



**United Nations
Environment
Programme**

EP



UNEP(DEPI)/MED WG. 306/2
9 January 2007

ENGLISH



**MEDITERRANEAN ACTION PLAN
MED POL**

Government-Designated Expert Meeting
on the application of the Ecosystem Approach
by the Mediterranean Action Plan

Athens (Greece), 20-21 February 2007

APPLYING THE ECOSYSTEM APPROACH IN THE MEDITERRANEAN

TABLE OF CONTENTS

Executive Summary	
1. Introduction	1
2. Relevant activities within the context of International Conventions and Organizations	2
2.1 Convention on Biological Diversity	2
2.2 European Union	2
2.3 OSPAR Commission	2
2.4 Helsinki Commission	3
2.5 Food and Agriculture Organization of the United Nations (FAO)	3
2.6 United Nations	3
2.7 Mediterranean Action Plan	4
3. A roadmap for the implementation of the ecosystem approach in the Mediterranean	4
3.1. Defining an ecological vision for the Mediterranean	7
3.2 Identifying important ecosystem properties and threats	8
3.3 Setting strategic goals	8
3.4 Developing objectives: discussion and examples	9
3.4.1 ICES (2005).....	10
3.4.2 OSPAR EcoQOs.....	10
3.4.3 HELCOM	11
3.4.4 The MAP case	12
3.5 A hierarchical system of objectives and indicators for MAP	12
3.5.1 Objectives	12
3.5.2 Indicators	13
3.6 Redrafting the management plans	13
4. Implications on MAP and adaptation strategies	14
4.1 Ecosystem approach principles	15
4.1.1 Adaptive management.....	16
4.1.2 Monitoring and review.....	16
4.1.3 Decentralization	17
4.2 On-going MAP programmes	17
4.3 Capacity, institutional framework and governance	18
5. Recommended actions	19

ANNEXES

Annex I. The twelve principles/characteristics of the ecosystem approach adopted by the Fifth Meeting of the Conference of the Parties to the Convention on Biological Diversity (Nairobi, 2000)

Annex II. Five points of operational guidance provided by the 5th Conference of the Parties to the Convention on Biological Diversity (Nairobi, 2000) for the application of the twelve ecosystem approach principles

Annex III. Further guidance on the implementation of the ecosystem approach principles provided by the 7th Conference of the Parties to the Convention on Biological Diversity (Kuala Lumpur, 2004)

Annex IV. Different management tools according to ICES (2005)

Annex V. References

EXECUTIVE SUMMARY

The ecosystem approach is a strategy for the comprehensive and integrated **management of human activities** affecting the marine ecosystem based on the best available scientific knowledge. In other words, the ecosystem approach strives to ensure that those human activities and demands that have an actual or potential impact on the marine environment are **managed effectively**. Moving to the ecosystem approach is an evolutionary step, not a revolutionary one. The ecosystem approach just highlights the need to approach the goals systematically and in a more coordinated manner. The overarching argument in favour of the ecosystem approach is that only by maintaining the functional and structural integrity of the ecosystem can the protection of its individual components be achieved.

A major step towards its implementation is the establishment of a vision for the marine ecosystem and its transformation in a step-wise manner (vision → strategic goals → ecological objectives → operational objectives → indicators → target levels) from a descriptive status to a quantified target defining the desired ecological quality status (i.e. the quality of the ecosystem **structure and function**) of the marine ecosystem aimed for. Once the suite of operational objectives, indicators, targets, and limits have been adopted, management tools are applied to continually move the ecosystem closer to the target and further from the limits.

The large amount of work performed and the vast experience gained within MAP will allow it to move to this approach easier and faster. However, MAP proceeded with management actions without setting objectives in relation to the ecosystem structure and function (ecological objectives). The information available and the preparatory work done will enable MAP to proceed immediately with the setting of ecological and operational objectives (with indicators and target levels) that are now missing. It is, however, probable that for certain areas of the Mediterranean Sea scientific information will not be sufficient and that the capabilities of some institutions will have to be enhanced to undertake the necessary scientific work.

Integration of policies within MAP is not at the desired level, so it is proposed that RACs work together for the formulation of the objectives and the preparation of the management plan (taking into account existing work) having in mind the ecosystem approach principles in order to reduce the impact from human activities. The management plan should be supported by activities such as monitoring and research, information and capacity building. No institutional changes are proposed for the time being but coordination should be strengthened so that cooperation between RACs is enhanced and the duplication of work is avoided.

Decision-making on management actions should preferably be supported by scenario studies with quantitative predictions. How well the effects of management actions can be quantified will rely on the availability of proper data and a good understanding of the major processes controlling the ecosystem components. In addition, the socio-economic consequences of each management action should be studied before implementation and proposals put forward for alleviating possible consequences without compromising the ecological objectives.

Monitoring and assessment of the current status of the indicators is important to see the progress achieved in meeting the objectives. Based on the outcome of these assessments, updates of the management measures should be considered and a new set of measures and actions, where and if needed, should be planned for the next cycle.

1. Introduction

The Ecosystem Approach was first “officially” adopted by the 5th Conference of the Parties to the Convention on Biological Diversity held in Nairobi, in May 2000 as the fundamental tool for delivery of the Convention’s three primary objectives. It was later endorsed by the World Summit on Sustainable Development (WSSD) in Johannesburg (2002) and features strongly in the subsequent Plan of Implementation which encourages its application in the marine environment by 2010. The Ecosystem Approach has also been recommended as a strategic approach to implementing the requirements of the Ramsar Convention, as well as numerous other international agreements on the marine and coastal environment. The term is usually used in the form of “ecosystem approach to...” as, for instance, ecosystem approach to environmental protection or to fisheries or to management of human activities.

The 5th Conference of the Parties to the Convention on Biological Diversity (Nairobi, 2000) described ecosystem approach as “a **strategy** for the integrated **management** of land, water and living resources that promotes conservation and sustainable use in an equitable way” and expected that its application will help to reach a balance of the Convention’s three primary objectives: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of the genetic resources. According to the Convention on Biological Diversity, ecosystem means “a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit”.

In the HELCOM and OSPAR Commissions, as well as in North Sea conferences of Ministers, the ecosystem approach is defined as “the comprehensive and integrated **management** of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity.”

The same definition as above was used for the purposes of the European Marine Strategy but specifying the ecosystems as **marine** ecosystems. This description clearly places humans as part of natural ecosystems, and stresses that human activities in these ecosystems must be managed so that they do not compromise ecosystem components that contribute to the structural and functional integrity of the ecosystem.

The concept of ecosystem-based approach is not new and goes back to the beginning of the 90’s or even earlier. However, management issues were discussed and included in the ecosystem approach later. Today, as we can see from the above definitions, it is considered a **management tool**. It is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems.

The ecosystem approach strives to ensure that those human activities and demands that have an actual or potential impact on the marine environment are managed effectively. The ecosystem approach does not require control of the natural processes of ecosystems; only that these must be considered in managing human activities.

The ecosystem approach being a management tool should be applied in the framework of a marine strategy, which would set up a number of goals and objectives to be achieved. It is the main tool for the application of such a marine strategy at any level, including the regional one.

2. Relevant activities within the context of International Conventions and Organizations

2.1 Convention on Biological Diversity

The ecosystem approach, in its present context, was first endorsed by the 5th Conference of the Parties to the Convention on Biological Diversity (Nairobi, 2000), which adopted, at the same time, twelve complementary and interlinking principles (**Annex I**) to be considered in a holistic way but appropriate weight given to each one according to local circumstances. In addition, it proposed five points as operational guidance in applying the principles (**Annex II**). The 7th Conference of the Parties to the Convention on Biological Diversity (Kuala Lumpur, 2004) provided further guidance on the implementation of the ecosystem approach principles (**Annex III**).

2.2 European Union

The European Union is promoting the use of the ecosystem approach as a management tool to be applied in the framework of a marine strategy. During the process for the development of a European Marine Strategy (EMS), a core group established jointly by ICES and the European Commission prepared a document giving guidance on the application of the ecosystem approach to management of human activities in the European Marine Environment. The document was published in 2005 as ICES Cooperative Research Report no. 273 (ICES, 2005).

The European Commission also adopted a Green paper on a Future Maritime Policy for the European Union and a Thematic Strategy for the Protection and the Conservation of the Marine Environment. The latter includes a proposal for a marine strategy directive to be adopted by the States. The Thematic Strategy will deliver the environmental pillar of the future EU Maritime Policy. Both initiatives open up the way to new approaches as regards oceans policy and constitute a firm engagement in new ways of decision-making, concretely implementing the ecosystem approach.

2.3 OSPAR Commission

In the North European Regional Seas Conventions (HELCOM for the Baltic Sea and OSPAR for the North East Atlantic) discussions on the ecosystem approach started long before 2000. The First Joint OSPAR and HELCOM Ministerial Meeting (Bremen, June 2003) agreed that the ecosystem approach and the setting of ecological quality objectives are key to improving the protection of the North-East Atlantic and the Baltic Sea.

The idea of a system of Ecological Quality Objectives (EcoQOs) as a means of applying the ecosystem approach to the management of human activities has a long pedigree within the North Sea process. At the Fifth North Sea Conference (Bergen, 2002) the North Sea States and the European Community committed themselves to developing a coherent and integrated set of EcoQOs.

Since then, OSPAR has been working in close cooperation with the International Council for the Exploration of the Sea (ICES) on the development of EcoQOs for nine aspects of the North Sea ecosystem: commercial fish species, marine mammals, seabirds, fish communities, benthic communities, plankton communities, threatened and/or declining species, threatened and/or declining habitats, and eutrophication. The North Sea Pilot project defined quantitatively eleven EcoQOs as descriptors of the good ecological status of the North Sea. The results are available on the OSPAR website (publication number 239/2006).

OSPAR is now applying these eleven EcoQOs in the North Sea and will evaluate the results in 2008/2009. OSPAR is also considering whether the system of EcoQOs covers all necessary ecosystem elements and how similar systems might be established in other parts of the OSPAR maritime area other than the North Sea, i.e. the Celtic Seas, Iberian – Biscay shelf and Wider Atlantic.

2.4 Helsinki Commission

In the Baltic Sea, a pilot project was established by HELCOM to develop the objectives necessary for the implementation of the ecosystem approach. It produced a Vision (adopted by the Helsinki Commission in 2004), four strategic goals and 18 objectives (HELCOM 27/2006 document 2/6) that were adopted by the Helsinki Commission in 2006 (HELCOM 27/2006 Minutes of the Meeting).

Thus, HELCOM is presently past the descriptive phase and is in the process of defining quantitatively the good ecological status of the Baltic Sea ecosystem. In addition to this normative work, HELCOM has also launched the next step in implementing ecosystem approach: an ad-hoc task force within HELCOM is presently drafting an action plan based on the adopted objectives. The Baltic Sea Action Plan, to be agreed by the Baltic Sea Ministers of Environment in autumn 2007, will consist of targeted management actions for reaching good ecological status of the Baltic Sea. The Baltic Sea Action Plan is a proactive regional implementation of the proposed EU Marine Strategy.

