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WAYS AND MEANS TO SUPPORT ECOSYSTEM RESTORATION

Note by the Executive Secretary

EXECUTIVE SUMMARY

The current extent and trend of ecosystem degradation and the resulting loss of ecosystem services severely threaten the livelihoods of people and the ecological security of our planet. After a short description of what ecosystem restoration entails, the present note recalls the multiple environmental and socioeconomic benefits from restoring degraded, damaged or destroyed ecosystems and highlights some principle for successful ecosystem restoration based on a preliminary review of a number of ecosystem restoration projects worldwide. Like in some other Multilateral Environmental Agreements, the Conference of the Parties to the Convention on Biological Diversity has, over the years, provided guidance and called for actions related to ecosystem restoration. Relevant decisions of the Conference of the Parties on ecosystem restoration are listed in the present note for information. However, the recently adopted target 14 (to restore by 2020 ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being) and target 15 (to restore at least 15 per cent of degraded ecosystems by 2020) of the Strategic Plan for Biodiversity 2011-2020 as well as target 4 (to secure at least 15 per cent of each ecological region or vegetation type) and target 8 (to have at least 20 per cent of threatened plant species available for recovery and restoration programmes) of the Global Strategy for Plant Conservation are referred to as goals that should guide efforts for ecosystem restoration in the coming decade. Building on Strategic Goal D of the Strategic Plan for Biodiversity 2011-2020 (Enhance the benefits to all from biodiversity and ecosystem services) and decision X/5 (Implementation of the Convention and the Strategic Plan), the present note proposes ways and means to support ecosystem restoration, including enhanced political commitment, awareness, stakeholder participation and cooperation, and capacity development for effective national action; and effective dissemination of suitable guidance, tools and best practices; mobilization of financial resources, and development of guidance on how to implement ecosystem restoration in general and in specific sectors and ecosystems through a stepwise approach. Finally, the present note presents messages gathered from recent reviews that could be used in a communication strategy for the promotion of ecosystem restoration.

* UNEP/CBD/SBSTTA/15/1.

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SUGGESTED RECOMMENDATIONS

The Subsidiary Body on Scientific, Technical and Technological Advice may wish to recommend that the Conference of the Parties adopt a decision along the following lines:

The Conference of the Parties,

Takes note of the key messages developed by SBSTTA contained in section IV of the present note.

Ways and means to support ecosystem restoration

1. *Urges* Parties and *invites* other Governments and relevant organizations to make concerted efforts to achieve targets 14 and 15 of the Strategic Plan for Biodiversity 2011-2020 and targets 4 and 8 of the Global Strategy for Plant Conservation including by effectively implementing the restoration-related provisions in previous decisions of the Conference of the Parties and relevant thematic and cross-cutting programmes of work, by addressing both underlying and direct causes of ecosystem degradation or destruction, by improving the status and resilience of ecosystems, and by further enhancing the use of ecosystem restoration as a means of *inter alia* carbon sequestration, ecosystem based adaptation and mitigation of climate change as well as other ecosystem services;

2. *Invites* Parties, other Governments, relevant intergovernmental organizations, the Society for Ecological Restoration, the International Union for Conservation of Nature, The World Resources Institute, the Global Partnership on Forest Landscape Restoration, the International Tropical Timber Organization and other relevant organizations to support countries in implementing ecosystem restoration by:

- (a) Making available tools such as e-learning programmes;
- (b) Compiling and disseminating case-studies, best practices and economic aspects;
- (c) Facilitating the sharing of public information and knowledge;
- (d) Supporting and/or coordinating capacity-building workshops;
- (e) Convening regional/subregional technical training on key themes;
- (f) Enhancing partnerships and exchange programmes between agencies and restoration practitioners;
- (g) Developing and implementing communication programmes highlighting the economic, ecological and social benefits of ecosystem restoration including awareness raising amongst the general public, policy makers and environmental managers not only on the crucial role that ecosystems and biodiversity play in providing ecosystem services but also on the costs associated with ecosystem degradation, lost incomes, increased expenses in production, the cost savings, benefits and the potential solutions to common political challenges that restoration can contribute;
- (h) Support the development of plans or national programmes for restoration of ecosystems or other disturbed areas; and
- (i) Support the execution of projects that implement the results of research on ecological restoration and rehabilitation.

3. *Requests* the Executive Secretary, subject to the availability of funding, to:
 - (a) Convene regional and subregional capacity-building workshops;
 - (b) Further develop and make available through the clearing-house mechanism a range of implementation tools for ecosystem restoration aimed at different audiences and translated into all United Nations languages;
 - (c) Facilitate the development of a user-friendly, comprehensive central webpage on ecosystem restoration in collaboration with partners; and
 - (d) Develop, in collaboration with partners, a TEMATEA issue based module on ecosystem restoration.
4. *Urges* Parties, and *invites* other Governments, organizations and donors to provide adequate financial and technical support to the Executive Secretary for the capacity development initiatives.

Possible development of practical guidance on ecosystem restoration

5. *Establishes* an *Ad hoc* Technical Expert Group (AHTEG) in accordance with the procedures outlined in the consolidated *modus operandi* of SBSTTA (decision VIII/10, annex III) and taking into account the need to draw upon the experience of relevant international organizations. The AHTEG would:
 - (a) Compile the information on practical guidance or guidelines developed by government agencies around the world, NGOs, and academic and research institutions for the restoration of specific landscapes, ecosystems, habitats, and/or biotic/abiotic components of ecosystems; identify gaps, if any, in their scope or coverage of types of degraded ecosystems, taking into consideration the causes of degradation, and in their objectives (whether for rehabilitation/revitalization, partial or full restoration), and suggest ways for filling those gaps;
 - (b) Consolidate the existing guidance to cater to the needs of different targeted end users such as policy makers, implementing agencies, and on the ground practitioners;
 - (c) Compile information on tools and technologies used at different spatial scales and for specific ecosystems; consolidate these tools and suggest ways and means to effectively disseminate them to support (i) informed decision-making on restoration policy, legislation, and regulation, (ii) adherence to best practices for ecosystem restoration among implementing agencies, and (iii) the effective design, implementation, and monitoring of restoration projects/programmes on the ground;
 - (d) Propose a *modus operandi* for reaching targets 14 and 15 of the Strategic Plan for Biodiversity 2011-2020 and targets 4 and 8 of the Global Strategy for Plant Conservation including a roadmap with milestones and indicators of progress; and
 - (e) Compile the most used definitions/descriptions of key terms.
6. *Requests* the Executive Secretary:
 - (a) Subject to the availability of funding, to convene the meeting of the AHTEG described above and submit its report for consideration at a meeting of the Subsidiary Body on Scientific, Technical and Technological Advice prior to the twelfth meeting of the Conference of the Parties; and

(b) Compile all decisions of the Conference of the Parties and required actions related to ecosystem restoration for wider dissemination to Parties and others for concerted action to implement them for achieving targets 14 and 15 and related targets of GSPC by 2020.

