent and participatory way, of local, national, regional, and global direct and underlying causes of losses of forest biological diversity.

Objective 3: Parties and Governments to review and revise forest laws and tenure and planning systems to ensure a secure forest resource and provide a sound basis for conservation and sustainable use of forest biological diversity.

Activities:

(a) Secure permanent forest estates sufficient to allow for future conservation and sustainable use of forest biological diversity;

(b) Establish land tenure and land use systems, agreed by all stakeholders, which ensure conservation and sustainable use of forest biological diversity;

(c) Encourage Parties and countries to ensure that forest-related laws adequately and equitably incorporate the provisions of the Convention on Biological Diversity and the decisions of the Conference of the Parties.

Objective 4: Combat illegal logging and related trade.

Activities:

(a) Increase knowledge of illegal logging practices and identify effective measures to combat them;

(b) Reform legislation to include clear definition of illegal activities and to establish effective deterrents;

(c) Develop capacity and methods for effective law enforcement;

(d) Develop ethical policies and ecologically sound codes of conduct for forest practices, logging companies and the wood-processing sector.

71. GOAL 2: Address economic failures and distortions that lead to decisions that result in loss of forest biological diversity.

Objective 1: Mitigate the economic failures and distortions that lead to decisions that result in loss of forest biological diversity.

Activities:

(a) Develop, test and disseminate methods for valuing forest biological diversity and other forest ecosystem goods and services and for incorporating these values into forest planning and management, including through stakeholder analysis and mechanisms for transferring costs and benefits;

(b) Incorporate forest biological diversity and other forest values into national accounting systems;

(c) Ensure that economic incentives and subsidies are favourable to forest biological diversity conservation and sustainable use and promote related economic instruments;

(d) Provide market and other incentives for the use of sustainable practices, develop alternative sustainable income generation programmes and facilitate self-sufficiency programmes of indigenous and local communities;

(e) Develop and disseminate analyses of the compatibility of current and predicted production and consumption patterns with respect to the limits of forest ecosystem functions and production;

(f) Ensure that national laws and policies and international trade regulations are compatible with conservation and sustainable use of forest biological diversity and promote related economic instruments.

72. GOAL 3: Increase public education and awareness.

Objective 1: Increase public support and understanding of the value of forest biological diversity and its goods and services at all levels.

Activities:

(a) Increase broad-based awareness of the value of forest biological diversity through international, national and local public awareness campaigns;

(b) Promote consumer awareness about sustainably produced forest products;

(c) Increase awareness amongst all stakeholders of the potential contribution of traditional forest-related knowledge to conservation and sustainable use of forest biological diversity;

(d) Develop awareness of the impact of forest-related production and consumption patterns on the loss of forest biological diversity and the goods and services it provides.

Ways and means for, and actors in activities related to institutional and socio-economic enabling environment

Ways and means

(a) Programmes and activities of forest-related international/regional/national conventions, agencies, research institute, non-governmental organizations and the private sector;

(b) Ensuring consistency between national strategies for sustainable development, national forest programmes, and action plans and other concerns of the Convention on Biological Diversity and UNFF;

(c) Enforcing existing laws and eliminating perverse laws;

(d) Multi-stakeholder participation and public consultations;

(e) Improving industry regulations and their collaboration;

(f) Adopting and implement targets;

(g) Independent studies and case-studies;

(h) Establishing education and public awareness programmes Eliminating perverse economic policies while promoting positive incentives;

(i) Strategic impact assessments.

Actors

(a) Parties and Governments;

(b) International, regional and national forest-related organizations and institutes;

(c) Non-governmental organizations;

(d) Donor countries and international financing organizations;

(e) Indigenous peoples and local communities;

(f) Private sector;

(g) International, regional and national trade organizations;

(h) Media.

IV. ADVICE ON SCIENTIFIC PROGRAMMES AND INTERNATIONAL COOPERATION IN RESEARCH AND DEVELOPMENT

73. In response to the request of the Conference of the Parties, as stated in paragraph 1 of the terms of reference of the Expert Group, one of the Group's tasks was to provide advice on scientific programmes and international cooperation in research and development related to conservation and sustainable use of forest biological diversity. Based on the options presented in part III of the present report, the Group identified a series of priorities. Detailed information is also annexed to the comprehensive review carried out by the Expert Group.

74. The Group identified the following areas that should be given priority in scientific programmes and proposed:

Assessment and monitoring:

(a) Develop international, regional and national indicators for forest biological diversity;

(b) Promote assessment and monitoring of within species diversity of forest species;

(c) Improve understanding of the relationship between species richness and various structures and elements (such as amount of decaying wood, age and size structure of trees, key biotopes, natural patterns of habitats and ecotones in forests, continuity of forest use history) at various scales (stand, landscape, regional level);

(d) Increase knowledge understanding of the relationship between forest biological diversity and ecosystem functioning;

(e) Improve understanding of critical thresholds of forest biological diversity loss, giving particular attention to key and/or rare forest species and habitats.

Conservation and sustainable use:

(a) Develop knowledge of the potential for restoration of forest biological diversity in degraded secondary forests and in new forests established on former forestlands, including plantations;

(b) Increase knowledge of long-term impacts of forest management and harvesting practices on forest biological diversity;

(c) Increase knowledge of the potential benefits of traditional forest related knowledge and the indigenous peoples traditional cultures for the conservation and sustainable use of forest biodiversity;

(d) Improve understanding of patterns of genetic diversity and its conservation *in situ*, in relation to landscape-scale forest change and climate change interactions;

(e) Improve understanding of predicted impact of climate change on forest biological diversity;

(f) Increase knowledge of the impacts of desertification on forest biological diversity and interactions of forest biological diversity loss and desertification;

(g) Increase knowledge the understanding of the impacts of invasive species on forest biodiversity.

