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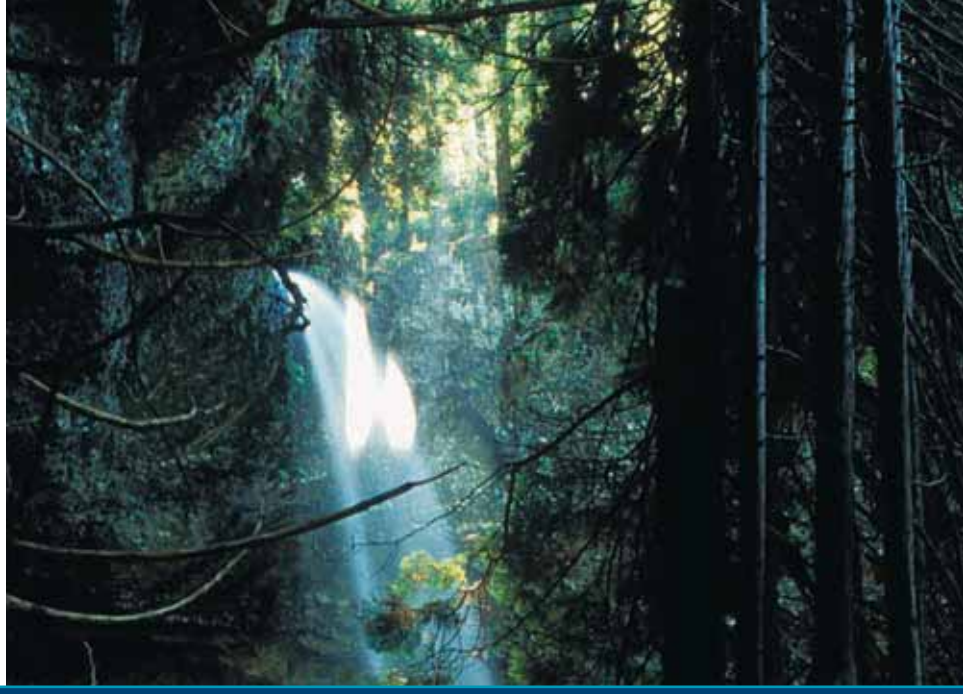


ECOSYSTEM MANAGEMENT PROGRAMME

A new approach to SUSTAINABILITY

Contents

SOURCE OF LIFE

Human well-being ultimately depends on the health of the ecosystems which envelope and sustain us. We exploit ecosystems for the food, water, and timber we need for everyday living. We depend on ecosystem processes to regulate natural cycles and keep diseases at bay. We rely on them for recreation, instruction and mental and spiritual enrichment.

We know that without healthy ecosystems we could not survive, and yet we are transforming and degrading them at an ever-increasing rate.

Our demands on nature are growing as our populations expand and our societies develop. We continually and carelessly modify the Earth's natural cycles through over-exploitation of freshwater, exhaustion of soils, depletion of forests and wildlife, and excessive use of pesticides and fertilizers. We pollute our air, water and soil. We propel greenhouse gases into our upper atmosphere, changing our climate and putting even more pressure on our ecosystems. We drive animals and plants out of their natural habitats and push them toward extinction.

How can we halt and reverse this degradation of the Earth's ecosystems even as we make increasing demands on their services?

To answer this challenge, and to better understand the consequences of our actions, in 2001 United Nations Secretary General Kofi Annan launched a comprehensive scientific study, the Millennium Ecosystem Assessment , focusing on ecosystem changes over the course of past decades and projecting those changes into the future.

> *An **ecosystem** is a dynamic complex of plant, animal, and microorganism communities and their nonliving environment interacting as a functional unit. Humans are an integral part of ecosystems. Ecosystems vary enormously in size; a temporary pond in a tree hollow and an ocean basin can both be ecosystems.*