I. INTRODUCTION

1. The Conference of the Parties to the Convention on Biological Diversity, at its tenth meeting in Nagoya, adopted a new Strategic Plan for Biodiversity 2011-2020 containing 20 headline targets.² Under target 15 the Parties have agreed that “by 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification”. In decision X/17 the Conference of the Parties adopted the consolidated update of the Global Strategy for Plant Conservation (GSPC) wherein target 4 calls for securing at least 15 per cent of each ecological region or vegetation type through effective management and/or restoration. Target 8 of this consolidated update calls for availability of at least 20 per cent of threatened plant species for recovery and restoration programmes.

2. In paragraph 6 of decision X/4 on the third edition of the Global Biodiversity Outlook, the Conference of the Parties noted the need to place greater emphasis on the restoration of degraded terrestrial, inland water and marine ecosystems with a view to re-establishing ecosystem functioning and the provision of valuable services taking into account existing guidance.

3. While adopting the Multi-Year Programme of Work (MYPoW) for the period 2011-2020, in decision X/9 (a) item IX, the Conference of the Parties decided to consider the identification of ways and means to support ecosystem restoration, including the possible development of practical guidance on ecosystem restoration and related issues at its eleventh meeting in 2012. Accordingly, SBSTTA will develop some advice on ecosystem restoration to prepare the consideration of this item by the Conference of the Parties at its eleventh meeting.

4. The Executive Secretary, in collaboration with the Society for Ecological Restoration (SER) and other partners, prepared the present note for consideration by SBSTTA at its fifteenth meeting. Section II describes the background of ecosystem restoration including how it has been dealt within the Convention on Biological Diversity and other Multilateral Environmental Agreements (MEAs). Ways and means to support ecosystem restoration including details of available practical guidance, case-studies and best practices on ecosystem restoration are explained in section III. Key messages are given in section IV.

5. This note incorporates comments received from the SBSTTA Bureau at a meeting held on 5-6 June 2011 in Montreal. An earlier draft of this note was posted for review from 22 June to 14 July 2011 in accordance with notification 2011-123, and the comments received have been incorporated as appropriate.

II. BACKGROUND

2.1 Generalities

6. It is estimated that ecosystems deliver essential services worth between \$21 trillion and up to \$72 trillion a year, comparable to the 2008 World Gross National Income of \$58 trillion. Yet in 2010, nearly

² As stated in decision X/2, the Strategic Plan and its Aichi Targets constitute a flexible framework for the development of national and regional targets, bearing in mind national priorities and capacities and taking into account both the global targets and the status and trends of biological diversity in the country, and the resources provided through the strategy for resource mobilization, with a view to contributing to collective global efforts to reach the global targets.

two-thirds of the globe’s ecosystems are considered degraded³ as a result of damage, mismanagement and a failure to invest and reinvest in their productivity, health and sustainability. Thus restoration of degraded ecosystems is important for achieving the Millennium Development Goals and for realizing the vision of the Strategic Plan for Biodiversity 2011-2020-“living in harmony with nature”, where by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services for all people.

What is ecosystem restoration?

7. Ecosystem restoration, the process of actively managing the recovery of an ecosystem that has been degraded, damaged or destroyed, has become very important and urgent. Through this process, which is a conscious intervention based on traditional or local knowledge, scientific understanding, and the recognition that what previously existed was precious and indeed necessary for the continued health and survival of many species, including humans. Its goal is to restore ecosystems to be resilient and self-sustaining with respect to their structure (species composition, physiognomy) and functional properties (e.g. productivity, energy flow, material cycling) as well as being integrated into the wider land and seascapes and supporting sustainable livelihoods. Many healthy ecosystems are products of human endeavours over very long time periods and therefore restoration commonly requires the participation of resource dependent communities. In this respect ecosystem restoration supports conservation and sustainable development efforts worldwide.

8. A conceptual model for understanding ecosystem states and transitions ⁴ (fig.1) helps to identify the types of interventions that may be required to restore the functions of ecosystems that are degraded to varying degrees.

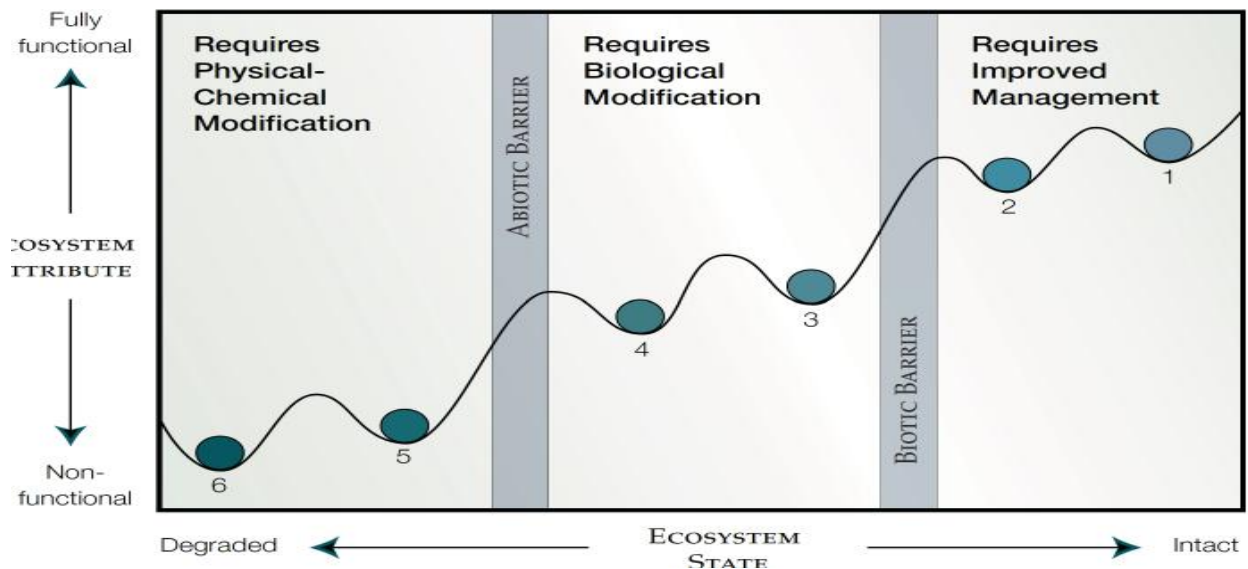


Figure 1. A conceptual model for ecosystem degradation and restoration.

