Training Resource Material

Coastal and Marine Biodiversity and Protected Area Management

Module 9

Tools for mainstreaming: Impact assessment and spatial planning

For MPA Managers

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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On behalf of:
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of the Federal Republic of Germany

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Summary

This module provides the conceptual background and introduction of mainstreaming biodiversity. To ensure that biodiversity-related issues and concerns become a part of the larger development planning process in the country, there is a need to incorporate it into policies, strategies and action plan. There is also a need to use science-based tools to understand the impact that projects can have on the environment and ensure that spatial planning incorporates measures for conservation of coastal and marine biodiversity. This module provides the basic concepts and examples of such tools, knowledge of which is useful for marine protected area managers.

Imprint

Training Resource Material:
Coastal and Marine Biodiversity and Protected Area Management
for MPA Managers

Module 1: An Introduction to Coastal and Marine Biodiversity
Module 2: Coastal and marine Ecosystem Services and their Value
Module 3: From Landscape to seascape
Module 4: Assessment and monitoring of coastal and marine biodiversity and relevant issues
Module 5: Sustainable Fisheries Management
Module 6: Marine and Coastal Protected Areas
Module 7: Governance, law and policies for managing coastal and marine ecosystems, biodiversity and protected areas
Module 8: Coasts, climate change, natural disasters and coastal livelihoods
Module 9: Tools for mainstreaming: impact assessment and spatial planning
Module 10: Change Management and connectedness to nature
Module 11: Communicating Coastal and Marine Biodiversity Conservation issues
Module 12: Effective management Planning of coastal and marine protected areas

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Key messages

- Biodiversity policy should not be seen as independent of sectoral policies, but rather sectoral policies should be seen as an instrument to implement national biodiversity goals. ‘Mainstreaming’ means integrating or including actions related to conservation and sustainable use of biodiversity in sectoral strategies.
- To ensure that development is planned and implemented with biodiversity in mind, impact assessment is being used as an important tool.
- The severity of impacts of infrastructure development in the coastal zone varies widely depending on many factors such as the extent, period and type of disturbance, manmade perturbations, capacity of the receiving water to assimilate requirements for assessing such impacts as general baseline information.
- The inclusion of biodiversity in EIA is a two-way process. It not only draws on information on biodiversity but also generates useful biodiversity data. There is no debate on the immediate need for biodiversity conservation, although a debate regarding the best methodology to address biodiversity continues.
- Where strategic environmental assessment (SEA) is applied to plans and programmes, a structured approach to integrating environmental considerations can be used.
- In the next 20 years, our oceans could be very different. We could have achieved a vision of clean, safe, healthy, productive and biologically diverse oceans. Ecosystem-based marine spatial planning of human activities could result in society gaining more benefits from the use of the marine environment than previously, while its natural diversity is better protected.

9.1 What is ‘mainstreaming?

Traditionally, the ‘green’ ministries and departments of countries dealt with the subject of biodiversity, and the most common tool was to designate specific areas as protected areas, inside which the habitats are managed for maximizing conservation. However, current knowledge on the main drivers of biodiversity loss leads to the conclusion that most often the drivers of biodiversity loss are situated in the sectors outside the ‘green sector.’

For example, the main threats to the population of Olive Ridley turtles in India seem to be from uncontrolled and unsustainable coastal tourism, industrial development in coastal zones such as the construction of ports, and pollution. A conservation strategy for this species may not bear fruits unless and until the impact of the tourism and industrial development is managed, which has to be carried out by the tourism and industries sector. Therefore, mainstreaming biodiversity concerns into the tourism and industrial sector will be one of the important factors for a successful conservation plan for the Olive Ridley turtle.

According to the Convention on Biological Diversity (CBD), '**mainstreaming' means integrating or including actions related to conservation and sustainable use of biodiversity in sectoral strategies relating to production sectors (such as agriculture, fisheries, forestry and mining), in national plans and programmes (such as poverty reduction plans and national sustainable development plans)**.