Institutional and socio-economic enabling environment:

(a) Improve understanding of the various causes for forest biodiversity loss, in particular the broader social and economic underlying causes as well as threats from other sectors;

(b) Develop methods for the appropriate valuation of forest biodiversity and related services;

(c) Improve understanding of the interrelationships between market and other economic incentives and subsidies and the conservation and sustainable use of forest biodiversity;

(d) Improve understanding of the impacts of production and consumption patterns on the conservation and sustainable use of forest biodiversity;

(e) Increase knowledge on the causes and the extent of illegal logging and possible solutions to combat illegal logging and related trade.

75. The Group, secondly, suggests that in terms of international cooperation on research and development activities in the field of forest biological diversity priority should be given to the following areas:

Assessment and monitoring:

(a) Review and adopt a mapped harmonized global to regional forest classification system, based on internationally agreed standard forest definitions to be used in global reporting to scale of forest types and addressing key forest biological diversity elements;

(b) Develop and select international and regional indicators for forest biological diversity;

(c) Promote the development of compatible information systems on forest species and genetic diversity;

(d) Create international, regional and national databases and case studies on the status of degraded forests, deforested, restored and afforested lands.

Conservation and sustainable use:

(a) Develop guidance for applying the ecosystem approach in forest ecosystems;

(b) Develop guidance to help the selection of suitable forestry practices for specific forest ecosystems;

(c) Create opportunities for the adequate involvement of indigenous and local community management systems and, as appropriate, traditional knowledge in the sustainable use and conservation of forest biological diversity;

(d) Develop methods for multi-stakeholder participation in policy development and implementation activities regarding ecosystem level planning and management;

(e) Develop an international network of forest areas for piloting and demonstrating the ecosystem approach, incorporating suitable examples from the current international Model Forest Network;

(f) Produce guidance for countries to develop, and evaluate strategies for genetic conservation of forest biological diversity both *in situ* and *ex situ*;

(g) Develop and implement strategies at regional and national level to mitigate impacts of invasive alien species including risk assessment, regulation, and containment or eradication programmes;

(h) Develop, promote and monitor effectiveness of voluntary forest certification and related labelling schemes;

(i) Create international databases and case studies on the status of degraded forests, and deforested restored and afforested lands;

(j) Identify status and conservation needs of rare and endangered species and habitats and of management impacts;

(k) Develop conservation strategies for rare and endangered species and habitats for global or regional application and practical systems of adaptive management at national level;

(l) Assess protected areas networks, in order to select additional representative areas of natural forest types with ecologically viable size and linkage;

(m) Develop and implement methods to assess the efficacy of protected areas;

(n) Develop knowledge of illegal logging practices and related trade and identify effective measures to combat this problem.

Institutional and socio-economic enabling environment:

Although many of the policy- related actions recommended by the Group in part III C above will require support from research, the following priority actions are particularly dependent on internationally co-ordinated research and development:

(a) Develop test and disseminate methods and tool kits for analysing the underlying causes of forest biodiversity loss and for adequately addressing them through the national, regional and international socio-economic and legal enabling environment;

(b) Develop test and disseminate methods for valuing forest biological diversity and other forest ecosystem goods and services and incorporating these values into forest planning and management; including through stakeholder analysis and mechanisms for transferring costs and benefits; for incorporating those values into national accounting systems and for raising awareness on those values;

(c) Support the development of market and other incentives for the use of sustainable practices, develop alternative sustainable income generation programmes and facilitate self-sufficiency programmes of indigenous and local communities;

(d) Develop and disseminate analyses of the compatibility of current and predicted production and consumption patterns with respect to the limits of forest ecosystem functions and production.

(e) Develop and disseminate methods for analysing the effects of international trade regulations on the conservation and sustainable use of forest biological diversity and for promoting related economic instruments.

V. INNOVATIVE, EFFICIENT AND STATE-OF-THE-ART TECHNOLOGIES AND KNOW-HOW

76. The Group recognised that many innovative and efficient and state-of-the art technologies and know-how are already in place. Therefore, the Group advised continuing their use and emphasised the need for their further refinements.

Assessment:

(a) Remote sensing technology for monitoring forest biodiversity conservation and use, in particular for the development of specific ecosystem maps, as well as for the monitoring of specific indicators for forest biological diversity;

(b) Methodologies of national forest inventories to be developed on the basis of multi-source inventory methods (combining satellite data, field data and other data sources);

(c) Methodologies assessing biodiversity indicators and criteria and indicators of sustainable forest management.

Planning:

(a) Tools for multi-stakeholder participation processes;

(b) National forest programmes, biodiversity strategies and other co-ordinated response strategies, conservation strategies, and action plans at global, regional and national levels.

Valuation:

(a) Valuation and awareness building of the economic, non-economic and intrinsic values of forests goods and services, market incentives, cost/benefit analysis, green accounting

Conservation and sustainable use:

(a) Incorporation of the ecosystem approach in forestry;

(b) Incorporation of forest management methods, such as "Reduced-impact logging", and "Close-to-nature forestry";

(c) Testing best practices of forest restoration practices;

(d) Evaluation of traditional knowledge, collaborative forest management with indigenous and local communities;

(e) Involvement of traditional forest related knowledge in the sustainable use and conservation of forest biological diversity;

(f) Assessment and development of forest certification and related labelling schemes;

(g) Private sector codes of conduct for sustainable forest management;

(h) Networks of protected areas and representative natural forest types;

(i) Model forest networks.