2.5 Food and Agriculture Organization of the United Nations (FAO)

As part of its activities to promote the implementation of the provisions of the Code of Conduct for Responsible Fisheries, FAO held a series of meetings and workshops to better define the concept and principles of the Ecosystem Approach to Fisheries (EAF). In this context, the ecosystem-based fisheries management was one of the main subjects addressed by the FAO's Conference on Responsible Fisheries in the Marine Ecosystem organised in Reykjavik in 2001. The International Conference on Implementing an Ecosystem Approach to Fisheries held in Bergen (Norway) in September 2006 offered an opportunity to take stock of the progress made and confirmed the concept of the Ecosystem Approach should consider man as part of the Ecosystem. FAO has issued a number of documents (FAO, 2003a,b) on the issue and is also looking into the economic, social and institutional considerations pertinent to the application of EAF.

2.6 United Nations

The seventh meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea that took place from 12 to 16 June 2006, was dedicated to the Ecosystem Approach. The Report of the Secretary General to the 61st General Assembly under agenda item "Oceans and the Law of the Sea" (document A/61/63) incorporates a description of the Ecosystem approach and its implementation. The report of the seventh meeting of the Informal Consultative Process (document A/61/156) provides an

insight on the emerging consensus on the implementation of this approach to the marine environment.

2.7 Mediterranean Action Plan

As far as MAP is concerned, ecosystem approach appeared for the first time in the Catania Declaration of the Contracting Parties (13th Ordinary Meeting, Catania, November 2003). In the declaration, the Contracting Parties agree that the initiative of the European Community to develop a European Marine Strategy should be encouraged, that cooperation with the European Community in its efforts to develop and implement the European Marine Strategy should be strengthened and that joint answers should be fully explored, such as, *inter alia*, the application of the ecosystem approach, taking into consideration the legislation and capabilities of concerned countries.

Consequently, MED POL staff participated in the EC meetings for the development of the European Marine Strategy. MED POL Phase IV envisages the application of the ecosystem approach to the management of human activities in the marine environment and a relevant document was prepared and presented to the Meeting of MED POL Coordinators (Barcelona, May 2005) as document UNEP(DEC)/MED/WG.264/Inf.3.

At their 14th Ordinary Meeting (Portoroz, Slovenia, November 2005) the Contracting Parties endorsed the cooperation with the EC in a project to be implemented by MED POL, on behalf of MAP, to review the implications of applying the ecosystem approach to the management of human activities in the Mediterranean region. The project should be implemented in cooperation with all Regional Activity Centres, with a view to the possible application of the ecosystem approach by the whole MAP system.

According to the project document, the aim of the EC/MAP project is to facilitate the implementation of the ecosystem approach by MAP and specifically to identify the implications of the implementation of the ecosystem approach upon the formulation and implementation of MAP policies, strategies and activities and on its working system and structure. The results of the project are expected to facilitate the implementation of the ecosystem approach by MAP and its components. The main product of the project is the present document that includes a road map for the implementation of the ecosystem approach by MAP and a proposal for the development of Mediterranean EcoQOs.

3. A roadmap for the implementation of the ecosystem approach in the Mediterranean

Decision VII/11 of the Seventh Meeting of the Conference of the Parties to the Convention on Biological Diversity states that: "When initiating the ecosystem approach, the first task is to define the problem that is being addressed. In doing so, the scope of the problem and the task to be undertaken has to be well specified. The strategy to be followed to promote the ecosystem approach has to be clearly defined with contingencies for unforeseen situations incorporated into the strategy. The approach should consider all principles as a package but depending upon the task at hand emphasis on particular principles may be warranted. A collective ownership for **the vision, strategy and parameters** for the ecosystem approach relevant to the task has to be developed, communicated, and facilitated among partners and sponsors. Collectively, developing the overarching **goals, objectives, targets** for the exercise is important before applying the ecosystem approach."

In the framework of the European Marine Strategy, work undertaken by the European Commission and Member States has concluded that the “**roadmap**” for implementing the Ecosystem Approach should have the following characteristics. It should:

- Have a vision, high-level principles and strategic goals.
- Have regionally-based operational objectives.
- Set out clear limits, targets and indicators.
- Be common across all areas, all users and all sectors, and acknowledge that people are intrinsic components of ecosystems.
- Be characterized by simplicity.
- Set out landmarks and principal routes, with a strategy to deliver them.
- Have actions with associated delivery tools.
- Undertake assessment, monitoring and scientific research.
- Embrace regional diversity through a regional approach.
- Embrace the principles of adaptive management as a progressive approach.
- Have pre-agreed risk management actions.

ICES (2005) recommend that in applying the ecosystem approach at a regional scale, the following steps should be followed:

Step 1: Scoping the current situation

Step 2: Contrasting with the Vision

Step 3: Identifying important ecosystem properties and threats

Step 4: Setting ecological objectives

Step 5: Deriving operational objectives with indicators and reference points

Step 6: Ongoing management

Step 7: Periodic updates

As an example of a regional implementation of this approach, HELCOM roadmap for the Baltic Sea Action Plan includes the following steps to fulfill the characteristics above:

- A vision
- Strategic goals
- Ecological objectives
- Indicators
- Target levels
- Actions

The present document proposes that the road map suggested by ICES (above) should also be followed for the Mediterranean. However, since in the framework of the Mediterranean Action Plan a lot of work has already taken place on the status of the marine environment and the human activities impacting on it, the road map could be simplified focusing on the important steps. The issue in the Mediterranean is not to start something from zero but basically to redirect some policy practices and approaches. Important ecosystem properties and threats have already been defined and a lot of work has taken place on indicators; however, there are no decisions by the Parties on specific ecological indicators and target levels. In this context, it is proposed that the roadmap includes the following broad lines:

- **Defining an ecological vision for the Mediterranean**
- **Identifying important ecosystem properties and threats**
- **Setting strategic goals**
- **Developing ecological objectives**
- **Deriving operational objectives with indicators and target levels**
- **Redrafting the management plans**
- **On-going management**
- **Periodic updates**

On the basis of the work already carried out, the first three steps could be completed very quickly. Work should be initiated as soon as possible for formulating specific ecological objectives to be proposed to the Parties. While undertaking the steps above, the ecosystem approach principles should be kept in mind and the relevant management practices should be employed. Implementing the ecosystem approach means inter alia: involvement of all stakeholders at all levels and stages, decentralization of management to the lowest appropriate level, management of the ecosystem in an economic context, implementation of an adaptive management approach, setting long term objectives for ecosystem management on temporal and spatial scales, good governance, monitoring the degree of achievement of

objectives and if necessary review measures, dissemination of information, research and development and capacity building.

3.1. Defining an ecological vision for the Mediterranean

As one can see from the objectives of MAP Phase II, the Mediterranean countries are cooperating for the protection of their common sea but also have wider aspirations of strengthening solidarity to protect their common heritage and to generally improve the quality of life of their people.

In a document entitled “Mediterranean vision for sustainable development” which has been adopted by the Parties in 2005 it is clear that there is a great ambition for social issues such as removing inequality and poverty and political issues such as peace and security. In fact, the document deals with a common environmental vision for development and environment protection, a common social vision for alleviating poverty and inequality, a vision for innovation and more dynamic economic entrepreneurship, a common cultural vision for cultural diversity and a common ethical vision for governance.

In adopting MED POL Phase IV, the Contracting Parties accepted as its vision the overall commonly shared vision for a clean, healthy, biologically diverse and productive Mediterranean marine and coastal environment that both we and our future generations can enjoy but also a strong commitment by the Contracting Parties towards the goals of the Convention and the Protocols, and the adoption of a clear strategy for sustainable development.

Sustainable development requires that the needs of future generations are not compromised by the actions of people today. The ecosystem approach is embedded in the concept of sustainable development. It puts emphasis on a management regime that maintains the health of the ecosystem alongside appropriate human use of the marine environment, for the benefit of current and future generations. It also implies a series of reforms requiring the active participation of all stakeholders and actors.

Regional Seas Conventions have set their vision for the sea they are responsible, and as one could expect they are all similar as all people share basically the same dream for healthy and productive seas. For the Baltic Sea, article 3 of the 1992 Helsinki Commission refers to the restoration and preservation of the ecological balance of the Baltic Sea. In 2004, the Meeting of the Helsinki Commission adopted the following overall vision: “Healthy Baltic Sea environment, with diverse biological components functioning in balance, resulting in a good ecological status and supporting a wide range of sustainable human economic and social activities”.

For the North-East Atlantic, the third recital to the OSPAR Convention says, the aim is to manage “human activities in such a way that the marine ecosystem will continue to sustain the legitimate uses of the sea and will continue to meet the needs of present and future generations”. The underlying concept is that of a “healthy and sustainable marine ecosystem”.

The Vision of the European Marine Strategy is “to protect and restore Europe’s oceans and seas and ensure that human activities are carried out in a sustainable manner so that current and future generations enjoy and benefit from biologically diverse and dynamic oceans and seas that are safe, clean, healthy and productive.”

In addition to what has already been adopted by the Contracting Parties to the Barcelona Convention, it is considered pertinent that a specific ecological vision should also be adopted on the basis of which strategic goals could be set in the framework of the implementation of the ecosystem approach.

The ecological vision proposed is: To manage human activities in such a way so as to ensure a clean, safe, healthy, productive and biologically diverse Mediterranean Sea/coast for the benefit of present and future generations.

3.2 Identifying important ecosystem properties and threats

In contrasting the current situation with the Vision, one has to consider ecosystem properties of particular importance e.g. endangered species, biodiversity features and species of economic importance. Ecosystem components impacted by human activities will also be identified. The evaluation of the current situation should not be limited to ecosystem status and policies but should also consider on-going human activities and relevant economic and social policies.

A number of documents already exist that deal with the ecosystem properties and threats, which could form the basis for discussions and decision-making. This document does not deal with the issue but makes reference only to two documents, namely, the Transboundary Diagnostic Analysis (UNEP/MAP/MED POL, 2005) and the EEA (2006) report on Priority issues in the Mediterranean environment.

3.3 Setting strategic goals

When adopting the second phase of the Mediterranean Action Plan, the Contracting Parties adopted at the same time the following as its main objectives:

- To ensure sustainable management of natural marine and land resources and to integrate the environment in social and economic development, and land-use policies;
- To protect the marine environment and coastal zones through prevention of pollution, and by reduction and, as far as possible, elimination of pollutant inputs, whether chronic or accidental;
- To protect nature, and to protect and enhance sites and landscapes of ecological or cultural value;
- To strengthen solidarity among Mediterranean coastal States in managing their common heritage and resources for the benefit of present and future generations; and
- To contribute to the improvement of the quality of life.