Why ecosystems need to be restored

9. Many of the world’s ecosystems have undergone significant transformation with negative impacts on biological diversity and human wellbeing. Ecosystem restoration often involves the enhancement,

³ Nellemann, C., E. Corcoran (eds). 2010. Dead Planet, Living Planet – Biodiversity and Ecosystem Restoration for Sustainable Development. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal, accessible at <http://www.grida.no/publications/rr/dead-planet/>

⁴ Hobbs and Harris 2001. Restoration Ecology: Repairing the Earth’s Ecosystems in the new Millennium. Restoration Ecology, 9:239-246

reinstatement, recovery, rehabilitation, or reclamation⁵ of ecosystem goods and services and their potential to deliver multiple tangible benefits at a variety of scales, including:

- (a) Conserving/protecting/augmenting biodiversity and fostering species recovery;
- (b) Slowing and reversing desertification and terrestrial/aquatic ecosystem degradation and, thus improving biodiversity values, water, food, and natural resource security;
- (c) Promoting sustainable livelihoods resulting in increased stakeholder involvement and equity in socio-economic development;
- (d) Climate change mitigation by reducing greenhouse-gas emissions and increasing carbon sequestration and its long-term stability; and
- (e) Climate change adaptation by increasing ecosystem resilience to adapt to the impacts of climate change.

10. An analysis of 89 major ecosystem restoration projects worldwide concluded that ecological restoration increased provision of biodiversity and ecosystem services by 44 and 25 per cent, respectively.⁶ In this meta-analysis, the authors concluded that at national, regional, and local scales, ecological restoration is likely to lead to large increases in biodiversity and provision of ecosystem services, offering potential win-win solutions of combining biodiversity conservation with socio-economic development objectives. The greatest impact of restoration was shown in tropical terrestrial ecosystems, supporting the view that such management interventions could benefit human livelihoods in tropical regions.

Principles of good ecological restoration practice

11. The Society for Ecological Restoration (SER) and the International Union for Conservation of Nature (IUCN)⁷ among others have developed principles of good ecological restoration practice consistent with the principles of the Ecosystem Approach of the Convention on Biological Diversity, based on experience gained over several decades. A degraded ecosystem can be considered to have been restored when it regains sufficient biotic and abiotic resources to sustain its structure, ecological processes and functions with minimal external assistance or subsidy. It will then demonstrate resilience to normal ranges of environmental stress and disturbance, interact with contiguous ecosystems in terms of biotic and abiotic flows and social and economic interactions, and will support, as appropriate, local social and economic activities. Such a state is often difficult to achieve and it can take time before all benefits are evident. Nevertheless, significant environmental and social benefits can be realized even in the earliest stages of restoration.

12. According to the SER, ecosystem health is the state or condition of an ecosystem in which its dynamic attributes are expressed within normal ranges of variability relative to its evolutionary stage of development. A restored ecosystem can be considered healthy if it functions normally relative to its reference ecosystem, or to an appropriate set of restored ecosystem attributes. In the current context of rapid climate change, the feasibility and desirability of striving for expression of these attributes must be

⁵ Descriptions of these terms can be found for example in the following documents SER and IUCN Commission on Ecosystem Management. 2004. Ecological restoration, a means of conserving biodiversity and sustaining livelihoods.

https://www.ser.org/pdf/Global_Rationale.pdf

WWF International. 2007. Experiences compiled from the WWF network during a study tour of Spain and Portugal, June 2006

<http://assets.panda.org/downloads/flrlessonslearntbooklet.pdf>

WWF/IUCN. 2000. WWF/IUCN International Workshop on Forest Restoration: July 3-5 2000, Segovia, Spain

http://cmsdata.iucn.org/downloads/flr_segovia.pdf

CIFOR. 2002. Review of forest rehabilitation initiatives - Lessons from the past. <http://www.cifor.cgiar.org/rehab>

⁶ Benayas, J.M. R., *et al.* 2009. Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis. *Science* 325: 121-124

⁷ SER and IUCN Commission on Ecosystem Management. 2004. Ecological restoration, a means of conserving biodiversity and sustaining livelihoods. https://www.ser.org/pdf/Global_Rationale.pdf

considered carefully. The key attributes for assessing restoration progress, *inter alia*, include: the restored ecosystem contains a characteristic assemblage of the species that normally occur in the reference ecosystem and that provide appropriate community structure; it is integrated into a larger ecological matrix or landscape, with which it interacts through abiotic and biotic flows and exchanges; it is sufficiently resilient to endure the normal periodic stress events in the local environment that serve to maintain the integrity of the ecosystem; the normal or expected flow of goods and services have been restored.

2.2. Restoration in the Convention on Biological Diversity and other MEAs

13. The concept of ecosystem restoration is clearly articulated in the Articles of the Convention text of the Convention on Biological Diversity and in the decisions of its Conference of the Parties as an important tool for achieving its objectives. The following articles of the Convention on Biological Diversity concern ecosystem restoration:

- (a) Article 8 (*In-Situ* Conservation) explicitly calls on the Parties to, as far as possible and as appropriate:
 - (i) Paragraph (f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia*, through the development and implementation of plans or other management strategies;
 - (ii) Paragraph (h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species: The control and eradication of invasive species is now squarely within the ambit of ecological restoration and is often a significant component in most restoration projects/programmes.
- (b) Article 9 (c) (*Ex-situ* Conservation) Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions
- (c) Article 14 (Impact Assessment and Minimizing Adverse Impacts) explicitly includes ecosystem restoration in the examination of mitigation/compensation measures to address biodiversity loss in the transnational context.

14. An indicative list of relevant decisions of the Conference of the Parties is contained in annex 1. They provide guidance on what ecosystem to restore, what could be the expected output and examples of enabling activities.