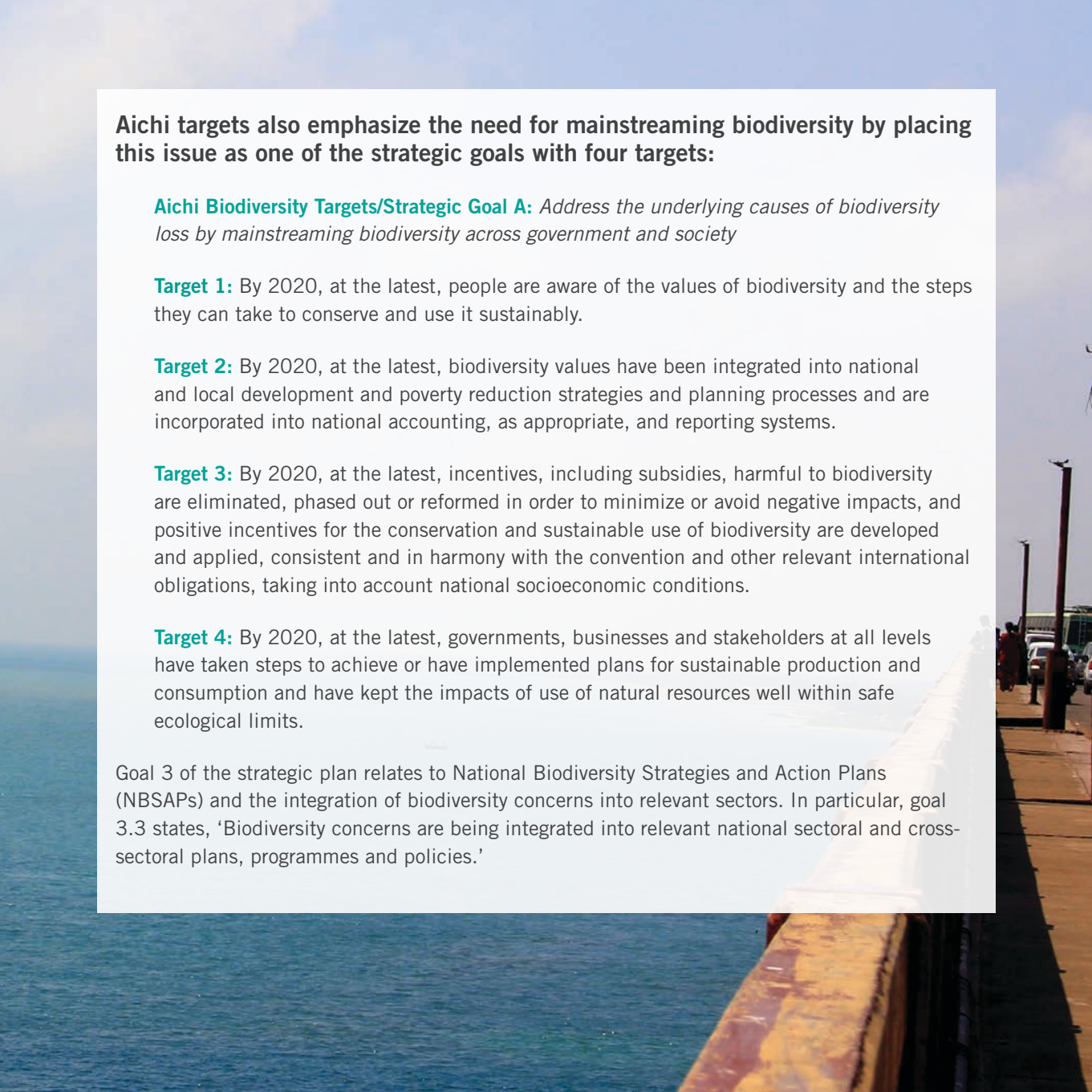
At the core of the concept of 'mainstreaming' lies the fact that like any relationship, the interlinkage between biodiversity and other sectors and processes is also a two-way process, where biodiversity affects the activities of the other sectors and/or is affected by the activities of a particular sector. Whether the relationship will be positive or negative depends on the degree to which the activities are carried out, keeping biodiversity in mind.