Further, at their 14th Ordinary meeting (Portoroz, November 2005) they decided “to adopt a Mediterranean Strategy for Sustainable Development and make the commitment to do their utmost to implement its objectives, orientations and proposed actions as appropriate.” The Mediterranean Strategy for Sustainable Development (MSSD) proposes four major objectives and seven priority fields of action. Only one of the priority fields of action refers to marine and coastal ecological issues. This is “to promote sustainable management of the

sea and coastal zones and take urgent action to put an end to the degradation of coastal zones.” The basic objectives of this priority field of action are:

- To promote integrated management and development of coastal zones;
- To prevent and reduce pollution from ships;
- To prevent and reduce land-based pollution; and
- To protect marine and coastal biodiversity and marine resources

On the basis of the above objectives already adopted by the Contracting Parties that refer to pollution, biodiversity and coastal zones, the following strategic goals are proposed for the Mediterranean:

- a) **To protect, allow recovery and, where practicable, restore the function and structure of marine and coastal biodiversity and ecosystems in order to achieve and maintain good ecological status of these ecosystems.**
- b) **To eliminate pollution in the marine environment so as to ensure that there are no significant impacts or risk to human and/or on ecosystem health and/or on uses of the sea.**
- c) **To preserve, enhance and restore the coastal areas aiming at a balance between human activities and natural resources and reduce their vulnerability to risks.**

The first two goals have already been included in the EU Marine Strategy.

3.4 Developing objectives: discussion and examples

Once the Vision has been decided and the goals have been set, the next step is the formulation of ecological objectives that are consistent with the Vision and strategic goals. **Ecological objectives relate to ecosystem health, structure and/or function** and should take into consideration the analysis of ecosystem properties and threats. It is important at this stage to ensure that all ecological objectives are compatible not only between them but also in relation to social and economic objectives.

Following the setting of ecological objectives, operational objectives should be derived from them. These are the objectives the achievement of which requires action. Also, they are supported by indicators and an associated target level. It is commonly understood that an indicator has to reflect the status and changes of well-defined parts of an ecosystem. A target level is a specific value of an indicator associated with a particular objective.

Ideally, **objectives** should be SMART i.e. Specific, Measurable, Achievable, Realistic and Time bound. It follows that **indicators**, needed to monitor the progress being made towards meeting operational objectives and to guide management decision-making, will be effective when they are Measurable, Cost-effective, Concrete, Interpretable, Grounded in theory, Sensitive, Responsive and Specific. Few indicators will have all these properties and thus several indicators with complementary properties may be needed to provide strong and

effective support for management decision-making. A more detailed discussion on the characteristics that objectives and indicators should have is found in ICES (2005).

Some examples of procedures to define objectives are given below:

3.4.1 ICES (2005)

Goal: To ensure that levels of pollution in the marine environment do not give rise to significant negative impacts or risk to human and/or on ecosystem health and/or uses of the sea.

Ecological objective: Reduce the impact of contaminants on ecosystems and humans.

Operational objectives: a) Reduce impacts on coastal ecosystems

b) Reduce impacts on marine mammals

c) Reduce contaminant levels in edible organisms

d) Other operational objectives

3.4.2 OSPAR EcoQOs

OSPAR uses presently slightly different terminology in defining the elements necessary to implement the ecosystem approach. OSPAR introduced earlier, in the 1990s, the terms ecological quality, ecological quality element and ecological quality objective.

Ecological quality objective (EcoQO) was defined as “the desired level of an **ecological quality (EcoQ)**” which in turn was defined as “an overall expression of the structure and function of the marine ecosystem taking into account the biological community and natural physiographic, geographic and climatic factors as well as physical and chemical conditions including those resulting from human activities.”

An **ecological quality element** was likewise defined as “an individual aspect of the overall ecological quality”.

In the OSPAR approach the first step is to select the aspects of the ecosystem (quality issues) through which the good ecological status will be defined, e.g. eutrophication. The next step is to decide, for each of these issues, the ecological quality elements, i.e. the individual aspects of ecological quality on which it is appropriate to focus, e.g. dissolved oxygen, dissolved inorganic nitrogen (DIN), dissolved inorganic phosphorus (DIP), chlorophyll a and phytoplankton indicator species. The number of elements selected under each of the issues will vary.

For each quality element an ecological quality objective is set. EcoQOs can take the form of targets (values where there is a commitment to attain them) or indicators (values which simply show what is happening). For example, the objective for chlorophyll a could be a target to keep its concentration below a percentage deviation from background levels not exceeding 50%.

3.4.3 HELCOM

HELCOM basically followed the concepts outlined in ICES (2005). However, the strategic goals in fact define major topic areas (e.g. eutrophication), and the ecological objectives describe central characteristics of a healthy sea (e.g. clear water). The final normative step is the definition of the indicators with target levels.

HELCOM agreed on the following strategic goals and ecological objectives:

Goal: Baltic Sea unaffected by eutrophication

- a) Concentration of nutrients close to natural levels.
- b) Clear water
- c) Natural level of algal blooms
- d) Natural distribution and occurrence of plants and animals.
- e) Natural oxygen levels

Goal: Baltic Sea life undisturbed by hazardous substances

- a) Concentrations of hazardous substances close to natural levels
- b) All fish safe to eat
- c) Healthy wildlife
- d) Radioactivity at pre-Chernobyl levels

Goal: Favourable status of Baltic Sea biodiversity

- a) Natural landscapes and seascapes
- b) Thriving and balanced communities of plants and animals
- c) Viable populations of species

The fourth goal, which does not refer to an ecological state, is that maritime activities in the Baltic Sea are carried out in an environmentally friendly way.

Some objectives, such as “clear water” and “nutrient concentrations close to natural levels” can be assessed with one or few indicators, while some objectives may need several indicators, especially such objectives as “healthy wildlife” and the objectives under biodiversity. In the case of “clear water” the indicator proposed is Secchi disk depth and for nutrients, dissolved inorganic phosphorus and nitrogen.

HELCOM is in the process of setting quantitative targets i.e. for each objective, a number of indicators with target levels will be agreed upon. Target levels specify good status for a given indicator. For eutrophication parameters a draft set of target levels have already been produced; e.g. for the objective “clear water” long-term averages of open sea summertime Secchi depth has been proposed. The target (how many meters?) to define the indicator value will represent an acceptable deviation from historical background levels (reference levels) for a given geographical area (sub-region within the Baltic Sea).

3.4.4 The MAP case

Within MAP, the terms “objective”, “overall objective”, “goal” “target” and even “action” and “activity” are used with no real distinction between them. On the same list it is possible to see goals, ecological objectives, operational objectives and actions. For example, the MSSD proposes four major objectives but also priority fields of action and under each one of them a list of “objectives, orientations and actions”. Most objectives (MED POL, SAP MED, SAP BIO) are activity-oriented and in many cases no distinction is made between those actions which contribute directly to the improvement of the marine environment, those which belong to the assistance component and those which relate to monitoring and research.

For example, the objectives of SAP MED and SAP BIO either aim at generating information (mapping, NDA, BB) or relate to capacity building and activities that countries should undertake in order to implement the protocols. Basically, the overall objectives of MED POL IV aim at generating information (monitoring and research) and at assisting the countries in the implementation of the protocols. However, the objective “assessment of the effectiveness of measures taken” is an important component in the application of the ecosystem approach provided that ecological indicators are used. In the case of SAP MED, the overall objective is to reduce pollution from land-based activities, which is a management strategic goal.

The major point to make is that a management plan has been prepared without setting ecological objectives and indicators on the basis of which **to see the improvement in the ecological status of the ecosystem**. Almost no objective relates to ecosystem health, structure and/or function i.e. ecological objective. The strategy is to reduce inputs and thus improve the status of the marine environment. In this case, monitoring the objectives means to assess by how much inputs were reduced.

3.5 A hierarchical system of objectives and indicators for MAP

3.5.1 Objectives

On the basis of the experiences and discussions above, it is proposed that MAP organises its objectives in the way described below:

- I. **An Ecological Vision, to describe the desired status of the Mediterranean Marine Environment**
- II. **A set of Strategic Goals, to specify the main human pressures to be tackled**
- III. **Ecological Objectives, defined in terms of Ecosystem Status**
- IV. **Operational objectives, the achievement of which requires action, accompanied by target levels**

It is recommended that MAP and the countries proceed with the necessary action, as soon as possible, to derive operational objectives with ecological indicators and target levels that are presently missing. This is not an easy exercise but it can be done for many areas of the Mediterranean where sufficient scientific information exists. In other areas, steps have to be taken to generate missing information and ensure that participating institutions have the capacity to determine the indicators.

The capacity to set and address ecological and operational objectives will differ between different areas based on the differences in factors such as the available scientific knowledge, the human activities in the areas, and the threats present. Reconciliation of economic and social objectives with ecological objectives will pose different challenges in different management regions. It is therefore appropriate to apply different ecological and operational objectives in different circumstances.

3.5.2 Indicators

The selection of indicators is very important as these indicators will be used to measure the progress made in meeting the objectives and will affect management of action. During the last few years, discussions have been going within MED POL and the relevant RACs but no decisions have been taken on ecological indicators to be used. Excellent documents have been produced (e.g. MTS 154 and the fact sheets on pollution indicators) which could form the background for the decision-making.

Discussion on the selection of indicators for the Mediterranean Sea will certainly take into consideration the existing monitoring programmes, data validation and data interpretation. It is possible that new monitoring or research activities will be initiated. Usually the scientific view is that “more work is needed” but a decision on their selection should not be delayed. They can be improved on the way by “learning by doing”. Selecting them as soon as possible will enable an early preparation of the necessary capacity building in certain countries and possible modifications to the monitoring programmes accordingly

3.6 Redrafting the management plans

Once the indicators and target levels have been agreed upon, a management plan should be prepared aiming at achieving the objectives by moving the ecosystem closer to the target levels. Operational objectives should be converted to specific management actions (e.g. the objective of reducing nutrient inputs could be broken down to construction of sewage treatment plants, treatment of industrial effluents, reduction of fertilizer use, etc.) and management tools and instruments should be devised (see **Annex IV** for details) to manage human activities in a way which is consistent with the operational objectives.

This is the field where MAP has a lot of experience. MAP has gathered substantial information on the human activities impacting on the marine ecosystem and has put forward action plans for alleviating these impacts. However, in most cases the plans were not drafted on the basis of ecosystem targets but relate solely to the management objective of reducing inputs. This way the degree of achievement was related to a percentage of reduction of inputs rather than to a change in the ecosystem status. Also management actions were proposed without really studying their implications or knowing what the results would be in the ecosystem status.