15. The United Nations Convention on Combating Desertification in its Convention text (<http://www.unccd.int/convention/text/convention.php>) advocates for ecosystem restoration in order to meet its objective of combating desertification. Article 1 (Use of terms) states (b) “combating desertification” includes activities which are aimed at: (ii) rehabilitation of partly degraded land; and (iii) reclamation of desertified land; Article 2 (Objective) recognizes the value of ecosystem restoration not only in reinstating nature’s provisioning and regulating services but also its role in sustainable livelihoods and community development. Achieving this objective will involve long-term integrated strategies that focus simultaneously, in affected areas, on improved productivity of land and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level.

16. The Chair of the Scientific and Technical Review Panel of the Ramsar Convention on Wetlands was invited to table a discussion paper “Towards a multi-Convention collaboration on ecosystem restoration”. The proposal outlined in the paper suggests specific measures to address both the immediate and long-term needs of the Ramsar Contracting Parties and other MEA Parties, many of which currently lack the appropriate, science-based tools and guidance to assist them in designing, implementing, and monitoring ecosystem restoration projects/programmes that are effective, efficient and engaging. <http://www.cbd.int/doc/meetings/csab/csab-04/official/csab-04-restoration-briefing-paper-en.pdf>

17. The Convention on Migratory Species, in its Convention text (http://www.cms.int/pdf/convtxt/cms_convtxt_english.pdf) echoes the language of the Convention on Biological Diversity with regard to threatened species, invasive species, mitigation/compensation

measures, and the role of ecosystem restoration. Article III (Endangered Migratory Species: Appendix I) 4. Parties that are Range States of a migratory species listed in Appendix I shall endeavour to: a) conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction; b) prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and c) the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species.

III. WAYS AND MEANS TO SUPPORT ECOSYSTEM RESTORATION INCLUDING POSSIBLE PRACTICAL GUIDANCE

18. Strategic Goal E of the Strategic Plan for Biodiversity 2011-2020 calls for enhancing implementation through participatory planning, knowledge management and capacity-building. The means of implementation of the Strategic Plan calls for broadening political support, partnerships and initiatives to enhance cooperation, support mechanisms such as capacity-building for effective national action, effective dissemination of tools and best practices through the clearing-house mechanism, and financial resources. All these parameters address ways and means to support ecosystem restoration and concerted efforts by all stakeholders are needed to make ecosystem restoration happen on the ground to achieve targets 14 and 15 of the Strategic Plan for Biodiversity and targets 4 and 8 of the GSPC.

3.1 Political commitment, awareness and participation

19. Strong political leadership and commitment are critical for effective implementation of restoration programmes. Without public education and awareness, there can be no public participation. Without public participation and stakeholder involvement, effective implementation of any programme cannot be achieved. There is a need for development and implementation of national, regional and global communication programmes highlighting the economic, ecological and social benefits of ecosystem restoration. It is essential to raise awareness among the general public, policy makers and environmental managers on the crucial role ecosystems and biodiversity play in providing ecosystem services. It is imperative that awareness is raised in relation to the costs associated with ecosystem degradation, lost labor productivity, lost incomes, increased expenses in production, the cost savings, benefits and the potential solutions to common political challenges that restoration can contribute to. This awareness would also facilitate development of innovative means of financing implementation of restoration projects. There is a need for increased involvement of local authorities, as well as other relevant stakeholders, including civil society, local and indigenous communities and the private sector, in the development and implementation of programmes related to ecosystem restoration.

3.2 Enhanced capacity development for effective national action

20. Many developing country Parties including least developed and small island developing States as well as countries with economies in transition may require support for developing and implementing ecosystem restoration projects. Useful ways to provide technical support and capacity development include: (a) regional capacity development workshops; (b) practitioner clinics; (c) technical support networks; and (d) development of e-learning modules. Practitioner clinics include focused, technical clinics, either within a country or across a region, that bring in experts on a specific topic to address key challenges and obstacles, and to provide direct training. Technical support networks can be described as a group of individuals and organizations committed to sharing information and peer-reviewing their progress on a specific theme or objective over time. Members of the SER's Global Restoration Networks, national and international non-governmental organizations, other expert institutions and agencies and indigenous and local communities in a region can organize and form such regional technical support networks. Such networks can be instrumental in providing technical support, making tools and guidance available, sharing information and knowledge with restoration practitioners. E-learning modules can

provide a concise, user friendly summary of the most important concepts of restoration topics, packaged into software that allows the user to explore each topic in detail in a very interactive way. These modules could be aimed at policy makers, officials and practitioners.

3.3 *Effective dissemination of suitable guidance, tools and best practices through a Clearing-House:*

21. Effective implementation of restoration projects requires an array of tools, best practices and guidelines. A wealth of tools, useful good practice cases and practical guidance on ecosystem restoration is currently available at a variety of spatial scales and levels of specificity depending on the targeted end-user. The existing databases of SER, Parks Canada and the Earth Restoration Network, amongst other examples, provide a useful compendium of case-studies and network of practitioners. There is a need to consolidate these tools and guidance to support: (i) informed decision-making on restoration policy, legislation, and regulation; (ii) adherence to best practices for ecosystem restoration among implementing agencies; and (iii) the effective design, implementation, and monitoring of restoration projects/programmes on the ground. Furthermore, most tools and guidelines exist only in English. The international restoration community should collaborate in developing a full range of tools, aimed at different audiences and facilitate translation into major languages, making them available online and in print. This will require both the development of new tools and methods, as well as better organization and accessibility of existing tools.

3.4 *Partnerships and initiatives to enhance cooperation*

22. There are many organizations working on ecosystem restoration and there is a need for more interaction, coordination or horizontal cooperation among them for integrated approaches, non-duplication of efforts including research, and to exchange and efficiently use resources. That means not only the cooperation between organizations working on ecosystem restoration, it is also necessary to integrate mitigation and compensation measures resulting from several impacts. Restoration issues are often addressed in a piecemeal manner on a project basis, rather than through mainstreaming and integrating biodiversity issues into other sectors for more far-reaching impacts. Similarly there is also a need for development and implementation of South-to-South and North-to-South cooperation programmes to exchange best practices, other information sharing and appropriate technologies.