Article 6(b) of the CBD says, 'Each Contracting Party shall, in accordance with its particular conditions and capabilities integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.' Ideally, biodiversity policy should not be seen as independent of sectoral policies, but rather sectoral policies should be seen as an instrument to implement national biodiversity goals.

“Many of the main drivers of biodiversity loss such as climate change, loss and degradation of habitat, overexploitation of fisheries and marine resources, invasive alien species, and illegal trade in wildlife are directly related to specific sectors of government such as forestry, fisheries, transport, energy, etc. Therefore, identifying and measuring the impact of these drivers at the national, regional, and global level will assist with mainstreaming biodiversity into all sectors.”

If biodiversity concerns are integrated in the overall development planning, sectoral strategies and legal frameworks, there will be a two-fold impact:

1. Negative impacts of the activities/ strategies/policies of the other sectors can be minimized, leading to conservation of biodiversity, for example urban development and agriculture.
2. Conservation of biodiversity may significantly increase sustainability of certain sectors, viz, poverty alleviation, climate change adaptation.



Aichi targets also emphasize the need for mainstreaming biodiversity by placing this issue as one of the strategic goals with four targets:

Aichi Biodiversity Targets/Strategic Goal A: *Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society*

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are incorporated into national accounting, as appropriate, and reporting systems.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the convention and other relevant international obligations, taking into account national socioeconomic conditions.

Target 4: By 2020, at the latest, governments, businesses and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Goal 3 of the strategic plan relates to National Biodiversity Strategies and Action Plans (NBSAPs) and the integration of biodiversity concerns into relevant sectors. In particular, goal 3.3 states, 'Biodiversity concerns are being integrated into relevant national sectoral and cross-sectoral plans, programmes and policies.'

The ecosystem approach

[Source: Secretariat of the Convention on Biological Diversity (2004)]

The 'ecosystem approach' of the CBD for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way is also a strategy used for mainstreaming biodiversity.

It is based on the application of appropriate scientific methodologies focussed on levels of biological organization that encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems.

The following 10 principles of an ecosystem approach are complementary and interlinked:

Principle 1: The objectives of management of land, water and living resources are a matter of societal choice involving all relevant sectors of society.

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. Management should take this into account and involve all relevant stakeholders at the local, national, regional and international levels, as appropriate. 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, etc.). This might be promoted through, for example, the formation of interministerial bodies within the government or the creation of networks for sharing information and experience. In this view, the ecosystem approach should be fully taken into account in developing and reviewing NBSAPs, and thus be integrated into agriculture, fisheries, forestry and other production systems that have an effect on biodiversity. Societal choices should be expressed as clearly as possible.

Principle 2: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and sustainable use of biological diversity as well as the fair and equitable sharing of benefits.

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 as either protected or nonprotected. 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.

Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way. 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 CBD, where appropriate, their replacement with local incentives for good management practices.

Principle 3: Ecosystem management must ensure the sustainable provision of ecosystem goods and services. 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, which in turn provide the basis of human environmental security and sustainability. 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 4: In order to maintain the provision of ecosystem goods and services, the conservation of ecosystem structure and functioning is a priority target.

Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic (nonliving) environment, as well as the physical and chemical interactions within the environment. Although these interactions are not always well understood, ecosystem management has to be carried out even in the absence of the full knowledge of functional biodiversity. 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. Conservation and, where appropriate, restoration of the interactions within and between species and with the environment and related processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 5: Ecosystem management should be decentralized to the lowest appropriate level taking into account the linkages with other levels. Decentralized systems may lead to greater efficiency, effectiveness and equity. Ecosystem 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 6: Management decisions should be based on all forms of relevant information, including that from all scientific disciplines as well as indigenous and local knowledge, innovations and practices.