Decision-making for management actions should rely on the assumption that their effects can be predicted and should preferably be supported by scenario studies with quantitative predictions. This ability of how well one can quantify the effects of management

actions relies on the availability of proper data and a good understanding of the major processes controlling the ecosystem components that are affected by management action. In addition, the socio-economic consequences of each management action should be studied before implementation, and proposals put forward for alleviating possible consequences without compromising the ecological objectives.

Another issue is integration. For example, SAP MED and SAP BIO are based on sectoral policies and in certain cases duplication exists as regards management actions. The Secretariat for the Barcelona Convention should prepare only **one** management plan encompassing all actions relevant to the Mediterranean Sea and coasts. The practice of addressing diverse uses and different components of the ecosystem separately should be abandoned.

Supporting activities

In a management plan we may include only actions, which contribute directly to the achievement of the objectives. However, no management plan can be implemented without supporting activities. Supporting activities, which are as essential as direct actions, could be divided into monitoring and research, capacity building, and information. The information component will also be responsible for the involvement of all stakeholders. Assessment, monitoring, and scientific research are required to provide a sound scientific basis for identifying ecological objectives, selecting indicators, and assessing the effectiveness of measures taken by providing regular evaluations of the ecosystem status.

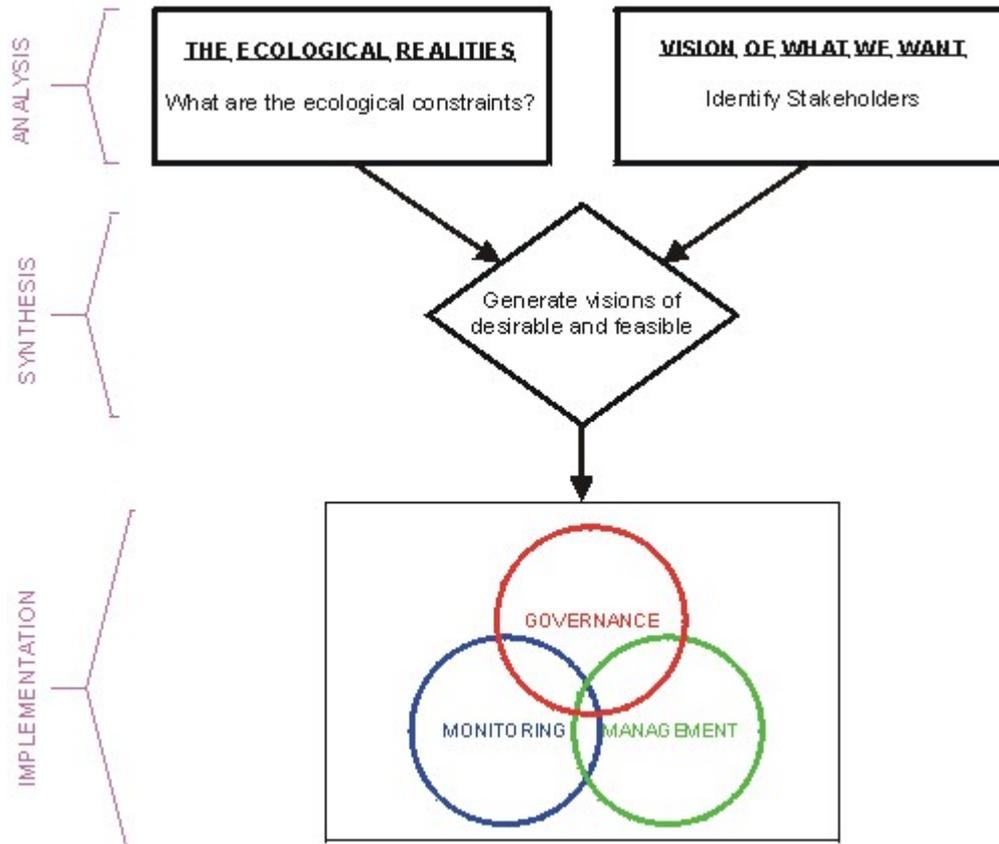
When preparing the management plan, one must have in mind that MAP does not have the power to implement management measures that will actually bring the desired results. MAP, acting as the secretariat, uses its coordination role to help the countries to agree on a number of actions and then assists certain countries to fulfill their obligations. It must be pointed out that the execution of the management plan is the responsibility of governmental and local authorities and that MAP can only assist in a limited way, if requested to do so.

It is advisable to initiate the formulation of the management plan right after the setting of ecological indicators and target levels to see what information is still missing so that steps are taken to generate the missing information.

4. Implications on MAP and adaptation strategies

Implementing the ecosystem approach does not mean, at the present stage, drastic changes to the institutional arrangements or the legal texts. However, budget proposals should include the additional activities necessary for the preparation of the implementation of the approach. Moving to the ecosystem approach is not a revolutionary step but an evolutionary one. The strategic goals and objectives for a clean and healthy environment remain the same and the actions to reduce impacts of the human activities on the marine environment with first and foremost the reduction of inputs will not change. What has to change is how we approach the goals and the problems. Objectives relating to the ecosystem status have to be set and the degree of their achievement followed. Everything has to be done in an integrated, coordinated and systematic manner taking into account all human uses and thus not neglecting that man is part of the ecosystem.

The process of applying the ecosystem approach is described schematically below.



So far we have initiated management actions without (a) setting objectives relevant to the ecological status of the marine environment, (b) knowing the exact environmental, social or economic consequences and (c) checking on the achievement of our actions.

All Contracting Parties to the Convention on Biological Diversity (which includes Mediterranean countries) are committed to apply the ecosystem approach and its principles (see Annexes I, II and III).

4.1 Ecosystem approach principles

In implementing the ecosystem approach the principles of Annex I should be followed i.e. all stakeholders should be involved at all levels and stages, management should be decentralized to the lowest appropriate level, the ecosystem should be managed in an economic context, the adaptive management approach should be followed, and objectives for ecosystem management should be set for the long term, temporal and spatial scales. Also apply good governance and, monitoring and review. Components should also include information, research and development and capacity building.

MAP and the Contracting Parties should study and apply the ecosystem approach principles to a higher extent. Emphasis should be given to integration, which is in fact the heart of the approach, but also to the following three principles for which not much has been said so far throughout the document.

4.1.1 Adaptive management

One of the prerequisites in the application of the approach is the use of adaptive management, which is the alternative to rigid and inflexible management frameworks. Adaptive management is probably not something new but in most cases it was applied only when it became necessary to shift deadlines for completing actions.

Adaptive management is a form of learning by doing, with structured feedback and decision-making. The adaptive approach requires that monitoring and assessment are of sufficient accuracy, precision, and frequency to ensure that the effects of management measures can be evaluated in a timely manner, and adjusted as necessary. In order to make adaptive management efficient, the indicators should provide rapid and reliable feedback on activities and management measures.

Adaptive management requires less stringent assumptions about scientific understanding of ecosystem processes but requires an ability to predict the trend and general magnitude of the effects of management actions.

The ecosystem approach should also take account of the natural variability in marine ecosystems and management should recognize that ecosystems are dynamic. This implies that management frameworks will not be static, but continually reassessed and updated as circumstances change.

4.1.2 Monitoring and review

Monitoring and review are crucial components in implementing the ecosystem approach. They allow a responsive and adaptive management capability to be developed. Monitoring and assessment of the current status of the indicators is important to see the progress achieved in meeting the objectives. Based on the outcome of these assessments, updates of the management measures should be considered and a new set of measures and actions, where and if needed, should be planned for the next cycle.

Scoping of the current situation needs to be repeated at intervals, to review ongoing changes in ecosystem status that may be influenced substantially by processes such as climate change. Only by comparing the changes in ecosystem status and human activities, over time and in relation to the Vision, strategic goals, and ecological objectives, is it possible to determine whether the ecosystem approach to management has been implemented successfully.

Such periodic re-evaluations also allow the effects of inevitable and often unforeseeable natural variability in ecosystems to be considered in management. Environmental changes may even require adjustments to the ecological objectives. Similarly, changes in social and economic conditions may result in changes to human activities affecting the marine ecosystem, whether the social and economic objectives have been changed explicitly or not. Periodic updates allow changing societal needs to be reconciled with changing ecological conditions.

Finally, each periodic update provides an opportunity for new scientific knowledge to be incorporated into the ecosystem approach. Where possible, of course, new knowledge is applied as quickly as it becomes available. Periodic revisions allow for the updating of the entire system, keeping practice as close to the state of knowledge as possible.

4.1.3 Decentralization

One of the twelve principles (no.2) states, "Management should be decentralized to the lowest appropriate level". Principle no. 7 states, "The ecosystem approach should be undertaken at the appropriate spatial and temporal scales". In addition, the fourth point of operational guidance proposes management actions at the scale appropriate for the issue being addressed, with decentralization to the lowest level, as appropriate.

Considering that an ecosystem is a functioning unit that can operate at any scale, depending upon the problem or issue being addressed, this can be used to define the appropriate level for management decisions and actions. This approach implies decentralization at a very low level e.g. local community.

Management areas

This brings us to the question whether the approach should be applied on a Mediterranean- wide scale. This will probably be a very hard job to do, if not impossible, both scientifically and management wise. The entire basin is a large area to be managed efficiently at the level demanded by the ecosystem approach. It will be necessary to identify individual management regions for which ecological and operational objectives should be defined.

Ecosystem boundaries are typically based on biological and physical processes and therefore the boundaries of management regions should be primarily based on biogeographic and oceanographic features. The differences between the regions are not only ecological; factors such as human activities and threats in the areas, priorities and available scientific knowledge and technical capabilities are also important. In addition existing political, social and economic divisions cannot be ignored. Identifying management areas, not only efficiency will be enhanced but local societies will also have the freedom to make their own choices.

4.2 On-going MAP programmes

The monitoring, assessment and research components of MAP (basically MED POL and SPA/RAC) have already generated valuable information for the application of the approach. Some of their activities, now, will have to focus on the definition and determination of the ecological indicators not neglecting quality control and auditing, so that they are of sufficient accuracy and precision to enable detection of trends. In addition, methods should be devised (e.g. modeling) to enable prediction of effects on the marine ecosystem resulting from the application of management measures.

However, it must be borne in mind that scientific knowledge is not complete as regards the functioning of the ecosystem and its reaction to anthropogenic factors. The extent to which it is incomplete will vary among regions and for different ecosystem components. Therefore, managers will have to base their decisions on the best available scientific information.

As far as the other RACs are concerned, CP/RAC could focus on helping producers and consumers to adapt their production and consumption patterns to the objectives of the ecosystem approach. BP/RAC, as already pointed out, could assist in studying the socio-economic consequences of all actions and INFO/RAC could, in addition to dissemination of information, devise methods of receiving input from the society, e.g. through Internet or

public meetings. It is not anticipated that PAP/RAC and REMPEC activities will be affected to a large extent.