Ecosystem services at risk

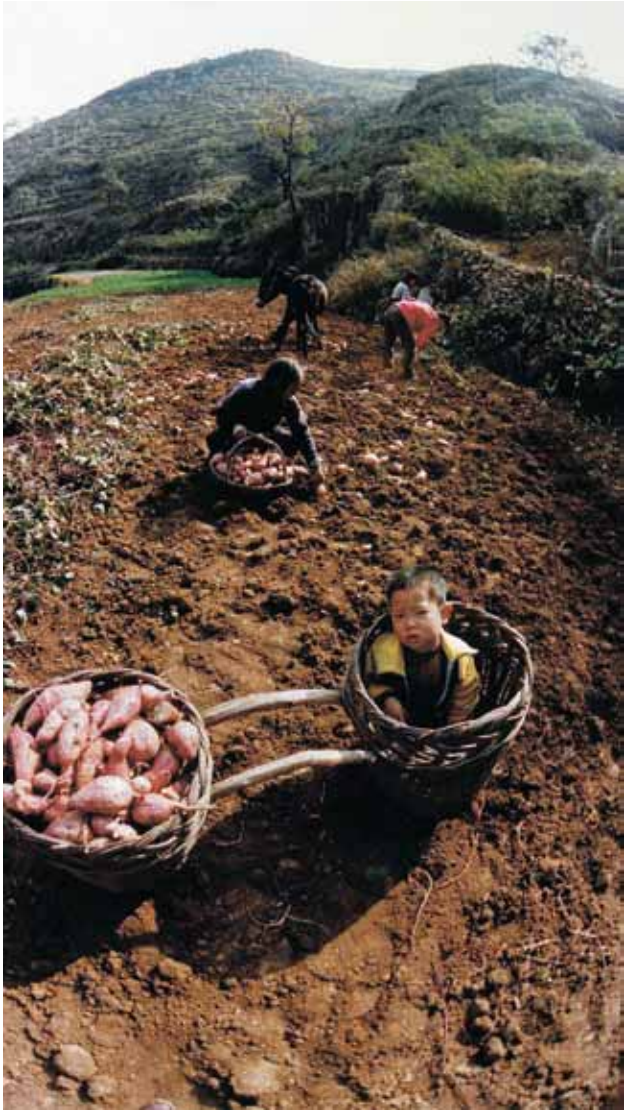
Ecosystem services are the benefits that people obtain from ecosystems. The Millennium Ecosystem Assessment analysed 24 ecosystem services, and found that 15 were being degraded or used unsustainably. The decline in services affects the world's disadvantaged people most strongly, impedes sustainable development globally and, in developing countries, represents a considerable barrier to achieving the UN's Millennium Development Goals of reducing poverty and hunger. The Millennium Ecosystem Assessment grouped ecosystem services into four categories:

- **provisioning services** such as the supply of food and water;
- **regulating services**, which help to stabilize ecosystem processes such as climate and water storage and purification;
- **supporting services**, including soil formation and nutrient cycling; and
- **cultural services**, such as recreational, spiritual, religious and other non material benefits.

Many of these services have been degraded over the past 50 years. These include services as varied as water supply, waste treatment, fisheries, natural hazard protection, regulation of air quality, regulation of regional and local climate, prevention of erosion, spiritual fulfilment, and aesthetic enjoyment.

Fisheries are in a particularly critical state. They are being exploited well beyond sustainable levels while demand continues to grow. At least one quarter of important commercial fish stocks are overharvested.

Freshwater supply presents an even greater challenge. From 5% to possibly 25% of global freshwater use exceeds long-term accessible supplies and demand is now met either through engineered water transfers or overdraft of groundwater supplies. Some 15-35% of irrigation withdrawals exceed supply rates.



Over one billion people have to live on an income of less than $1 per day. Most of them are crucially dependent on ecosystem services, supporting themselves mainly through agriculture, grazing, hunting and fishing. So it is not surprising that the regions facing the greatest developmental challenges tend to be those having the most trouble maintaining their ecosystems and the services they provide.

The ecosystem approach

So far, most attempts to reverse the decline in ecosystem services have targeted particular sectors – for example, water, agriculture and forests – rather than looking at these collectively. The general failure of this sectoral approach meant that a radical shift in thinking about environmental management was needed. A more holistic view of the links between ecosystem service delivery and human needs – an *ecosystem approach* – may be our last and best hope for living sustainably on our threatened planet.

According to the Convention on Biological Diversity, *the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way….* It recognizes that humans, are an integral component of many ecosystems.

The Convention specifies that the ecosystem approach *requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning, and that measures may need to be taken even when some cause-and-effect relationships are not yet fully established scientifically.*

This major international treaty also points out that *there is no single way to implement the ecosystem approach, as it depends on local, provincial, national, regional or global conditions. Indeed, there are many ways in which ecosystem approaches may be used as the framework for delivering the objectives of the Convention in practice.*

The Millennium Development Goals further reinforce the notion that ecosystem health and sustainability are central to the well being of humankind, and must be pursued if such issues as poverty and hunger are to be solved.