Most problems of biological diversity management are complex, with many interactions, side effects and implications. Therefore, 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 CBD. Assumptions behind proposed management decisions should be made explicit, involve the necessary expertise and checked against available knowledge and views of stakeholders.

Principle 7: Ecosystem management must consider the relevant economic values, impediments and opportunities including

(a) the reduction of those market distortions that adversely affect biological diversity;

(b) the alignment of incentives to promote biodiversity conservation and sustainable use; and

(c) the internalization of costs and benefits to the extent feasible.

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 8: Ecosystem management should be undertaken at spatial and temporal scales appropriate to the objectives taking into consideration effects on adjacent and other ecosystems.

Application of ecosystem approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for ecosystem management will be defined operationally by users, managers, scientists and indigenous and local peoples. Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical

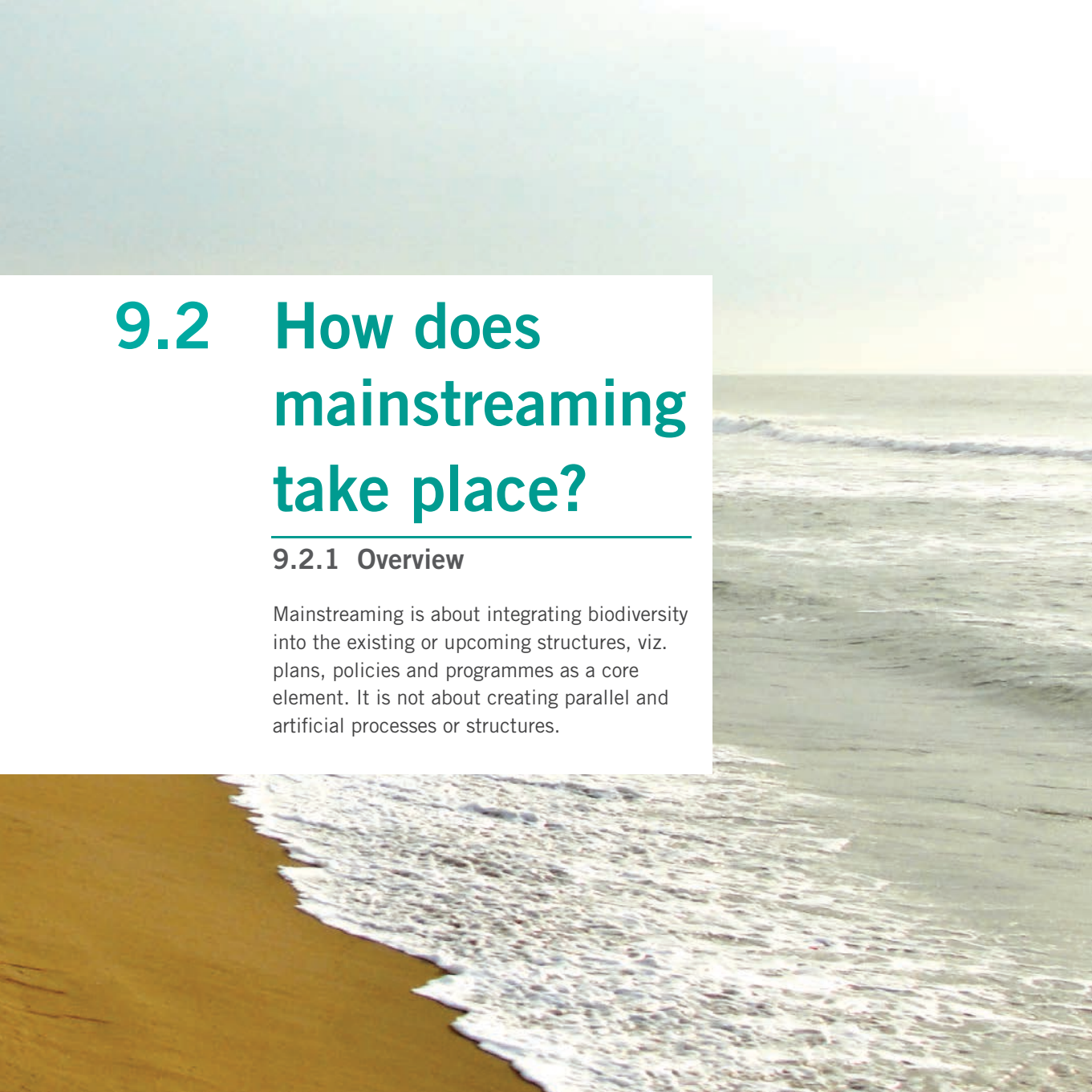
nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 9: Ecosystem management should set objectives for the long term recognizing the varying temporal scales and lag effects that characterize ecosystem processes.