Pilot projects

In almost all other areas where the approach will be implemented, pilot projects have been initiated to test its implementation. For the Mediterranean, pilot projects could be initiated in one or two management areas of the basin and the experience gained could be extended to all the Mediterranean. However, it might be a challenge to apply the findings or the experience to the rest of the Mediterranean as most of these may be specific to the region. The most important drawback is the imminent danger that management areas not participating will fall out of the process, especially if these are the less developed areas.

Pilot projects could be initiated in well-studied areas where ample information regarding the ecological status and the impacts and threats as well as sources is available. One other advantage would be that countries in the sub-region should have previous experience in regional common projects and good cooperation.

Contracting Parties could make use of article 3, paragraph 2 of the Barcelona Convention to initiate pilot projects in sub-regions. **It must be noted, however, that before a pilot project can be initiated, the Contracting Parties should approve a Vision and strategic goals for the entire Mediterranean.**

4.3 Capacity, institutional framework and governance

In general, MAP and the Mediterranean countries have the capacity to implement the ecosystem approach but a special effort will be required as its application is **very demanding**. A new roadmap has to be followed and some of the work will have to be repeated more systematically, coherently and in a coordinated manner. Possible weaknesses in less developed countries are the capacity to monitor the ecological indicators, the lack of sufficient reliable scientific information and the administrative structures and financial capabilities to implement management actions.

One of the questions, which arise, is whether the existing institutional framework will deliver the integration and coherence required to achieve the goals and objectives. At this stage no modifications to the legal texts or the MAP structure are proposed but they may be necessary in the future when work is well underway and especially if integration cannot be achieved. The tendency of some of the RACs, handling various policy issues, to operate largely independently has to be reversed. Sectoral approaches focusing on the protection of species, habitats, biodiversity, or elimination of specific pollutants should be abandoned. All new work should be decided at the Coordinator's level and coordination should be strengthened so that cooperation between RACs is enhanced and the duplication of work is avoided. Interactions and cumulative effects among multiple policy instruments (e.g. protocols) responsible for the management of the uses of the marine ecosystem should be addressed in a coordinated manner.

MED POL and SPA/RAC will have the main responsibility of promoting the development of ecological indicators and target levels. PAP/RAC will lead the way for the achievement of the third strategic goal on coastal zones, but all RACs will be involved in the development of the action plan. It is understood that after everything has been prepared on paper, work will be shared between RACs. REMPEC, CP/RAC and INFO/RAC have specific roles to play. However, BP/RAC could undertake cost-benefit studies to convince the countries to invest the necessary funds and devise economic incentives to promote management actions. They

could also assist countries in promoting measures to alleviate possible socio-economic consequences resulting from management actions. It must, however, be stressed that the socio-economic objectives should be met without compromising ecological objectives.

Also, the concept of a 'healthy' ecosystem needs to be reconciled across sectors and policy instruments. For most users, a "healthy" ecosystem is an un-impacted one but from the fisheries point of view a "healthy" ecosystem is one that is impacted until the fishery provides the maximum sustainable economic and social benefits to society.

Good governance is essential for the successful application of the ecosystem approach. Good governance includes sound environmental, resource and economic policies and administrative institutions that are responsive to the needs of the people. Robust and sound resource management systems and practices are required to support these policies and institutions. Decision-making should account for societal choices, be transparent and accountable and involve society. Accountability for making decisions has to be placed at the appropriate level that reflects that community of interest.

5. Recommended actions

- (1) MAP should endorse in a more explicit way the intention to implement the ecosystem approach, including launching of pilot projects.
- (2) MAP should then start a process aiming at:
 - (a) Defining an ecological Vision and setting strategic goals common to all the Mediterranean
 - (b) Establishing a set of ecological objectives and indicators corresponding to the Vision and strategic goals
 - (c) Identify the associate target levels for each indicator in each region
 - (d) Develop operational and management objectives on the basis of the ecological objectives and decide on the management tools
 - (e) Ensure that a common management plan aimed at achieving the objectives is prepared, including sectoral actions and supporting activities.
 - (f) Study the socio-economic consequences of the proposed management actions and put forward ideas for alleviating them.
- (3) MAP is to assess whether the available scientific information is reliable enough to enable setting of target levels. In addition, it should ensure that the capacity exists to determine the indicators at the required accuracy, precision and frequency.
- (4) MAP will initiate and maintain a process to involve the stakeholders in the entire course of implementation, in particular,
 - (a) Prepare an information package on the objectives for the benefit of the stakeholders

- (b) Obtain feedback from all stakeholders on the management actions and tools proposed.
- (5) MAP will assist countries, where necessary, in the implementation of the management actions.

In implementing the management plan, MAP will apply the ecosystem approach principles especially adaptive management and periodic reviews and updates.

ANNEX I

**The twelve principles/characteristics of the ecosystem approach
adopted by the Fifth Meeting of the Conference of the Parties to the
Convention on Biological Diversity (Nairobi, 2000)**

Principle 1: The objectives of management of land, water and living resources are a matter of societal choice.

Rationale: Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognised. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Principle 2: Management should be decentralized to the lowest appropriate level.

Rationale: Decentralised systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Rationale: Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organisation for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 4: Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

(a) Reduce those market distortions that adversely affect biological diversity;

(b) Align incentives to promote biodiversity conservation and sustainable use;

(c) Internalize costs and benefits in the given ecosystem to the extent feasible.

Rationale: The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favour the conversion of land to less diverse systems.

Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Rationale: Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 6: Ecosystems must be managed within the limits of their functioning.

Rationale: In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

Rationale: The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterised by the interaction and integration of genes, species and ecosystems.

Principle 8: Recognising the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term.

Rationale: Ecosystem processes are characterised by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Principle 9: Management must recognize that change is inevitable.

Rationale: Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilise adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Rationale: Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Rationale: Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use are desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, *inter alia*, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Rationale: Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

ANNEX II

Five points of operational guidance provided by the 5th Conference of the Parties to the Convention on Biological Diversity (Nairobi, 2000) for the application of the twelve ecosystem approach principles

Focus on the functional relationships and processes within ecosystems

The many components of biodiversity control the stores and flows of energy, water and nutrients within ecosystems, and provide resistance to major perturbations. A much better knowledge of ecosystem functions and structure, and the roles of the components of biological diversity in ecosystems, is required, especially to understand: (i) ecosystem resilience and the effects of biodiversity loss (species and genetic levels) and habitat fragmentation; (ii) underlying causes of biodiversity loss; and (iii) determinants of local biological diversity in management decisions. Functional biodiversity in ecosystems provides many goods and services of economic and social importance. While there is a need to accelerate efforts to gain new knowledge about functional biodiversity, ecosystem management has to be carried out even in the absence of such knowledge. The ecosystem approach can facilitate practical management by ecosystem managers (whether local communities or national policy makers).

Enhance benefit-sharing

Benefits that flow from the array of functions provided by biological diversity at the ecosystem level provide the basis of human environmental security and sustainability. The ecosystem approach seeks that the benefits derived from these functions are maintained or restored. In particular, these functions should benefit the stakeholders responsible for their production and management. This requires, inter alia: capacity-building, especially at the level of local communities managing biological diversity in ecosystems; the proper valuation of ecosystem goods and services; the removal of perverse incentives that devalue ecosystem goods and services; and, consistent with the provisions of the Convention on Biological Diversity, where appropriate, their replacement with local incentives for good management practices.

Use adaptive management practices

Ecosystem processes and functions are complex and variable. Their level of uncertainty is increased by the interaction with social constructs, which need to be better understood. Therefore, ecosystem management must involve a learning process, which helps to adapt methodologies and practices to the ways in which these systems are being managed and monitored. Implementation programmes should be designed to adjust to the unexpected, rather than to act on the basis of a belief in certainties. Ecosystem management needs to recognise the diversity of social and cultural factors affecting natural-resource use. Similarly, there is a need for flexibility in policy-making and implementation. Long-term, inflexible decisions are likely to be inadequate or even destructive. Ecosystem management should be envisaged as a long-term experiment that builds on its results as it progresses. This "learning-by-doing" will also serve as an important source of information to gain knowledge of how best to monitor the results of management and evaluate whether established goals are being attained. In this respect, it would be desirable to establish or strengthen capacities of Parties for monitoring.

Carry out management actions at the scale appropriate for the issue being addressed, with decentralization to lowest level, as appropriate

As noted in section A above, an ecosystem is a functioning unit that can operate at any scale, depending upon the problem or issue being addressed. This understanding should define the appropriate level for management decisions and actions. Often, this approach will imply decentralisation to the level of local communities. Effective decentralisation requires proper empowerment, which implies that the stakeholder both has the opportunity to assume

responsibility and the capacity to carry out the appropriate action, and needs to be supported by enabling policy and legislative frameworks. Where common property resources are involved, the most appropriate scale for management decisions and actions would necessarily be large enough to encompass the effects of practices by all the relevant stakeholders. Appropriate institutions would be required for such decision-making and, where necessary, for conflict resolution. Some problems and issues may require action at still higher levels, through, for example, transboundary co-operation, or even co-operation at global levels.

Ensure inter-sectoral co-operation

As the primary framework of action to be taken under the Convention, the ecosystem approach should be fully taken into account in developing and reviewing national biodiversity strategies and action plans. There is also a need to integrate the ecosystem approach into agriculture, fisheries, forestry and other production systems that have an effect on biodiversity. Management of natural resources, according to the ecosystem approach, calls for increased inter-sectoral communication and co-operation at a range of levels (government ministries, management agencies, etc.). This might be promoted through, for example, the formation of inter-ministerial bodies within the Government or the creation of networks for sharing information and experience.

ANNEX III

Further guidance on the implementation of the ecosystem approach principles provided by the 7th Conference of the Parties to the Convention on Biological Diversity (Kuala Lumpur, 2004)

1. In applying the operational guidance of the ecosystem approach ecosystem approach, the following cross-cutting issues need to be considered.

Initiating the approach

2. When initiating the ecosystem approach, the first task is to define the problem that is being addressed. In doing so the scope of the problem and the task to be undertaken has to be well specified. The strategy to be followed to promote the ecosystem approach has to be clearly defined with contingencies for unforeseen situations incorporated into the strategy. The approach should consider all principles as a package but depending upon the task at hand emphasis on particular principles may be warranted. A collective ownership for the vision, strategy and parameters for the ecosystem approach relevant to the task has to be developed, communicated, and facilitated among partners and sponsors. Collectively developing the overarching goals, objectives, targets for the exercise is important before applying the ecosystem approach.

Capacity-building and collegiate will

3. To apply the ecosystem approach successfully it is critical to investigate what resources and sponsorship are required to undertake the exercise. This can be in the form of capacity-building and fostering collegiate will.