> *The* **ecosystem approach** *is a strategy for the integrated management of land, water and living resources that provides sustainable delivery of ecosystem services in an equitable way.*

THE ECOSYSTEM MANAGEMENT PROGRAMME

The UNEP Ecosystem Management Programme will work to change the piecemeal (i.e., sector by sector) approach to environmental management and move to an approach that integrates forests, land, freshwater, and coastal systems where they impact upon the overall deliver of ecosystem services. UNEP will work towards assisting countries and regions to:

- integrate an ecosystem approach into development and planning processes;
- acquire and improve the capacity to use ecosystem management tools; and
- realign their environmental programmes and financing to tackle the degradation of priority ecosystem services.

Of the 15 ecosystem services in decline listed by the Millennium Ecosystem Assessment, UNEP identified 11 as priorities, based on the seriousness of the degradation, impacts on human well-being and implications for sustainable development. These services were also considered most relevant to UNEP's mandate, strengths, expertise and current activities, and were not being addressed by other agencies.

Within these 11, six top the list:

- climate regulation
- water regulation
- natural hazard regulation
- energy
- freshwater
- nutrient cycling

The other five, currently of secondary priority, are water purification and waste treatment; disease regulation; fisheries; primary production (production of organic substances by green plants); and recreation and ecotourism.

Regulating services

Regulating services are defined as the benefits obtained from the regulation of ecosystem processes. They include the following:

Climate regulation. Ecosystems influence climate both locally and globally. At the local scale, changes in land cover can affect both temperature and precipitation. At the global scale, ecosystems play an important role in climate either by sequestering carbon (e.g., in forests, grasslands and marine ecosystems) or by emitting greenhouse gases (e.g., forests destruction by fire and melting permafrost). Forests, and the services they provide, are particularly vulnerable to overexploitation and habitat degradation.

Natural hazard regulation. Healthy ecosystems provide protection from extreme events such as hurricanes, tsunamis, high tides, floods, droughts, etc. For example, mangroves and coral reefs help protect coastal areas from storm surges; vegetation cover on a hillside can help prevent erosion and mudslides.

Natural disaster and post-conflict response is another key area for results in the UNEP medium-term strategy, and has strong linkages to ecosystem management.

Water regulation. Water scarcity is increasingly affecting human well-being and making us aware of the importance of healthy terrestrial ecosystems as the major source of accessible, renewable freshwater (in itself a top priority service). Ecosystems supply, store and retain water in watersheds and natural reservoirs; they regulate the flow of water required for irrigation and industry, and provide protection against storms, erosion and floods.

Water purification and waste treatment. Water purification and waste treatment are facilitated by healthy ecosystems, providing clean drinking water and water suitable for industry, recreation and wildlife. Natural wetlands can process and filter pollutants such as metals, viruses, oils, excess nutrients, and

sediment. Forests retain water and slowly filter it through the ground.

Disease regulation. Healthy soils and wetlands can trap and detoxify pathogens and regulate disease-carrying organisms. By breaking down human and ecosystem waste, many organisms reduce the threat of diseases such as cholera. Predatory organisms keep a population of pathogens and its carriers relatively low. Therefore, reducing predator populations, as a result of habitat fragmentation or competition from invasive species, can increase human and other diseases. Recent research has demonstrated that the risk of Lyme disease decreases when the diversity of vertebrate communities is high.

Provisioning services

Provisioning services are the products obtained from ecosystems. These include food, freshwater, wood, fibre, genetic resources and medicines. Of particular interest to UNEP are:

Freshwater. The well-being of both ecosystems and humans is strongly dependent on this vital ecosystem service, which provides people with water for domestic use, irrigation, power generation, and transportation. The natural availability of freshwater in rivers, lakes and other aquifers varies considerably, however, and demand has exploded over the last century. This has led to the construction of dams, irrigation channels, river embankments and inter-basin canals, often at the cost of ecosystem degradation.

Energy. This ecosystem service was mentioned as 'biomass energy' in the Millennium Ecosystem Assessment. The increased production of biofuels to replace such fossil fuels as wood and charcoal – of particular importance to poor people – has provoked keen debate about the potential impacts of this production on ecosystem and human well being. Hydropower as a low carbon energy source is dependent on freshwater related ecosystem services (provided, for example, by dams) and can also have major impacts on upstream and downstream ecosystems.

Fisheries. Marine and freshwater fisheries are in decline, in spite of increasing demand. Fish protein is of particular importance to poor people. Overfishing is the main problem, but keeping aquatic ecosystems healthy can help sustain populations in the face of growing demand.