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.

Principle 10: Ecosystem management should adopt adaptive management strategies recognizing the inherent dynamics of change and uncertainties in ecosystems.

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. 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. There is also 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.



9.2 How does mainstreaming take place?

9.2.1 Overview

Mainstreaming is about integrating biodiversity into the existing or upcoming structures, viz. plans, policies and programmes as a core element. It is not about creating parallel and artificial processes or structures.

The enabling conditions for mainstreaming biodiversity include presence of anchoring points where it is possible for the concerned sector to integrate biodiversity. A strong leadership and motivation is another key prerequisite for mainstreaming.

In this context, motivation for mainstreaming biodiversity is an area that has a prerequisite of awareness among public as well as policy-makers on the need for mainstreaming and that drives the sectors to identify these anchoring points. And, therefore, this is the area where media professionals have a key role to play in enhancing the levels of awareness among the public and the policymakers on the need and means of mainstreaming biodiversity.

9.2.2 What may biodiversity mainstreaming look like?

There are several ways for mainstreaming biodiversity into overall development planning:

- National Biodiversity Strategy and Action Plans (NBSAPs)
- Institutional and legal frameworks at national level that support integration of biodiversity into different policies and plans
- Planning system
- Knowledge and information systems on biodiversity
- Political commitment (provided it reflects what society really wants)
- Participation from all stakeholders in developing programmes for biodiversity conservation
- Technical capacity development of the sectors responsible for managing biodiversity and coastal ecosystems
- Integrating coastal and marine biodiversity specifically into the strategies and plans of the key production sectors
- Comprehensive coastal and marine ecosystem monitoring
- Regional cooperation among the maritime states
- Economic and social incentives for conservation of coastal and marine biodiversity

Mainstreaming of biodiversity into sectors (and vice versa) can include strategies to

1. **Reduce the negative and enhance the positive impacts that the sector has on biodiversity.**

In fisheries strategies this may involve actions to reduce bycatch or eliminate effects of fishing practices on sea bottom habitat. In agricultural strategies, it might involve minimizing the use, and optimizing the application, of chemical fertilizers and pesticides so as to reduce negative impacts on groundwater, surrounding habitats and wildlife, and strengthening practices that integrate the natural processes into production systems or enhance agricultural biodiversity such as intercropping and on-farm conservation and management of agricultural crops.

2. **Enhance or restore biodiversity and ecosystem services.**

This may involve establishing no-take zones and/ or effectively managed zones in coastal and marine ecosystems. In fisheries, when such zones are established in areas where fish spawn and feed, the areas provide local relief to the pressure on commonly harvested wild species. It might also involve the replanting and/or reintroduction of native species to areas where they may have been depleted or lost, as well as the creation of in situ conservation areas.

3. **Secure and promote local communities' access to and benefits from the use of biodiversity, and enable their participation in the design and implementation of biodiversity management policies and practices.**

In agriculture and fishery strategies, this could involve reserving certain areas for exclusive use by local communities and indigenous people, the joint management of areas and/or species with such groups, and the clarification of resource access and tenure in areas where the erosion and overlap of customary and formal rights have left tenure unclear and insecure. Provided local communities and indigenous people manage these resources sustainably, such strategies will have important results in terms of poverty reduction and human well-being more broadly.