4. Collegiate will can be in terms of community partnerships, stakeholder engagement, political and institutional will, and the commitment of donors or sponsors. An important consideration is the length of time such collegiate will is required; that is, it may be required in the initiation phase, assessment phase or the phase associated with implementation of outcomes. Examples of where the ecosystem approach has been compromised can be from a loss of allegiance from one or more of the community, other stakeholders, the political establishment and institutions, or sponsors and donors.

5. Capacity-building is also important for the success of the ecosystem approach. Adequate financial support and appropriate infrastructure support are important requirements to the success of an approach. So too is access to suitable expertise and the sharing of knowledge and experience. In undertaking the ecosystem approach it is useful to build from lessons learnt from other undertakings applying the ecosystem approach. Technology, including decision support tools and inventory systems, which have been developed in other applications of the ecosystem approach, may be transferable or can be adapted.

Information, research and development

6. The collection of resource, biophysical, social, and economic information is important to the successful completion of the ecosystem approach. Research and development is needed to target strategic gaps in knowledge that are important for addressing the exercise at hand. Knowledge derived from research and information from other sources has to be integrated and packaged into information products (including decision-support systems) that allow and provide for interpretation, and which facilitate their use in applying the ecosystem approach. Information products are necessary for communicating with stakeholders, planners, managers and decision makers. Consideration should be given to enhancing the access of stakeholders to information because the more transparent the decision-making is, based on information at hand, the better the ownership of the resultant decisions between partners, stakeholders and sponsors. Priorities for research and development are likely to be

clearer once the ecosystem approach begins to be applied and implementing actions are put in place.

Monitoring and review

7. Monitoring and review are crucial components in implementing the ecosystem approach. They allow a responsive and adaptive management capability to be developed. Monitoring and review are also useful in reporting performance and the resultant outcomes of the approach.

Indicators of performance should be defined, developed and implemented. Appropriate monitoring and auditing systems need to be implemented to support reporting on indicators of performance. Periodic reviews of these indicators need to be undertaken to assess performance and whether adaptive management needs to be applied. Strategies, practices and processes may need to be modified depending upon the findings from monitoring and auditing.

Good governance

8. Good governance is essential for successful application of the ecosystem approach. Good governance includes sound environmental, resource and economic policies and administrative institutions that are responsive to the needs of the people. Robust and sound resource management systems and practices are required to support these policies and institutions. Decision-making should account for societal choices, be transparent and accountable and involve society. Accountability for making decisions has to be placed at the appropriate level that reflects that community of interest. For example strategic land-use planning and management might be taken by central government, operational decisions taken by local government or management agency, whereas decisions associated with the sharing of benefits could be taken by a community organization.

9. Good governance at all levels is fundamental for achieving sustainable use and conservation of biodiversity. It is important to ensure intersectoral cooperation. There is a need to integrate the ecosystem approach into agriculture, fisheries, forestry and other production systems that have an effect on biodiversity. Management of natural resources, according to the ecosystem approach, calls for increased intersectoral communication and cooperation at a range of levels (government ministries, management agencies).

Table 1: The 12 Principles of the ecosystem approach and their rationale (decision V/6 of the Conference of the Parties) suggested annotations to the rationale and implementation guidelines.

Principle 1: The objectives of management of land, water and living resources are a matter of societal choice.

Rationale

Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Annotations to the rationale:

The objectives for managing land, water, and living resources is a matter of societal choice, determined through negotiations and trade-offs among stakeholders having different perceptions, interests, and intentions. In this regard it should be noted that:

- *Human society is diverse in the kind and manner of relationships that different groups have with the natural world, each viewing the world around them in different ways and emphasising their own economic, cultural, and societal interests and needs.*
- *All relevant sectors of society need to have their interests equitably treated, which may involve providing for different outcomes in separate locations or at different times.*
- *It is also necessary to ensure that the needs of future generations and the natural world are adequately represented.*
- *Given this diversity, good decision-making processes that provide for negotiations and trade-offs are necessary to establish broadly acceptable objectives for the management of particular areas and their living resources.*
- *Good decision-making processes incorporate the following characteristics:*
 - *All interested parties (particularly including indigenous and local communities) should be involved in the process,*
 - *It needs to be a clear how decisions are reached and who the decision-maker(s) is(are),*
 - *The decision-makers should be accountable to the appropriate communities of interest,*
 - *The criteria for decisions should be appropriate and transparent, and*

Implementation guidelines

- 1.1 Involve all stakeholders (interested parties) (including indigenous and local communities) in:
 - clearly articulating, defining and agreeing upon the goals of management
 - defining problems
 - making choices (in principle 12).
- 1.2 There need to be clearly defined boundaries (in time and space) for the management unit that is the subject of the societal choice process.
- 1.3 Ensure that those stakeholders that cannot directly represent themselves are adequately represented by someone else.
- 1.4 Ensure that all stakeholders have an equitable capacity to be effectively involved, including through ensuring equitable access to information, ability to participate in the processes, etc.
- 1.5 Ensure that the decision-making process compensates for any inequities of power in society, in order to ensure that those who are normally marginalized (e.g. women, the poor, indigenous people) are not excluded or stifled in their participation.
- 1.6 Determine who the decision-makers are for each decision, how the decisions will be taken (what process will be used), and what are the limits on the discretion of the decision-maker (e.g. what are the criteria for the decision in law, what is the overall policy guidance within which the decision must fit, etc).
- 1.7 Ensure that the recognition of stakeholder interests occurs within the full range of decisions over time and space and levels. In doing so, however, ensure that “stakeholder fatigue” does not develop, by incorporating known stakeholder views into future decisions, and allowing efficient stakeholder input.
- 1.8 Where possible, use existing societal mechanisms, or build new mechanisms that are compatible with existing or desired societal

- *Decisions should be based on, and contribute to, inter-sectoral communication and coordination.*
- *Good decisions depend on those involved having access to accurate and timely information and the capacity to apply this knowledge.*

conditions.

- 1.9 Ensure that decision-makers are accountable to the appropriate communities of interest.
- 1.10 Develop the capacity to broker negotiations and trade-offs, and manage conflicts, among relevant stakeholder groups in reaching decisions about management, use and conservation of biological resources.
- 1.11 There need to be mechanisms in place to ensure that, once an appropriate societal choice has been made, the decision will be able to be implemented over the long term, i.e. policy, legislative and control structures need to be in place.
- 1.12 Undertake assessment at the national level to analyse effects of ecosystem management practices on society, with a view to find ways and means to mitigate possible constraints between stakeholders in the implementation phase.

Principle 2: Management should be decentralized to the lowest appropriate level.

Rationale:

Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Annotations to the rationale:

Decisions should be made by those who represent the appropriate communities of interest, while management should be undertaken by those with the capacity to implement the decisions. In this regard it should be noted that:

- *There are usually many communities-of-interest in ecosystem management. These can be compatible, complimentary, or contradictory. It is important to ensure that the level of decision-making and management selected maintains an appropriate balance among these interests.*
- *Often, but not always, the closer the decision-making and management are to the ecosystem, the greater the participation, responsibility, ownership, accountability and use of local knowledge will be, all of which are critical to the success of management.*
- *Because there are several levels of interests with people who have varying capacities to address different aspects of ecosystem management, there are often multiple decision-makers and managers with different roles for any individual place or resource.*
- *Decisions made by local resource managers are often affected by, or even subordinate to, environmental, social, economic and political*

Implementation guidelines

- 2.1 The multiple communities of interest should be identified, and decisions about particular aspects of management assigned to the body that represents the most appropriate community of interest. If necessary, management functions/decisions should be subdivided. For example, strategic decisions might be taken by central government, operational decisions by a local government or local management agency, and decisions about allocation of benefits between members of a community by the community itself.
- 2.2 The potential adverse effects of fragmented decision-making and management responsibilities should be compensated for by:
 - ensuring that decisions are appropriately nested and linked
 - sharing information and expertise
 - ensuring good communication between the different management bodies
 - presentation of the overall combination of decisions/management to the community in an understandable and consolidated form so they can effectively interact with the overall system.
 - supportive relationships between the levels.
- 2.3 Good governance arrangements are essential, particularly:
 - clear accountabilities

processes that lie outside their sphere of influence, at higher levels of organisation. Therefore there is a need for mechanisms to coordinate decisions and management actions at a number of different organisational levels.

- accountabilities of the necessary authorities
- accountabilities of competent bodies or persons

Note that this is not a complete enough list, and there seems no good reason to particularly identify these.

2.4 Achieving an appropriate level of decentralization requires taking decisions at a higher level to create an enabling and supportive environment, as well as a commitment to devolve those decision-making responsibilities that are currently situated at too high a level.

2.5 In choosing the appropriate level of decentralization, the following are relevant factors that should be taken into account in choosing the appropriate body. .

- whether the body represents the appropriate community of interest
- whether the body has a commitment to the intent of the function
- whether the body has the necessary capacity for management
- efficiency (e.g. by moving the function to a higher level you may have sufficient work to allow maintenance of the necessary level of expertise to do the function efficiently and effectively).
- whether the body has other functions which represent a conflict of interest
- the effect on marginalized members of society (e.g. women, marginalized tribal groups)

In some cases problems could be corrected, such as through capacity-building. If no appropriate body is available at the level, a new body might be created, or an existing body modified, or a different level chosen.

2.6 Where functions are to be moved to another level, it is necessary to ensure that the body receiving the responsibility has sufficient capacity to fulfil that responsibility (e.g. resources, systems, authority), and that any risks arising from the transition can be managed. This means doing capacity-building if necessary to allow the decentralization to occur.

Institutional arrangements are the key. If you don't have the institutional structure that supports and coordinates the decision-making authorities then their work is worthless.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Rationale:

Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Annotations to the rationale:

Implementation guidelines

3.1 Natural resource managers, decision makers and politicians should

Ecosystems are not closed systems, but rather open and often connected to other ecosystems. This open structure and connectedness of ecosystems ensures that effects on ecosystem functioning are seldom confined to the point of impact or only to one system. In this regard it should be noted that:

- *The effects of management interventions, or decisions not to intervene, are therefore not confined solely to the point of impact.*
- *The effects between ecosystems are frequently non-linear and will likely have associated time-lags.*
- *Management systems need to be designed to cope with these issues.*

There is a need for this to reflect the fact that impacts are in both directions – into and out of a particular ecosystem. Not just adjacent and downstream, but those have other connections as well (e.g. systems linked by migratory species).

consider the possible effects that their actions could have on adjacent and downstream ecosystems (river basins and coastal zones) so that effects inside and outside the ecosystem are determined.

- 3.2 Where impacts of management or use of one ecosystem has or is projected to have effects elsewhere, bring together relevant stakeholders and technical expertise to consider how best to minimize adverse consequences.
- 3.3 Environmental impact assessment (EIAs), including strategic environmental assessments (SEAs) should be carried out for developments that may have substantial environmental impacts taking into account all the components of biological diversity. These assessments should adequately consider the potential offsite impacts. The results of these assessments, which can also include social impact assessment, should subsequently acted upon. When identifying existing and potential risks or threats to ecosystem, different scales need to be considered.