3.5 *Financial resources*

23. Effective implementation of restoration projects warrants sufficient and adequate financial resources. Expanded public funding will be fundamental to financial sustainability and for achieving the Aichi Targets of the Strategic Plan for Biodiversity. Institutions, including governments, donors, international NGOs and the private sector should seek opportunities to create synergies and partnerships for supporting restoration projects through concerted efforts. Business and industry sectors should set aside adequate funds for restoration in development projects. As the financial mechanism of the Convention, the Global Environment Facility (GEF) has a central role to play in providing international funding support for the restoration projects. Projects in eight countries with a strong restoration component were approved under the GEF 4 Resource Allocation Framework. In the GEF 5 funding cycle (2010-2014) US\$ 1.2 billion is allocated for biodiversity out of which 700 million and 250 million are programmed for protected areas and mainstreaming biodiversity respectively.

3.6 *Economic case for ecosystem restoration*

24. Initial studies compiled by TEEB indicate that restoration of grasslands; woodlands and forests offer some of the highest rates of returns on investment in terms of recovered services per amount of money spent (Box 1). Effective conservation is the most cost effective and most desired option for securing ecosystem goods and services, costing from tens to a few hundred United States dollars per hectare. However, protected areas cover only 13 per cent of world's terrestrial surface, 6 per cent of territorial waters and <1 per cent of the high seas, and many of them are not under effective management.

Of the remaining 80-90 per cent of the planet, almost one-third of the world's ecosystems are already directly converted for human activities such as for agriculture and cities, and another one-third have been degraded to some extent. With such levels of degradation it is apparent that major improvements and efforts are needed to restore and manage ecosystems outside protected areas as well and at a much greater scale than today. Restoration efforts between protected areas will also enhance landscape and seascape connectivity, further contributing to the effectiveness of these protected areas, particularly in the context of climate change. Indeed, restoration costs range from hundreds to thousands, or even hundreds of thousands of United States dollars for every hectare restored, or over 10-fold that of effectively managed protected areas. However, well planned, appropriate restoration, compared to loss of ecosystem services, may provide benefit/cost ratios of 3–75 in return on investments and an internal rate of return of 7–79 per cent, depending on the ecosystem restored and its economic context, thus providing in many cases some of the most profitable public investments including generation of jobs directly and indirectly related to an improved environment and health.⁸ Ecological restoration can further act as an engine of economy and a source of green employment.

Box 1. The economic benefits of ecosystem restoration

- In Vietnam, planting and protecting nearly 12,000 hectares of mangroves has cost just over US\$ 1 million but saved an annual expenditure on dyke maintenance of well over US\$ 7 million.
- In Rwanda, Democratic Republic of Congo and Uganda, strict law enforcement, costing the lives of over 190 rangers, has helped restore the critically endangered mountain gorilla population back to a slight increase in the Virunga National Park - and is generating large revenues from tourism.
- Restoration of over 500 hectares of mangroves in India's Andhra Pradesh region has cost US\$ 3 million over seven years but has increased the population of edible crabs and fodder for livestock thereby boosting local incomes while increasing biodiversity such as otter and birds.
- Coastal ecosystems in Biscayne Bay, Florida have been restored for an annual benefit worth US\$ 1.7 million.
- Re-introductions of native fish species and re-planting of native aquatic grasses have transformed the once highly polluted and degraded Lake Hong in China resulting in improved water quality, return of rare birds like the Oriental White Stork and tripling of income for fishermen.
- An 18-year reforestation project in Tanzania has reversed land degradation and improved rural livelihoods leading to multiple benefits such as better diets and food security, augmented fuel wood supply and increased cash flow.

3.7 Available practical guidance on how to implement ecosystem restoration

25. A number of government agencies around the world, from the local to the national/regional level, have issued guidance or guidelines for the restoration of specific landscapes, ecosystems, habitats, and/or biotic/abiotic components and functional aspects of ecosystems. NGOs, which include academic and research institutes, professional societies, indigenous and community-based organizations, and others (from local to global), have been active in producing ecosystem restoration guidance for specific ecosystems, species assemblages (habitat), ecosystem goods and services components, and targeted interventions. As much of this guidance is set within specific regional, national, and subnational levels including policy, legislation, and directives, an in-depth review would be required to collate the available information, identify gaps, fill these gaps and disseminate the information to help implement restoration projects. A small sample of general to specific guidance available from biodiversity related Conventions, intergovernmental organizations, governments and non-governmental organizations is given in table 1 (generic guidance) and table 2 (specific guidance).

Table 1. Examples of available practical guidance on ecosystem restoration at generic level and databases.

⁸ Nellemann, C., E. Corcoran (eds). 2010. Dead Planet, Living Planet – Biodiversity and Ecosystem Restoration for Sustainable Development. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal. www.grida.no

Country/ organization	Details
Canada	Ecological Restoration Guidelines for British Columbia http://www.env.gov.bc.ca/fia/documents/restorationguidelines.pdf
Germany	www.kfw.de : Impact mitigation and biodiversity offsets - Compensation approaches from around the world (NaBiV 101). This study compares compensation approaches taken with respect to impacts on biological diversity in selected countries from four different continents.
Japan	Nature restoration policy and project in Japan (http://www.env.go.jp/en/nature/npr/nrp_japan/index.html) ⁹
New Zealand	Guidelines to the Development and Monitoring of Ecological Restoration Programmes http://www.doc.govt.nz/upload/documents/science-and-technical/docts07.pdf
Society for Ecological Restoration	The SER has two foundation documents that provide a good starting point for the development of practical policy and planning guidance on ecosystem restoration. SER International Primer http://www.ser.org/content/ecological_restoration_primer.asp SER International Guidelines for Developing and Managing Ecological Restoration Projects. http://www.ser.org/content/guidelines_ecological_restoration.asp . SER also circulated a note on ecological restoration SBSTTA-14 http://www.cbd.int/doc/meetings/sbstta/sbstta-14/information/sbstta-14-inf-15-en.pdf SER's Global Restoration Network (GRN) hosts a database with over 200 restoration case studies and employs an advanced search engine that allows the user to refine his or her query in order to obtain all relevant information on ecological restoration based on ecosystem (biome) type, geographical location and source of degradation. http://www.globalrestorationnetwork.org/database/ Part 1 of the SER Restoration Reader -the foundation volumes provide orientation, scope, scientific and philosophical underpinnings of restoration. http://www.islandpress.org/ser/index.html
The Earth Restoration Network	The Earth Restoration Network hosts a very basic case study database of projects worldwide. http://www.earthrestoration.net/topics/view/22439/

Table 2. Examples of available practical guidance on restoration of specific ecosystems, and sectors.