Supporting services

Supporting services are necessary for the production of all other ecosystem services. Not surprisingly, these relate to fundamental environmental processes and intangible values. Their impacts are either indirect or occur over a very long time.

Examples of supporting services include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.

UNEP will focus on two in particular:

Nutrient cycling. Approximately 20 nutrients essential for life, such as nitrogen, phosphorus and calcium, are absorbed, retained and recycled by ecosystems. Phytoplankton – microscopic plants – in lakes, rivers and the sea absorb nutrients from runoff and pass them up the food chain. Soil organisms – from microbes and fungi to earthworms and insects – are crucial to the chemical conversion and physical transfer of essential nutrients to higher plants. In simplified low-diversity agricultural

landscapes, this capacity is much reduced. Many parts of the world suffer from inadequate nutrients in their soils and food, while others must deal with excessive nutrients leading to overload and eutrophication (depletion of oxygen in the water).

Primary production. The life-sustaining production of organic compounds, mainly through photosynthesis by green plants and algae, is known as primary production. All life on Earth relies directly or indirectly on primary production, yet we know very little about its natural limits or its risk of collapse under increasing pressure from climate change and other environmental factors.

Cultural services

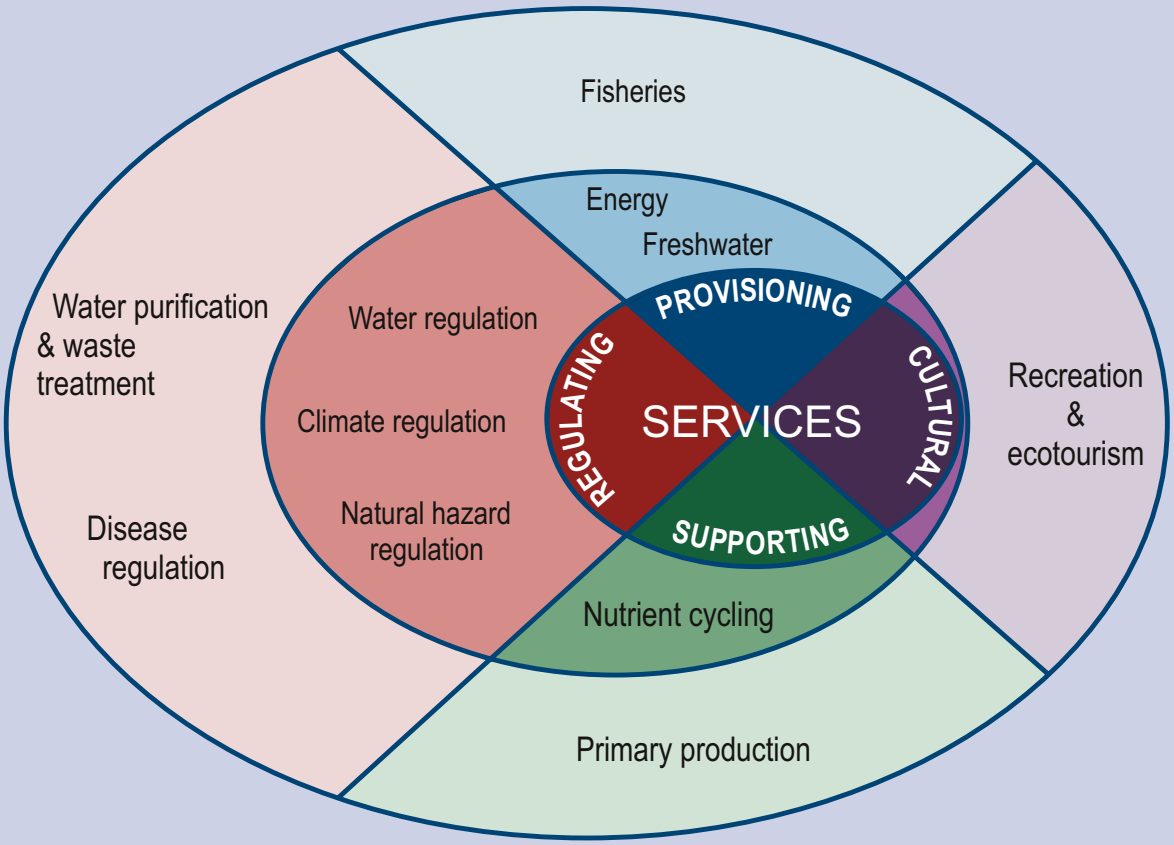
'Cultural services' is the umbrella term used for the non-material benefits that people obtain from ecosystems, such as spiritual enrichment, intellectual development, reflection, religious experience, and recreation. It comprises knowledge systems, social relations, aesthetic values and appreciation of nature.