Establish and/or maintain national and regional, where applicable, feed-back mechanisms to monitor the effects of management practices across ecosystems.

Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

- (a) Reduce those market distortions that adversely affect biological diversity;
- (b) Align incentives to promote biodiversity conservation and sustainable use;
- (c) Internalize costs and benefits in the given ecosystem to the extent feasible.

Rationale:

The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favour the conversion of land to less diverse systems. Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

Annotations to the rationale:

Many ecosystems provide economically valuable goods and services and it is therefore necessary to understand and manage ecosystems in an economic context. Frequently economic systems do not make provision for the many, often, intangible values derived from ecological systems In this regard it should be noted that:

- *Ecosystem goods and services are frequently undervalued in economic systems.*
- *Even when valuation is complete, most environmental goods and*

Implementation guidelines

- 4.1 Develop an understanding of the social and economic context of the issue to which the ecosystem approach is being applied
- 4.2 Apply appropriate practical economic valuation methodologies for ecosystem goods and services (direct, indirect and intrinsic values); and for the environmental impacts (effects or externalities).
- 4.3 Aim to reduce those market distortions that adversely affect biological diversity
- 4.4 Align economic and social incentives to promote biodiversity conservation and sustainable use.

- services have the characteristic of “public goods” in an economic sense, which are difficult to incorporate into markets.*
- *It is often difficult to introduce new uses of ecosystems, even where these are less impacting or provide wider benefits to society, because economic and social systems exhibit significant inertia, particularly where strong existing interests are affected by and resist change.*
 - *Many stakeholders with strong interests in the ecosystem, but having limited political and economic influence, may be marginalized from the relevant economic systems.*
 - *Where those who control use of the land do not receive benefits from maintaining natural ecosystems and processes, they are likely to initiate unsustainable land use practices from which they will benefit directly in the short term. To counter this, more equitable sharing of benefits is advised.*
 - *International, national and sub-national policies, laws and regulations, including subsidies may provide perverse incentives for unsustainable management of ecosystems. Economic systems therefore need to be redesigned to accommodate environmental management objectives.*
 - *Addressing the issue of market distortions that adversely affect biodiversity will require establishing dialogue with other sectors.*

Deriving economic benefits is not necessarily inconsistent with attaining biodiversity conservation and improvement of environmental quality.

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Rationale:

Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Annotations to the rationale:

Biodiversity conservation and the maintenance of human well being depend on the functioning and resilience of natural ecosystems. In this regard it should be noted that:

- *Ecosystem services – the benefits people obtain from ecosystems by way of resources, environmental regulation including, support of biospheric processes, inputs to culture, and the intrinsic values of*

- 4.5 Internalize costs and benefits in the given ecosystem to the extent feasible.
- 4.6 Evaluate the direct as well as indirect economic benefits associated with good ecosystem management including biodiversity conservation and environmental quality.
- 4.7 Enhance benefits of using biological diversity.
- 4.8 Ensure equitable sharing of costs and benefits.
Incorporate social and economic values of ecosystem goods and services into National Accounts, policy, planning, education and resource management decisions

Implementation guidelines

- 5.1 Improve understanding of the interrelationship among ecosystem composition, structure and function with respect to (i) human interaction, needs and values (including cultural aspects), (ii) conservation management of biodiversity, and (iii) environmental quality, integrity and vitality.
- 5.2 Determine and define conservation, social and economic objectives and goals that can be used to guide policy, management and planning using participatory processes.

the systems themselves – depend on maintaining and, where appropriate, restoring particular ecological structures and functions.

- *Ecosystem functioning and resilience depend on inter-relationships within and among species, between species and their abiotic environments, and on the physical and chemical interactions within these environments.*
- *Given this complexity, management must focus on maintaining, and where appropriate restoring, the key structures and ecological processes (e.g., hydrological systems, pollination systems, habitats and food webs) rather than just individual species.*
- *Given that the loss of genetic diversity predisposes populations and species to local extinction, the conservation of ecosystem composition and structure requires monitoring of population sizes of vulnerable and economically important species.*

Management of ecosystem processes has to be carried out despite incomplete knowledge of ecosystem functioning.

- 5.3 Assess the extent to which ecosystem composition, structure can function contribute to the delivery of goods and services to meet the desired balance of conservation, social and economic outcomes.
- 5.4 Expand knowledge of the responses of ecosystems, in terms of changes in composition, structure and function, to both internally and externally induced stresses caused by, *inter alia*, human use, disturbance, pollution, fire, alien species, disease abnormal climatic variations (drought, flood) etc.
- 5.5 Develop and promote management strategies and practices that enable and ensure conservation of ecosystem service and take account of, or minimize, risks/threats to ecosystem function and structure.
- 5.6 Apply instruments to maintain and/or restore ecosystem service.
- 5.7 Where required, develop management strategies and practices to facilitate recovery of ecosystem structure and function (including threatened components) to generate or enhance ecosystem services and biodiversity benefits.
- 5.8 Develop and apply instruments that contribute to achievement of conservation management goals through a combination of managing protected area networks, ecological networks and areas outside of such networks to meet both short-term and long-term requirements and conservation outcome in accordance with VII/28.
- 5.9 Monitoring population sizes of vulnerable and important species should be linked to a management plan that identifies appropriate response measures and actions.

Principle 6: Ecosystems must be managed within the limits of their functioning.

Rationale:

In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious

Annotations to the rationale:

There are limits to the level of demand that can be placed on an ecosystem while maintaining its integrity and capacity to continue providing the goods and services that provide the basis for human well being and environmental sustainability. Our current understanding is insufficient to allow these limits to be precisely defined, and therefore a precautionary approach coupled with adaptive management, is advised. In this regard it should be noted that:

Implementation guidelines

- 6.1 Identify practices that are not sustainable and develop appropriate mechanisms for improvement involving all stakeholders.
- 6.2 Given the uncertainty associated with defining the limits to ecosystem functioning under most circumstances, the precautionary approach should be applied.
- 6.3 Implement an adaptive management approach.
- 6.4 Develop understanding of the limits of ecosystem functioning and the effects of various human use on the delivery of ecosystem goods and services.

- *Just as there are limits to the demands (production, off-take, assimilation, detoxification) that can be made on ecosystems, so too there are limits to the amount of disturbance that ecosystems can tolerate, depending on the magnitude, intensity, frequency and kind of disturbance.*
- *These limits are not static but may vary across sites, through time, and in relation to past circumstances and events.*
- *Cumulative effects of interventions over time and space should be assessed when considering ecosystem limits.*
- *If these limits are exceeded, an ecosystem undergoes substantial change in composition, structure and functioning, usually with a loss of biodiversity and a resulting lower productivity and capacity to process wastes and contaminants*
- *There is considerable lack of knowledge and uncertainty about the actual limits (thresholds for change) in different ecosystems. While further research can reduce these uncertainties, given the dynamic and complex nature of ecosystems we may never have perfect understanding.*
- *Given the pervasiveness of uncertainties in managing ecosystems, management will need to be adaptive, with a focus on active learning derived from monitoring the outcomes of planned interventions using a sound experimental approach that allow the effects of the intervention to be accurately determined.*

Management to restore lost capacities or control use should be appropriately cautious and apply an adaptive management approach.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

Rationale:

The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Annotations to the rationale:

The driving forces of ecosystems, including those due to human activities, vary spatially and through time, necessitating management at more than one scale to meet management objectives. In this regard it should be noted that:

- *Ecosystems are made up of biotic and abiotic components and processes, which function at a range of spatial and temporal scales, within a nested hierarchy.*

- 6.5 Where permissible limits to change in specific ecosystem components can be agreed, manage within these but monitor and assess the ecosystem response. Feedback the information at regular intervals to those responsible for setting the off-take or other limits.
- 6.6 Encourage the use of environmental assessments and monitoring to establish ecosystem responses to disturbance, in order to provide management feedback and develop appropriate responses.
- 6.7 Develop and promote appropriate management strategies and practices that sustain resources and maintain ecosystems within the limits of their functioning.
- 6.8 Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure and functions as well as other components of ecosystems.
- 6.9 Formulate, review and implement regulatory framework, codes of practice and other instruments to avoid using ecosystems beyond their limits.

Implementation guidelines

- 7.1 Enhanced capacity is required to analyse and understand the temporal and spatial scales at which ecosystem processes operate, and the effect of management actions on these processes and the delivery of ecosystem goods and services. Identification of spatial patterns and gaps in connectivity should be included in this analysis.
- 7.2 Functional mismatches in the administration and management of natural resources should be avoided by readjusting the scale of the institutional response to coincide more closely with spatial and temporal scales of

- *The dynamics of human social and economic systems also vary across scales of space, time and quality.*
- *How components are perceived spatially depends partly on the scale of observation. At one scale, individuals of a species may seem relatively regularly and continuously distributed; at another the distribution may be discontinuous. Likewise with time, for example, at one time scale (e.g., monthly, annually) a component or process may appear predictable; at another, longer or shorter time scale, the temporal dynamics may be unpredictable.*
- *Management processes and institutions should be designed to match the scales of the aspects of the ecosystem being managed. More importantly, perhaps, given that ecosystem components and processes are linked across scales of both space and time, management interventions need to be planned to transcend these scales.*
- *Failure to take scale into account can result in mismatches between the spatial and time frames of the management and those of the ecosystem being managed. For example, policy makers and planners sometimes may have to consider shorter time frames than the time frames of major ecosystem processes. The reverse can also be true, for example, where bureaucratic inertia can delay the quick management response needed to address a rapidly changing environmental condition. Spatial mismatches are also common, such as when administrative boundaries and those of ecosystem properties or related human activities that they are designed to regulate do not coincide.*

processes in the area under management. This logic underpins the current global trend towards decentralized natural resource management.

- 7.3 Given that ecosystem components and processes are linked across scales of both time and space, management interventions need to be planned to transcend these scales. Developing a nested hierarchy of spatial scales may be appropriate in some circumstances.
- 7.4 Managing large areas such as river basins or large marine areas may require development of new institutional mechanisms to engage stakeholders across administrative borders and different levels of administration.
- 7.5 Attention to spatial and temporal scales is needed in the design of assessment and monitoring efforts.
- 7.6 Concepts of stewardship, intergenerational equity and sustainable yield need to be applied to considerations of the temporal scale.
- 7.7 Regional collaboration is necessary to deal with large-scale changes.

Principle 8: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.