Ecosystems and sectors	Details
Deserts, drylands, prairies and savannas	USDA Forest Service Ecosystem Restoration: A Framework for Restoring and Maintaining the National Forests and Grasslands. http://www.fs.fed.us/restoration/documents/RestFramework_final_010606.pdf Part 2 of the SER's Restoration Reader describes, the science, policy, and repairing damaged ecosystems from arid lands to forests to river ecosystems. http://www.islandpress.org/ser/index.html
Forests and woodlands	The Global Partnership on Forest Landscape Restoration (GPFLR) with WRI, South Dakota State University, and IUCN has produced an updated map showing where global forests have great potential for recovery. http://www.wri.org/map/global-map-forest-landscape-restoration-opportunities . The GPFLR has also produced a number of guidance-related documents http://www.ideastransformlandscapes.org/resources/documents/ The International Tropical Timber Organization with the Center for International Forestry Research, the Food and Agriculture Organization of the United Nations, IUCN and the World Wide Fund for Nature International, issued guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests providing a useful introduction to the issues confronting policy-makers, forest practitioners, extension workers and others in restoring and managing degraded or secondary forests. http://www.ito.int/direct/topics/topics_pdf_download/topics_id=1540000&no=1&disp=inline
Coastal & marine	USA: NOAA Coastal Ecosystem Restoration Guidance http://www.csc.noaa.gov/coastal The Mangrove Action Project has put together a very practical set of guidance, entitled Five Steps to Successful Ecological Restoration of Mangroves, in order to make the methodology accessible to

⁹ Following the March 2011 earthquake and tsunami, a number of meetings are taking place in Japan for the restoration of the devastated communities and ecosystems, including, for example, the one organized by the Secretariat of the International Partnership for the *Satoyama* Initiative (IPSI) and the Sustainable Oceans Initiative (SOI) in August 2011 (<http://satoyama-initiative.org>).

Ecosystems and sectors	Details
	a wider range of coastal resource managers and mangrove restoration practitioners. The techniques outlined are only a basic guide, and should be tailored to each unique situation and coastal region where restoration is being attempted. http://mangroveactionproject.org/files/restoration/5-Step-EMR-Manual.pdf . IUCN, through its Mangroves for the Future project, also has an online compendium of coastal system management tools that include support for ecosystem management and restoration (www.mangrovesforthefuture.org/documents-resources.html)
Peat lands	The Institute of Botany and Landscape Ecology, Greifswald University, Germany presents a science-based and practical guide to peatland restoration for policy makers and site managers. The work has relevance to all peat lands of the world but focuses on the four core regions of the UNEP-GEF project “Integrated Management of Peatlands for Biodiversity and Climate Change”: Indonesia, China, Western Siberia, and Europe (http://www.imcg.net/docum/prm/gprm_01.pdf)
Rivers and watersheds	The Center for Watershed Protection developed an eleven-manual series on practical techniques to restore urban watersheds. The manuals cover the seven major practices used to restore urban watersheds: storm water retrofits, stream repair, riparian management, discharge prevention, pollution source controls, watershed forestry and municipal operations (http://www.cwp.org/categoryblog/92-urban-subwatershed-restoration-manual-series.html). The River Restoration Centre offers a Manual of River Restoration Techniques to assist practitioners. http://www.therrc.co.uk/rrc_manual_pdf.php
Wetlands	United States Environment Protection Agency: An Introduction to Wetland Restoration, Creation, and Enhancement http://www.epa.gov/owow/wetlands/restore/finalinfo.html Ramsar, which implements the programme of work on inland waters biodiversity of the Convention on Biological Diversity, has produced two primary guidance documents with a specific focus on wetland ecosystem restoration: Restoration as an element of national planning for wetland conservation and wise use (Resolution VII.17 http://www.ramsar.org/pdf/res/key_res_vii.17e.pdf) and Principles and Guidelines for Wetland Restoration (Resolution VIII.16 http://www.ramsar.org/pdf/res/key_res_viii_16_e.pdf)
Protected Areas	Canada: Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas http://www.pc.gc.ca/docs/pc/guide/resteco/index_e.asp Parks Canada hosts a compendium of case studies is a companion to the Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas. The case-studies are from a variety of parks and other protected natural areas across Canada and illustrate a broad range of restoration challenges and solutions. http://www.pc.gc.ca/eng/progs/np-pn/re-er/ec-cs/index.aspx US National Parks Service Guidance on Disturbed Land Restoration http://www.nature.nps.gov/rm77/restore/programguide.cfm .
Transport networks and Habitat networks	Nationwide Priorities for Re-Linking Ecosystems: Overcoming Road-Related Barriers (http://www.bfn.de/0312_landsch_planung.html). The landscape of Germany is fragmented by a dense road network. The compendium shows how and where to defragment the most important areas of habitat networks which are fragmented by road networks.

3.7.1 Step-wise generic practical guidance for restoration projects

26. In paragraph 6 of decision X/4 the Conference of the Parties noted the need to place greater emphasis on the restoration of degraded terrestrial, inland water and marine ecosystems with a view to re-establishing ecosystem functioning and the provision of valuable services taking into account existing guidance. Target 15 of the Strategic Plan for Biodiversity 2011-2020 and Target 4 of the GSPC specifically calls for at least 15 per cent of degraded ecosystems need to be restored by 2020. Available practical ecosystem restoration guidance both at generic and specific levels indicated in tables 1 and 2 above. In the following section simple basic steps for any ecosystem restoration project is described.

27. SER identified 51 guidelines for a step-wise thorough process of ecological restoration. These guidelines are applicable to the restoration of any ecosystem – terrestrial or aquatic – that is attempted anywhere in the world under any circumstances. These guidelines are grouped into six phases: Conceptual planning (including feasibility assessments), preliminary tasks (upon which subsequent planning relies), implementation planning, project implementation, post implementation (monitoring and

after care) and evaluation and publicity. The National Oceanic and Atmospheric Administration developed a systematic approach consisting of five basic components for coastal ecosystem restoration projects viz., planning, implementation, performance assessment, adaptive management, and dissemination of results. Parks Canada developed principles and guidelines for ecological restoration in Canada's protected natural areas to be used in a step by step approach viz., define the problem, develop goals, objectives and detailed plans, implement plan and monitor and report. The guiding principles for ecological restoration in Canada's protected natural areas enshrine three 'E's- *Effective* in restoring and maintaining ecological integrity; *Efficient* in using practical and economic methods to achieve functional success; and *Engaging* through implementing inclusive process and by recognizing and embracing interrelationships between culture and nature.¹⁰

28. All these generic guidelines and principles broadly adhere to a systematic approach to ecosystem restoration for identifying realistic goals, measurable performance criteria, and developing and implementing a monitoring plan. Taking these principles and guidelines into account, five components for any generic restoration project are described in figure 2.