Of these varied services, ecotourism is of particular interest to UNEP.

Recreation and ecotourism. Healthy ecosystems which offer opportunities for outdoor recreation and nature-based tourism are becoming an increasingly important economic resource.

Far beyond providing an aesthetic experience only for the privileged, ecotourism has great potential – and proven success in many parts of the world – for alleviating poverty and improving human well-being.

Ecosystem service categories: UNEP priorities



Of the ecosystem services categorized in the Millennium Ecosystem Assessment, UNEP identified 11 as being of critical importance and lying within its mandate. The lopsided diagram illustrates UNEP's role being most significant in the regulating services and with the six priority services closest to the centre and five secondary services at the periphery.

A new concept

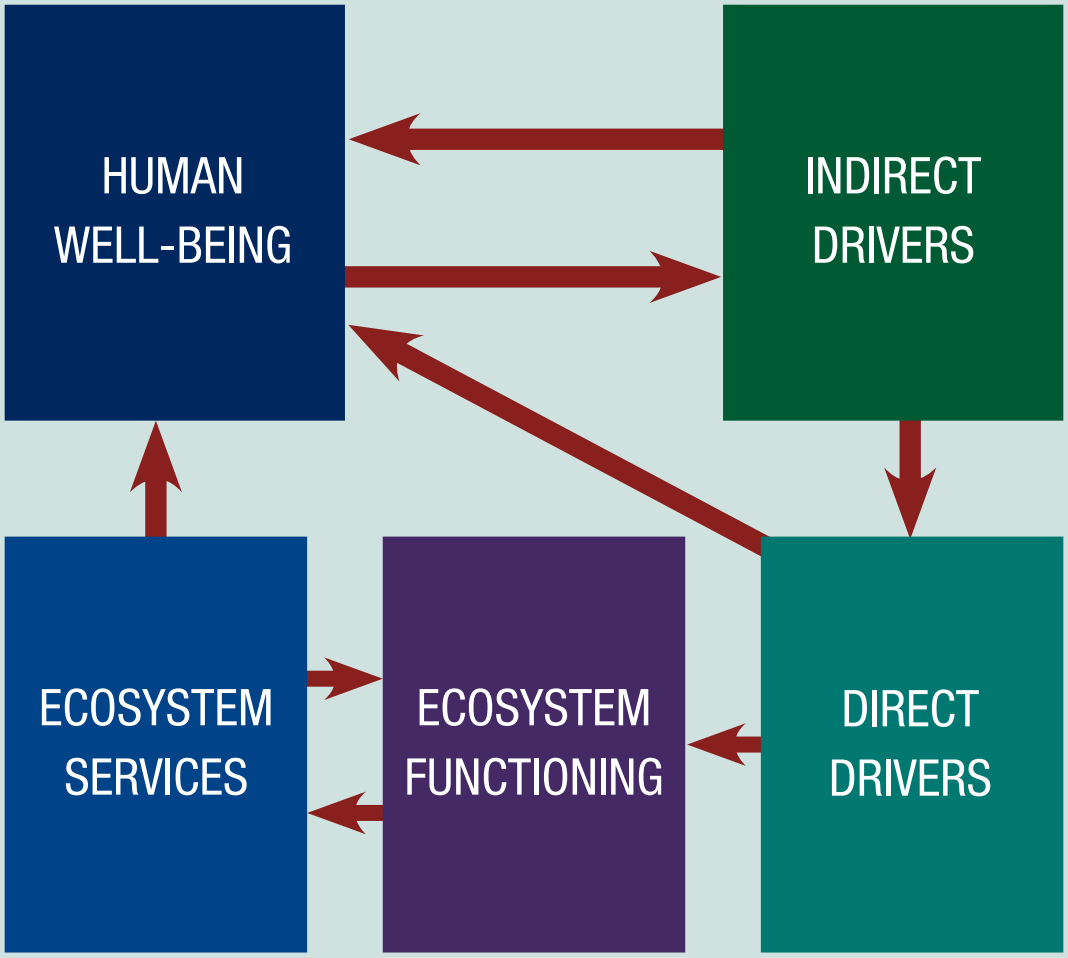
The traditional approaches to environmental management according to sectors (e.g., forestry, agriculture) or biomes (geographically and climatically linked natural communities) have a number of shortcomings. For example, they consider ecosystem concerns as separate from development concerns, they ignore the interdependence of ecosystem services and human needs, and they do not acknowledge the diverse effects on various social groups of declining ecosystem services

By taking a more holistic view of the links between ecosystem services and human well-being, the Ecosystem Management Programme can correct these deficiencies and focus on maintaining the functioning and the resilience of ecosystems and ensuring equitable access to their services. This approach also invites all the relevant stakeholders to take part in collaborative decision making, priority setting and conflict resolution.