Mainstreaming instrument in India

National Environment Policy

The National Environment Policy (NEP) by the Ministry of Environment, Forests and Climate Change (MoEFCC) aims at mainstreaming environmental concerns into all developmental activities. It emphasises conservation of resources, and points that the best way to aid conservation is to ensure that people dependent on resources obtain better livelihoods from conservation, than from degradation of the resources. It argues that environmental degradation often leads to poverty and poor health outcomes among populations.

The policy emphasise on the

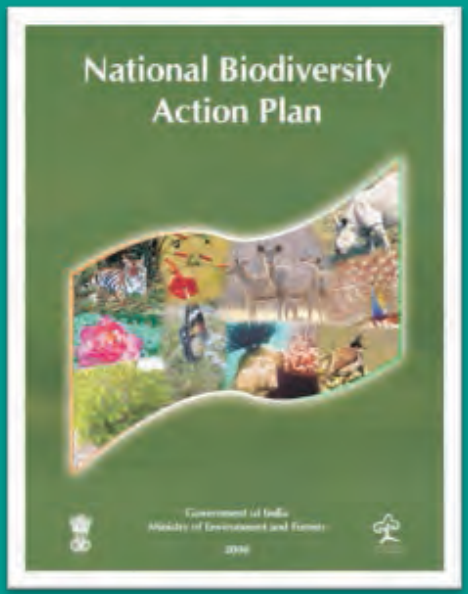
- Important role of human beings in the sustainable development processes
- The non-negotiable and incomparable value of environmental resources
- Right to development for all
- Equity in the use of environmental resources and
- The need for the decentralised and multisectoral approach in dealing with environmental issues.

The objectives of the policy are:

- Conservation of critical environmental resources
- Intra-generational equity- Livelihood security for the poor
- Inter-generational equity

Mainstreaming instrument in India:

The National Biodiversity Action Plan (NBAP) proposes to design actions based on the assessment of current and future needs of conservation and sustainable utilization, and of physical and fiscal instruments, with particular reference to implications and impact of such instruments on short- and long-term basis. Considering the multidisciplinary nature of biodiversity, the actions identified in the NBAP are aimed towards integration of the three objectives of the CBD into relevant sectoral or cross-sectoral plans, programmes and policies. The NBAP takes into account the ecosystem approach, where appropriate, and promotes mainstreaming of gender considerations. The challenge before India is not only to sustain the efforts of the past, but also to further consolidate the endeavour in accordance with a rational need assessment.



Key action points vis-à-vis mainstreaming:

- Develop strong research base on impact assessment and conduct rigorous impact assessment of development projects, with a focus on biodiversity and habitats.
- Integrate biodiversity concerns across development sectors (such as industry, infrastructure, power and mining) and promote use of clean technologies.
- Accord priority to the potential impacts of development projects on biodiversity resources and natural heritage while undertaking EIA. In particular, ancient sacred groves and biodiversity hotspots should be treated as possessing incomparable values.
- Take steps to adopt and institutionalize techniques for environmental assessment of sectoral policies and programmes to address any potential adverse impacts, and enhance potential favourable impacts.

- Develop and integrate preproject plans for reallocation and rehabilitation of local people likely to be displaced by development projects keeping in view their sociocultural and livelihood needs.
- Give priority to impact assessment of development projects on wetlands, in particular, ensuring that environmental services of wetlands are explicitly factored into cost–benefit analysis.
- Consider and mitigate the impacts on river and estuarine flora and fauna, and the resulting change in the resource base for livelihoods, of multipurpose river valley projects, power plants and industries.
- Promote sustainable tourism through adoption of best practice norms for tourism facilities and conservation of natural resources while encouraging multistakeholder partnerships favouring local communities.
- Survey and develop a national inventory of toxic and hazardous waste dumps and an online monitoring system for movement of hazardous wastes. Strengthen capacity of institutions responsible for monitoring and enforcement in respect of toxic and hazardous wastes.