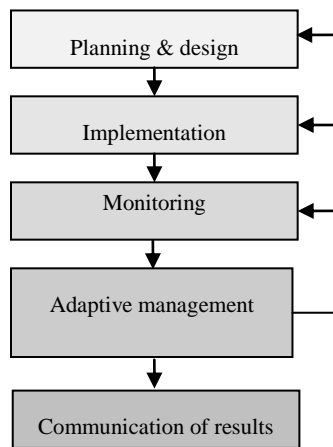


Fig. 2. Five components of a restoration project.

29. **Planning & design** identifies the restoration project site, specifies its current state of health and the goals of restoration, and provides relevant background information including stakeholder involvement. Planning also includes the documentation of existing site conditions (biotic and abiotic), baseline measurements, and the establishment of a reference model to guide the project work toward its intended goals. It could also be relevant to evaluate the potential economic benefits of the project. Restoration should not follow a monolithic top-down plan that treats all projects the same but should encourage public and stakeholder participation whenever possible which is absolutely crucial for success.

30. **Implementation** is the phase in which tasks are executed according to the project design. Project boundaries are demarcated and monitoring equipment is setup. Site maintenance and protection are also important during the implementation phase.

31. **Monitoring** provides direct feedback on the development of a restored system with respect to performance criteria. The attainment of objectives may depend as much on aftercare as it does on the care given to the execution of implementation tasks. The importance of post-implementation work cannot be overemphasized.

32. **Adaptive management** as a continual evaluation process leads to cost-effective successful restoration projects. Adaptive management as a restoration strategy is highly recommended, if not

¹⁰ Parks Canada and the Canadian Parks Council, 2008. Principles and guidelines for ecological Restoration in Canada's Protected Natural Areas http://www.pc.gc.ca/docs/pc/guide/resteco/index_e.asp

essential, because what happens in one phase of project work can alter plans for the next phase. This applies to social, cultural and economic outcomes as well.

33. **Communication of results** is also critical components of a successful restoration project. Thorough assessments are periodically necessary to ensure the ongoing fulfilment of project objectives and goals. However, monitoring, adaptive management practices and site maintenance must be ongoing. The project is publicized for public outreach as well as academic and professional feedback.

3.7.2 Available specific practical guidance

34. As indicated in section 3.7 and in table 2, specific practical guidance on restoring different ecosystems, sectors and biotic components such as, *inter alia*, wetlands, rivers, riparian and river basins; mangroves, salt marshes, other coastal systems and coral reef systems; deserts and dry lands, prairies and savannas; forests; different sectors such as mining, infrastructure development; and specific biotic components like wildlife; tall grasses, oak forests, pine forests, have been developed by governments, non-governmental organizations and academic institutions. The 10 books published under Part II of the SER and Island Press series on ecological restoration describe the science, practice, and policy of repairing damaged ecosystems ranging from arid lands to forests to river ecosystems. In these publications practitioners and leading researchers share hands-on experience and account both success and failure and offer recommendations for future research and effective application of principles in the field (<http://www.islandpress.org/ser/index.html>).

35. UNEP's rapid response assessment document "Dead planet, living planet: Biodiversity and ecosystem restoration for sustainable development" provides a good overview of 36 successful case studies referencing restoration projects ranging from deserts and rainforests to rivers and coasts. These case studies would help inform practical guidance on ecosystem restoration.

3.7.3 Conclusions on the available practical guidance

36. The Conference of the Parties in decisions of its tenth meeting on GBO3, the Strategic Plan for Biodiversity 2011-2020, GSPC, MYPoW, protected areas, climate change, forests, dry and sub-humid lands, marine and coastal biodiversity, inland waters and agricultural biodiversity, called for specific actions on ecosystem restoration. In some of its previous decisions as well as in the thematic and relevant cross-cutting programmes of work, the Conference of the Parties provided specific guidance on ecosystem restoration. There is a need for compiling all these decisions and required actions related to ecosystem restoration for wider dissemination to Parties and others for concerted action to implement them for achieving target 15 and related targets of GSPC.

37. A number of government agencies around the world, NGOs, academic and research institutions, have developed guidance or guidelines for the restoration of specific landscapes, ecosystems, habitats, and/or biotic/abiotic components of ecosystems. As much of this guidance is set within specific regional, national, and subnational levels including policy, legislation, and directives, an in-depth review and compilation of this information is essential to identify gaps if any, to fill up the identified gaps and for dissemination to support effective implementation of restoration projects.

38. A wealth of tools, technologies, and practical guidance on ecosystem restoration are currently available at a variety of spatial scales and levels of specificity depending on the targeted end-user. There is a need to consolidate these tools and guidance to support (i) informed decision-making on restoration policy, legislation, and regulation, (ii) adherence to best practices for ecosystem restoration among implementing agencies, and (iii) the effective design, implementation, and monitoring of restoration projects/programmes on the ground. A suite of effective and practical guidance must recognize and make use of the Ecosystem Approach taking into account landscape connectivity, sustainable livelihoods,

biodiversity values, and multi-sectoral linkages. The available guidance, best practices and tools need to be categorized into:

(a) **General policy and planning guidance:** geared towards national and subnational policy-makers, legislators, and regulators to inform and guide the decision-making process, and specifically assist with the formulation of new or revised restoration policy, legislation, and regulation within new or existing natural resource management frameworks;

(b) **Best practice guidance:** geared towards administrators and implementing agencies to highlight the guiding principles behind effective restoration projects/programmes that include stakeholder involvement, frameworks for prioritization and adaptive management, long-term monitoring strategies, and the establishment of baselines, performance indicators, and reporting requirements;

(c) **Specific, technical guidance:** geared towards restoration practitioners and volunteers in the field doing or supervising the actual work of designing, implementing, and monitoring restoration projects/programmes. This guidance often takes the form of manuals and handbooks that address specific restoration interventions, ecosystem types or habitats and their biotic and abiotic components/features.