The Ecosystem Management Programme is guided by a concept of five interlinked elements, each of which offers an entry point for UNEP intervention:

- human well-being,
- indirect drivers of change,
- direct drivers of change,
- ecosystem functioning and
- ecosystem services.

Conceptual framework of the Ecosystem Management Programme



Schematic representation of the conceptual framework of the Ecosystem Management Programme. Technological progress – e.g., out-of-soil production of biofuels (algal culture in containers) – may directly contribute to human well-being (the diagonal arrow) and indirectly through improved ecosystem service delivery (less pressure). Other short-term improvements can come in the form of policies directly affecting direct drivers such as habitat change, invasive species and pollution.

Drivers of change

Natural or human-induced factors that change ecosystems are called drivers. Designing interventions to maintain proper ecosystem functioning to sustain ecosystem services requires an understanding of the factors that cause the changes in ecosystem functioning – i.e., indirect and direct drivers.

Indirect drivers affect ecosystems by influencing the direct drivers. Habitat change and overexploitation, for instance, are direct drivers. These influence ecosystem processes explicitly.

Examples of important **indirect drivers** are changes in human population, economic activity, and technology, as well as socio-political and cultural factors. For example, world population has doubled in the past forty years, with most of the growth taking place in developing countries. This indirect pressure has influenced direct drivers of habitat destruction and overexploitation of resources. Another example may be agricultural subsidies – this indirect driver may also cause overexploitation.

Pressures on ecosystems have grown in absolute terms, but the growth has been slower than GDP growth. This is due to changing economic structures, increased efficiency, and use of substitutes for ecosystem services.

Important **direct drivers** include habitat change, climate change, invasive species, overexploitation, and pollution. Habitat change occurs, for instance, when the area of land used for agriculture or cities is expanded. The world's climate has already changed and continues to change, affecting temperature, rainfall, and sea level. Commercially exploited fish stocks are probably at a historical low. Intensive use of fertilizers has polluted ecosystems with excessive nutrients. Most direct drivers of degradation are currently staying constant or growing in intensity.

Understanding drivers

Understanding the drivers at work in a particular ecosystem is essential for planning successful interventions. The Ecosystem Management Programme will accomplish this in three steps:

(1) assess what drivers are at work in the ecosystem;

(2) determine the relative value and importance of the services they provide for the economy and for sustainable development; and

(3) decide on the best way to influence the drivers to minimize ecosystem impacts and maximize the delivery of services.

An example of a direct driver would be: increased use of fertilizer overloads the groundwater and surface water with nutrients, which influences ecosystem processes by causing eutrophication, algal blooms and hypoxia.

What are drivers?

EXAMPLE

The price increase of fossil fuels (an economic process) boosts the demand for biofuels, which causes changes in land-use cover through deforestation, increases greenhouse gas emissions through the drainage of peat marshes, expands use of agrochemicals and raises the likelihood of establishment of invasive species. A long-term intervention could be to reduce the demand for fossil fuel by changing consumer and producer behaviour.

EXAMPLE

An expanding population may increase demand for land (land use change), leading to more consumption of wild foods (resource extraction) and more intensive agriculture (external inputs like fertilizers), require more transport to and within sprawling cities (emissions), and result in experiments with fast growing alien organisms in an attempt to increase productivity for people and for goods (modification and movement of organisms), etc.

FROM STRATEGY TO ACTION

Using an ecosystem approach, natural resource managers can identify and analyse the drivers operating on an ecosystem and designed appropriate action. Once this analysis is complete, implementation may begin. Using this framework and with assistance from UNEP, authorities at local, national and regional levels will be able to launch assessments of their ecosystems.