9.3 Public awareness and support

Having a policy in place does not fully ensure that the desired impact will be achieved. Here, a crucial deciding factor is effective implementation of that policy, which subsequently is governed by public support. Public education and awareness can play important roles in improving conservation efforts (Goodale 1995). A learned and informed society can make sound and informed decisions about conservation. In order to make an informed decision, the public needs background knowledge and current information on biodiversity, an appropriate forum to raise their voice and also a mechanism to monitor the policy processes. This will help in receiving greater public support for implementing biodiversity-friendly policies and programmes.

There are a number of factors, which influence the involvement of society in the decision-making process, including knowledge on the importance of the issue, ability to analyse policies and envision their impacts, capacity to organize them, and enter into a dialogue with the governments.

In order to have an effective stakeholder partnership in a country for achieving the biodiversity targets, it is imperative that the awareness level of the people is high, which comes from biodiversity education from an early stage.

Promoting and encouraging understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes are some of the steps that countries must take in order to enhance awareness (CBD, Article 13, UNEP).

The Millennium Ecosystem Assessment (2005) reinforces the importance of public environmental awareness and participation through educational courses or publication of reports as a support system to traditional legal enforcement measures. Experts, academics and mass media play important roles in enforcement and in increasing public awareness of environmental needs (Rosendal 2000; Wuori 1997; Somsen 1998; Wolf 2002).

Key measures implementable at the field level

- Access to and sharing of information
- Sharing and applying existing knowledge, especially local and indigenous
- Adapt research better to management needs
- Communication between scientists, local communities, media and managers (local languages!!)

9.4 Legal instruments

Legal instruments help the regions and countries in integrating biodiversity concerns into functioning of different sectors and programmes, and help in minimizing the impacts (refer to module 7 of this training resource material for details).

Important Central Acts and Rules having relevance to Biodiversity Conservation and where biodiversity should be integrated

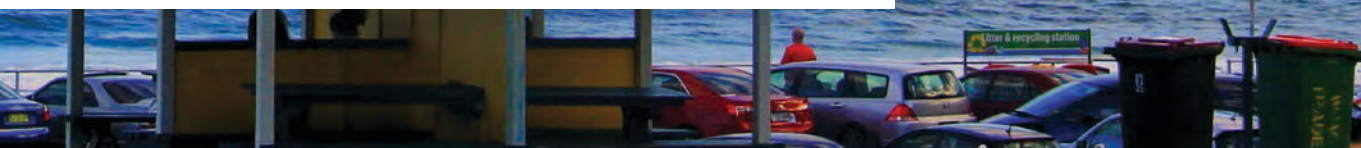
- Fisheries Act, 1897.
- Destructive Insects and Pests Act, 1914.
- The Indian Forest Act, 1927.
- Agricultural Produce (Grading and Marketing) Act, 1937.
- Indian Coffee Act, 1942
- Import and Export (Control) Act, 1947.
- Rubber (Production and Marketing) Act, 1947.
- Tea Act, 1953.
- Mining and Mineral Development (Regulation) Act, 1957
- Prevention of Cruelty to Animals Act, 1960.
- Customs Act, 1962.
- Cardamom Act, 1965.
- Seeds Act, 1966.
- The Patents Act, 1970.
- Wildlife (Protection) Act, 1972.
- Marine Products Export Development Authority Act, 1972.
- Water (Prevention and Control of Pollution) Act, 1974.
- Tobacco Board Act, 1975.
- Territorial Water, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976.
- Water (Prevention and Control of Pollution) Cess Act, 1977.
- Maritime Zones of India (Regulation and Fishing by Foreign Vessels) Act. 1980.
- Forest (Conservation) Act, 1980.
- Air (Prevention and Control of Pollution) Act, 1981.