Rationale:

Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Annotations to the rationale:

Time needs to be considered explicitly in formulating management plans, and in longer-scale processes need to especially considered and planned for because these are otherwise often neglected. In this regard it should be noted that:

- *People find long-term trends more difficult to detect than short term*

Implementation guidelines

- 8.1 Adaptive management processes should include the development of long-term visions, plans and goals that address inter-generational equity, while taking into account immediate and critical needs (e.g., hunger, poverty, shelter).
- 8.2 Adaptive management should take into account trade-offs between short-term benefits and long-term goals in decision-making processes.
- 8.3 Adaptive management should take into account the lag between

- trends, particularly in complex systems.*
- *Management systems tend to operate at relatively short time scales, often much shorter than the timescales for change in ecosystem processes.*
- *Where there is a lag between management actions and their outcomes, it is difficult to take reasoned management decisions.*
- *Long-term ecological processes, which can be very important, are therefore likely to be poorly accommodated in management systems, unless these are explicitly and carefully designed to address long-term issues.*

Awareness of long-term processes is important because it is the long-term, spatially, extensive processes that both characterize and determine the broad ecosystem properties.

Principle 9: Management must recognize that change is inevitable.

Rationale:

Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.

Annotations to the rationale:

Change in ecosystems is both natural and inevitable, and therefore management objectives should not be construed as fixed outcomes but rather the maintenance of natural ecological processes. In this regard it should be noted that:

- *Ecosystems change constantly as a result of natural processes. Those changes include shifts in species composition, population abundance, and physical characteristics.*
- *Such changes are not necessarily constant, variable, dynamic and usually difficult to predict at any point in time.*
- *It is therefore difficult to select an appropriate outcome or future state of an ecosystem as a static management goal. Instead, in addressing this and Principle 8, management should focus on maintaining the natural processes, which drive those changes.*
- *This focus on processes requires a management approach that is flexible and adaptive, both as a response to changing circumstances and to take account of new knowledge and understanding. Adaptive management should generate new knowledge and reduce*

management actions and their outcomes.

- 8.4 Monitoring systems should be designed to accommodate the time scale for change in the ecosystem variables selected for monitoring. Alternatively, if the monitoring cannot be adjusted, a more appropriately scaled but still relevant variable should be selected to monitor.
- 8.5 The capacity to monitor and detect long-term, low frequency changes in ecosystem structure and functioning should be strengthened.
- 8.6 To implement long-term management requires stability of institutions, legal and policy frameworks, monitoring programs, and extension and awareness-raising programs.

Implementation guidelines

- 9.1 Adaptive management is needed to respond to changing social and ecological conditions, and to allow management plans and actions to evolve in light of experience.
- 9.2 Natural resource managers must recognise that natural and human-induced change is inevitable and take this into account in their management plans.
- 9.3 Adaptive management should be encouraged when there is a risk degradation or loss of habitats, as it can facilitate taking early actions in response to change.
- 9.4 Monitoring systems, both socio-economic and ecological, are an integral part of adaptive management, and should not be developed in isolation from the goals and objectives of management activities.
- 9.5 Adaptive management must identify and take account of risks and uncertainties.
- 9.6 Where changes occur across national borders, the scale of adaptive management may need to be adjusted.
- 9.7 While ecosystems are inherently dynamic and resilient, special adaptation and mitigation measures are needed when ecosystems may be pushed beyond the limits of natural variation. Capacity-building

uncertainties, thereby allowing the manager to anticipate and cater for change.

- *Ecosystem management must therefore involve a learning process that will help to adapt methods and practices to improve the ways in which these systems are being managed and monitored. Flexibility is also needed in policy-making and implementation. Long-term, inflexible decisions are likely to be ineffective or detrimental.*

efforts are needed to address highly vulnerable areas such as small island states and coastal areas.

- 9.8 Capacity-building efforts are needed to address highly vulnerable areas such as small island states and coastal areas.
- 9.9 Traditional knowledge and practice should be used to enable better detection and understanding of ecosystem change, and to develop appropriate adaptation measures.
- 9.10 Adaptive management should recognize the resilient capacity of ecosystems in response to natural disturbances, and should be aimed at maintaining or restoring this capacity so as to reduce the risk of adverse social and economic consequences of natural variability in ecosystems.
- 9.11 Awareness-raising measures are needed to enhance public knowledge that ecosystem change is a natural phenomenon, and to build support and capacity for adaptive management.

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Rationale:

Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems

Annotations to the rationale:

Biological resources play a role in providing the ecosystem goods and services on which humans ultimately depend. In this regard it should be noted that:

- *The ecosystem approach is designed to support the conservation of biodiversity, the sustainable use of its components, and the equitable sharing of benefits derived from the use of biodiversity.*
- *Sustainable use and management depends on also achieving conservation objectives.*
- *Management for conservation and sustainable use are not inherently incompatible, and can be integrated.*
- *Integration can be achieved at various scales and in various ways including both spatial and temporal separation across the landscape as well as through integration within a site.*

Implementation guidelines

- 10.1 Develop integrated natural resource management systems and practices to ensure the appropriate balance between, and integration of, the conservation and use of biological diversity, taking into account long- and short-term, direct and indirect, benefits of protection and sustainable use as well as management scale.
- 10.2 Develop policy, legal, institutional and economic measures that enable the appropriate balance and integration of conservation and use of ecosystems components to be determined.
- 10.3 Promote participatory integrated planning, ensuring that the full range of possible values and use options are considered and evaluated.
- 10.4 Seek innovative mechanisms and develop suitable instruments for achieving balance appropriate to the particular problem and local circumstances.
- 10.5 Manage areas and landscapes in a way that optimises delivery of ecosystem goods and services to meet human requirements, conservation management and environmental quality.
- 10.6 Determine and define sustainable use objectives that can be used to guide policy, management, and planning, with broad stakeholder

participation.

Identify solutions which relieve sectoral pressure on existing resources

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Rationale:

Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, *inter alia*, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Annotations to the rationale:

Ecosystems can be viewed at various scales and from different perspectives, each yielding unique information and insights. Good management should therefore consider all relevant information. In this regard it should be noted that:

- *The ecosystem approach is designed to accommodate a range of values and associated goals, and the information and perspectives of the communities that hold those values are therefore important in designing and implementing management.*
- *There is no single level of organisation at which one can understand and optimize management of ecosystem functioning. Different information sources will address issues at different levels, providing complementary perspectives to support integrated management.*

Implementation guidelines

- 11.1 Relevant information should be shared with other stakeholders and actors and technical and scientific information be made available in an accessible way (indigenous and local knowledge should be treated with full respect of Article 8(j) and further decisions of the CBD).
- 11.2 Assumptions behind proposed management decisions should be made explicit based on the best available expertise, explicitly regard scenarios of future change and include the knowledge and views of stakeholders.
- 11.3 Appropriate mechanisms should be developed to document and make more widely available the information from all relevant disciplines (including natural and social sciences) and from relevant knowledge systems, particularly those based on local and traditional practices. This guideline should be implemented consistent with any decision to be taken under Article 8(j) of the CBD.
- 11.4 The implications for ecosystem management of different "world views" based on different knowledge systems should be evaluated.
- 11.5 Good management depends upon improving the information base and scientific understanding of ecosystems through the promotion, implementation and application of research and integrating this information into decision-making.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Rationale:

Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

Annotations to the rationale:

The complexity of ecosystem management for sustained use and conservation requires integrating the activities and actions of many different stakeholders. In this regard it should be noted that:

- *The activities of all sectors affect biological diversity, and can contribute to, or detract from, the achievement of the objectives of*

Implementation guidelines

- 12.1 The integrated management of land, water and living resources requires increased communication and cooperation, (i) between sectors, (ii) at various levels of government (national, provincial, local), and (iii) among governments, civil society and private sector stakeholders. Increased communication among international and regional organisations also.

the Convention.

- *The management of biodiversity, because of its complexity, and the significance of human impacts, requires a wide range of scientific and management skills, including those located in sectors that have not traditionally been involved in biodiversity conservation or management.*

For these reasons the ecosystem approach should provide a framework for fostering greater involvement of all relevant stakeholders and technical expertise in planning and carrying out coordinated activities, sharing management resources, or simply exchanging information.

- 12.2 Further incorporation of the ecosystem approach as an integral part of planning in, among others, the agriculture, fisheries, forestry and other natural resources management sectors potentially affecting biodiversity and ecosystem functioning, should be encouraged, following the example, for instance, of the Code of Conduct for Responsible Fisheries, Sustainable Forest Management or others. Sectors other than the primary production sectors may also have major effects but are often less recognized in this respect.. These include sectors such as the judicial sector, which affects governance, as well as those such as energy and transport, which are managing or affecting resources either directly or indirectly.
- 12.3 Procedures and mechanisms should be established to ensure effective participation of all relevant stakeholders and actors during the consultation processes, decision making on management goals and actions, and, where appropriate, in implementing the ecosystem approach.
- 12.4 The effective implementation of the ecosystem approach may require involving multidisciplinary professional and scientific expertise, including such disciplines as economic, social and natural sciences.
- 12.5 When assessing the costs and benefits of conserving, maintaining, using and restoring ecosystems, the interests of all relevant sectors should be taken into account for equitable sharing of the benefits according to national law.

ANNEX IV

Different management tools according to ICES (2005)

(1) **Input controls.** Management measures that influence the amount of a human activity that is permitted. These include controls on emission levels of contaminants, on fishing capacity and activity, on numbers of tourists, and on vessel sizes or numbers in shipping.

(2) **Output controls.** Management measures that influence the degree of perturbation of an ecosystem component that is permitted. Controls include nutrient input limits for land-based activities, limits of concentration of contaminants in water, sediment, and biota, allowable catches and by-catch limits in fisheries, tonnage allowances in sediment extraction, regulation of coastal development, tourism, and ballast water exchanges rules for shipping.

(3) **Spatial and temporal distribution controls.** Management measures which influence where and when an activity is allowed to occur. These include regulations for the localization of industrial installations, closed areas for fisheries, defined shipping lanes for transportation, and zoning and marine protected areas for regulation of multiple uses.

(4) **Integrated planning tools.** These are not management *measures*, but are tools to ensure that management is coordinated. Coordination can be achieved by using integrated planning mechanisms that ensure that management actions complement each other both across multiple human activities and diverse ecosystem effects. Integrated planning tools include strategic environmental assessment, integrated coastal zone management, and systems of spatial planning. It is important that these Integrated Tools take full account of land-based activities that affect marine ecosystems.

(5) **Remediation tools.** Management tools which guide human activities to restore damaged components of marine ecosystems. These include clean-up operations on polluted sites, recovery plans for species at risk and for depleted fish stocks, and shoreline restoration programmes for damaged habitats.

(6) **Economic incentives.** Management measures which make it in the economic interest of those using the marine ecosystem to act in ways which help to achieve the ecological objectives for the ecosystem, rather than pursue selfish goals. Eco-certification schemes and economic sector-based instruments such as the FAO Code of Conduct have both contributed to placing fisheries in a broader ecosystem context. Such tools have the potential to integrate the planning and management of other human activities as well.

ANNEX V
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