IV. KEY MESSAGES¹¹

39. Restoration is not a substitute to conservation, nor is it a conduit for allowing intentional destruction or unsustainable use. It is the last resort for ameliorating degraded ecosystems to the benefit of all life on Earth.

40. Ecosystems deliver essential services to humankind estimated to be worth over US\$ 21-72 trillion a year – comparable to the World Gross National Income. Yet in 2010, nearly two-thirds of the globe's ecosystems were considered degraded as a result of damage, mismanagement and a failure to invest and reinvest in their productivity, health and sustainability.

41. The ability of world's expanding population to thrive, let alone survive, over the coming decades will in part depend on maintaining, enhancing and investing in restoring ecological infrastructure and expanding rather than squandering the planet's natural capital.

42. Mismanagement of natural and nature-based assets is under-cutting development on a scale that dwarfs the recent economic crisis.¹²

43. It is time that governments systematically factor not only ecosystem management but also restoration into national and regional development plans.

44. Effective conservation is the cheapest and most optimal option for securing ecosystem goods and services. Protected areas are the most-used and effective conservation method. However, protected areas cover only 13 per cent of world's terrestrial surface, 6 per cent of territorial waters and <1 per cent of the high seas, and many of them are not under effective management. Of the 80–90 per cent of the planet outside of protected areas, almost one-third of the ecosystems have been converted for human activities and another third have been degraded to some extent. With such levels of degradation major improvements and efforts are needed to restore and manage these ecosystems and at a much greater scale to achieve targets 14 and 15 by 2020, and taking into account targets 4 and 8 of the GSPC.

¹¹ Key messages are largely drawn from the document Nellemann, C., E. Corcoran (eds). 2010. *Dead Planet, Living Planet – Biodiversity and Ecosystem Restoration for Sustainable Development*. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal.

¹² Achim Steiner at <http://www.care2.com/causes/how-do-we-value-birds-bees-and-trees-world-environment-day-calls-for-action.html>

45. Well planned restoration, compared to loss of ecosystem services, may provide benefit/cost ratios of 3–75 in return on investment and an internal rate of return of 7–79 per cent, depending on the ecosystem restored and its economic context, thus providing in many cases some of the most profitable public investments including generation of jobs directly and indirectly related to improving environment and health.

46. It is essential to raise awareness among the general public, policymakers and environmental managers on the crucial role of ecosystems and biodiversity in providing valuable ecosystem services and the high costs associated with ecosystem degradation not only toward replacing those services but also lost labor productivity, lost incomes for example from tourism, and increased expenses in production.

Annex

**DECISIONS OF THE CONFERENCE OF THE PARTIES TO THE CONVENTION ON
BIOLOGICAL DIVERSITY REFERRING TO ECOSYSTEM RESTORATION**

Issue	Decision
Marine and Coastal Biodiversity	X/29 paras 13, 71, 72 IX/20 annex – rationale VII/5 para 49, objectives 1.2, 1.3, 2.1, 2.3, appendix 3 3 – Elements of a marine and coastal biodiversity management framework. Section D. para 10 IV/5 Operational obj. 1.2, activity C; obj.1.3 activity C II/10 annex I para (ii)
Agricultural Biodiversity	X/34 para 5 VI/5 annex II. I context - para 4. II para 6; Element 2 – rationale, Activities 2.1; Element 3 V/5 para 15 III/11 paras 15, 17, annex II para 1(vii)
Biodiversity and climate change	X/33 paras 8, 9 IX/16 para 3(f) VIII/30 para 1 VII/15 paras 5, 18
Guidance to the financial mechanism	X/24 para B4 VII/20 para 6
Biodiversity of dry and sub-humid lands	X/35 para 8 VIII/2 Goal 2, target 2.1 VII/2 annex activity 7 (b). V/23 para 11, and activity 7
Forest Biodiversity	X/36 para 5 IX/5 para 1(k),1(g) VIII/19 B, para 3(c) VI/22 Programme element 1, obj. 1, activity (i); and Goal 2, obj. 3 (c), and (d); obj. 4 (e); and obj. 5 (a). Goal 3, obj. 1, (a),(b),(c); obj. 3 (c); Programme element 3, Goal 3, obj. 1 (c). V/4 para 10, annex I para 2
Global Biodiversity Outlook	X/4 para 6
Global Strategy for Plant Conservation	X/17 Objective II, Targets 4 and 8, para 15, VI/9 paras 5, 11; Targets strategy b (viii), Targets 4 and 8
Inland waters biodiversity	X/28 paras 10, 45 VII/4 para 26, and programme element 1, Goal 1.1, objective b., Goal 1.3, 1.4, and 2.2 and related activities IV/4 paras 8, 9
Mountain biodiversity	X/30 paras 4, 5 VII/27 Goal 1.2, and related actions
Multi-year programme of work	X/9 para (a) (ix)
Protected Areas	X/31 paras 8, 14, 26 VII/28 para 12, annex of the programme of work, para 1 and Goals 1.2, 1.5, 3.3 and related activities
The Strategic Plan	X/2 the concept of habitat restoration is embedded in the Vision, the Mission, Targets 14 and 15 and in para 10. VII/30 Goal 2, Target 2.1
Sustainable Use	VII/12, annex II para 2
Ecosystem Approach	VII/11 Principle 5 (rationale and in 5.6); Principle 9 (rationale and 9.10); principle 12 (12.5); annex II paras 6, 12, 16. V/6 principle 5 (rationale), principle 9, section C operational guidance to (2) enhance benefit sharing
Invasive alien species	IX/4 para 15(e) VIII/27 para 41 VI/23 para 28(d), section D – guiding principle 12 V/8 outline for case-studies para 2
Liability and redress	IX/23 para 1 VIII/29 paras 2, and 3 VI/11 paras 1(c), 2
Identification, monitoring, indicators and assessments	VI/7 Paras 25, 41 VIII/15 annex II – Indicators - Targets 2.1, 8.2. Impact assessment VIII/28 , paras 23, 25
Tourism and biodiversity	VII/14 Goal 22, para 66, para 84
Island biodiversity	VIII/, 1Target 1.1, action 1.1.3; Target 2.1 action 2.1.1; appendix
Incentive Measures	VIII/25 para 8