Successful implementation should involve four steps:

- Making the case
- Generating knowledge
- Turning knowledge to action
- Monitoring, evaluation and feedback

This conceptual approach to ecosystem management will be new to many governments and stakeholders. It will require explanation of the underlying rationale and the concepts of ecosystem services, the ecosystem approach and drivers of change. It will require new technical and institutional approaches to environmental management at all levels.

Moreover, It will require new understanding, new knowledge and ways to organize it, and new methods of applying the Ecosystem Management Programme concept to management action on-the-ground.

The proposed steps listed below are neither prescriptive nor exhaustive, and are subject to change as further input and initial results feed back into the process.

Step 1: Making the case

Understanding and accepting an ecosystem approach

Not all countries and stakeholders are familiar with the Millennium Ecosystem Assessment and its findings. Many (if not most) countries still measure development and wealth purely in economic terms and do not consider the value that ecosystems provide towards overall human well-being. Furthermore, the government institutions of most countries are organized sectorally (e.g., for forestry, agriculture, water) and address environmental problems independently when an integrated approach would be more effective.

A new organizational mindset, coupled with institutional changes, may be required for countries to fully understand, adopt and implement the new approach being advocated by the Ecosystem Management Programme. Information must flow in all directions: when UNEP explains its approach and offers assistance in its implementation, it will need to receive information from governments and other stakeholder on their needs, approaches and development goals.

The objective will be to engage countries and other stakeholders (those directly interested) in a dialogue on ecosystems and development.

It will involve:

- conducting regional and national awareness-raising workshops on the concept of "place-based" ecosystem management and on ecosystem services, their interlinkages, and their relationship to human well-being;
- facilitating rapid assessment of the links between key ecosystem services at the national and regional levels;
- delivery of accessible guides on the ecosystem approach directed at various groups of stakeholders;
- disseminating key messages as widely as possible, particularly regarding the important links between ecosystem services and human well-being, and the drivers of ecosystem degradation.

Step 2: Generating knowledge

Assessing and developing knowledge systems for ecosystems

Environmental management aimed at the maintenance and resilience of ecosystem functioning requires a new approach to knowledge management, one that differs fundamentally from more traditional sector or biome approaches.

The Millennium Ecosystem Assessment used global and ecosystem level assessments to generate a comprehensive picture of ecosystem functioning, ecosystem service delivery and the drivers of ecosystem change. The Ecosystem Management Programme adopts a similar 'place-based' methodology for assessment and management in which assessment areas are defined in ecological terms (e.g., a water basin) rather than political or sectoral ones.

The Ecosystem Management Programme will promote the collection of place-based information to ensure that ecosystem services are considered in national and regional development planning and policies. It will promote knowledge development on the interactions between key ecosystem services and human well-being, identify the relevant drivers for key ecosystem services, help to define the economic value of the services, and offer insight into the costs and benefits of changes in their delivery.

Specifically, UNEP will:

- establish networks for data and information exchange on ecosystem service;
- facilitate or undertake ecosystem level assessments as needed;
- identify relevant ecosystem services and their relation to human well-being;
- identify the direct and indirect drivers of ecosystem change;
- develop plausible scenarios based on the impacts of direct and indirect drivers over time; and
- build capacity to undertake economic valuation of ecosystem services.

UNEP throught the Ecosystem Management Programme will promote the engagement of all stakeholders to determine which services are most important to them.

At times the provision of one service will mean the postponement or curtailment of another. This requires a careful analysis of the resulting trade-offs, keeping sustainability at the heart of the decision-making process.

Step 3: Turning knowledge to action

Improving delivery of ecosystem services

This third step builds on the first two, and is designed to change the way we manage ecosystems to maximize the delivery of services. It aims at improving ecosystem functioning and resilience by addressing the drivers of change and ensuring equitable access to ecosystem services.

This step involves using place-based data and knowledge to:

- determine which services have priority,
- develop effective intervention strategies, and
- ensure equitable access and use of ecosystem services by all stakeholders.

The Ecosystem Management Programme will focus on building local capacity in ecosystem management. The goal will be to increase the ability of authorities, managers and stakeholders at local, national and transboundary level to assess and analyse ecosystems and make decisions relating to the optimal delivery of ecosystem services. Specifically, UNEP will build capacity for:

- developing appropriate actions and interventions for mitigating the negative impacts of ecological change on ecosystem services; and
- ensuring equitable access to, and use of, ecosystem services based on a system of rights, entitlements and ownership.

Step 4: Monitoring and evaluation

Refining intervention strategies

As with any environmental programme, once management measures are put in place they must be monitored and evaluated and, if needed, improved.

The delivery of ecosystem services is a complex process involving many factors. As a result, the Ecosystem Management Programme is adopting a new approach to monitoring and evaluation of its management interventions: it will use overall delivery of ecosystem services as a measuring stick rather than impacts on specific drivers. If a decline in delivery of services is detected or lack of recovery in ecosystem services from restored ecosystems, new intervention strategies will be put in place. Thus, to ensure the optimal delivery of ecosystem services, UNEP will:

- offer technical support for the development and review of indicators of ecosystem service delivery;
- facilitate review of the delivery of ecosystem services against established baselines; and
- facilitate and build capacity to develop and implement feedback mechanisms into steps 1-3 above.

Looking ahead

UNEP will pursue this work at the global, regional, national and local levels to promote the ecosystem approach for human well-being and sustainable development. For example, maintaining water-regulating services on the global scale may require dialogue, awareness programmes, advocacy, etc., whereas local actions would be directed more towards capacity-building in ecosystem assessment and management.

Global level. Managing natural resources at the level of ecological units ('place-based' management), rather than by sector, will require new technical tools. There are also a significant number of tools already developed by UNEP and its partners that can be collected in a 'toolbox' for ecosystem management. In addition, advocacy of the ecosystems approach will require promoting the approach at international forums, explaining its advantages for development, and the recruitment of additional partners.

Regional level. Ecological units do not have political boundaries, and transboundary cooperation is required for effective management of natural resources and maintenance of ecosystem functioning and services. Building in the first instance on existing transboundary commissions and authorities (e.g., transboundary water resources authorities), UNEP will work with countries at a regional or subregional level to maximize the delivery of ecosystem services. This will require a transboundary assessment of the most relevant ecosystem services.

National and local level. At the national level, UNEP will work with ministries of environment, planning and finance to promote the overall incorporation of the ecosystem approach into national development planning. The UNDP-UNEP Poverty-Environment Initiative will be a useful vehicle for promoting this work.

Linking hands

UNEP is in the process of shifting its programme approach from divisional to thematic work. Ecosystem management is one of its six priority areas, and is closely linked to all the others.

Climate change. Ecosystem management has a crucial role to play in climate change mitigation through improved land use, reduced deforestation and encouraging indirect measures. For example, coping with sea level rise will require improved management of coral reefs, mangroves and coastal areas to increase resilience. Prevention of and coping with extreme flood events will require securing catchment forests and reforestation along drainage lines. As growing seasons lengthen and milder conditions prevail, healthier, more resilient ecosystems will help keep pests and parasites under control.

Environmental governance. Success stories of ecosystem management can help in shaping public response to the cultural, social, political and institutional processes that govern the drivers of change. Effective governance at multiple levels is essential for ecosystem management.

Hazardous substances. The reduction of hazardous substances (e.g., through the UNEP Strategic Approach to International Chemicals Management (SAICM) will improve ecosystem health. Conversely, ecosystem management can strengthen the regulating services that clean air and water.

Natural disasters and post-conflict response. The ecosystem approach can contribute to the effective prevention and mitigation of natural disasters by strengthening natural barriers (e.g., coral reefs, mangroves, and forests) and through restoration and recovery operations in post-crisis areas. Healthy and

productive ecosystems also reduce competition for natural resources, often a causal factor of conflict.

Resource efficiency. Ecosystem management can identify interlinkages, constraints, opportunities and risks of irreversible change linked to drivers and pressures on ecosystem integrity. It can contribute to setting the priorities and analysing potential impacts of interventions under different scenarios. Incorporating environmental costs into economic accounting and removing perverse subsidies can also be expected to improve ecosystem health.

The ecosystem approach is gradually making its way into the development dialogue. UNEP's Ecosystem Management Programme will show how, through partnership, countries can take this promising new approach onboard in their planning and decision-making designed to meet both the Millennium Development Goals and maintain essential services for the healthy future of the planet.

First published in February 2009

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Edited and designed by Nikki Meith

Printing: UNON, Publishing Services Section, Nairobi, ISO 14001:2004 manufacturer

www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel: (254 20)7621234
Fax: (254 20) 7623927
Email: uneppub@unep.org
web: www.unep.org

Division of Environmental Policy Implementation

United Nations Environment Programme (UNEP)

P.O. Box 30552 Nairobi, 00100

Kenya

Tel: [+245] 20 762 3508

Fax: [+245] 20 762 3917

E-mail: depiinfo@unep.org

www.unep.org/depi/