- Agricultural and Processed Food Products Export Development Authority Act, 1985/ 1986.
- Environment (Protection) Act, 1986.
- Spices Board Act, 1986.
- National Dairy Development Board, 1987.
- Rules for the manufacture, use/import/export and storage of hazardous microorganisms/ genetically engineered organisms or cells, 1989
- Foreign Trade (Development and Regulation) Act, 1992.
- Protection of Plant Varieties and Farmers' Rights (PPVFR) Act, 2001
- Biological Diversity Act, 2002
- Plant Quarantine (Regulation of Import into India) Order, 2003
- Biological Diversity Rules, 2004
- The Food Safety and Standards Act, 2006
- Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

9.5 Impact assessment as a legal instrument for mainstreaming biodiversity[1]

One legal instrument specifically of relevance to mainstreaming biodiversity is impact assessment. In the following section, we discuss two forms of impact assessment: EIA, which is already a mandatory requirement in India supported by law, and SEA, which is still in its infancy and purely voluntary. These two differ in scales and objectives.

1 Source: http://envfor.nic.in/legis/crz/crznew.html



To ensure that development is planned and implemented with biodiversity in mind, impact assessment is being used as an important tool. The major conventions on biodiversity—CBD, the Ramsar Convention and the Convention on Migratory Species—recognize impact assessment as an important decision-supporting tool to help plan and implement development with biodiversity 'in mind.'

The CBD requires parties to apply impact assessment to projects (EIA) as well as to programmes, plans and policies (SEA), which have potential negative impact on biodiversity. The impact assessment should ideally address biodiversity conservation, sustainable use and equal benefit-sharing issues at the three levels, viz, habitat, species and genetic diversity.

Some of the areas where integration of biodiversity may yield significant positive results are urban development, coastal zone management plans combating climate change, forestry, agriculture, fisheries, shipping and trade, biotechnology, tourism, renewable energy plans, climate change mitigation and adaption plans, disaster management plans, and poverty reduction programmes.

9.5.1 Environmental impact assessment (EIA)

EIA is a planning tool used to predict and evaluate the potentially significant impacts of proposed action and provide a mitigation plan for minimizing adverse impacts for making decisions on the proposed project/program/policy. It is a procedure to know the positive and negative aspects of a proposed activity including the natural, social and economic aspects. It is a decision-making process to take a decision whether a developmental project must start or not.

The International Association for Impact Assessment (IAIA) defines EIA as '*the process for identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken and commitments made.*' In environmental cases the purpose of the assessment is to ensure that decision makers consider the potential environmental impacts when deciding whether a project should be allowed to proceed or not. The EIA process looks at the potential impacts on biological and environmental resources as well as social and economic impacts.

The EIA is a tool that seeks to ensure sustainable development through the evaluation of those impacts arising from a major activity (policy, project or programme and plan) that are likely to have environmental effects. The purpose of EIA is to ensure the protection and conservation of the environment and natural resources including human health aspects against uncontrollable development. It is anticipatory, participatory and systematic in nature and relies on multidisciplinary input.

Link to the global convention

Rio Principle 17 states, 'EIA as national instrument, shall be undertaken for the proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.'

THE LEGAL BASIS FOR EIA

EIA is an important management tool for ensuring optimal use of natural resources for sustainable development. A beginning in this direction was made in our country with the impact assessment of river valley projects in 1978–79, and the scope has subsequently been enhanced to cover other developmental sectors such as industries, thermal power projects and mining schemes. To facilitate collection of environmental data and preparation of management plans, guidelines have been evolved and circulated to the concerned central and state government departments. EIA has now been made mandatory under the Environmental Protection Act, 1986, for 29 categories of developmental activities involving investments of INR 50 crores and above. (Source: MoEFCC website)

The Environmental Clearance Regulation of 2006 is in supersession of the notification of 1994 relating to EIA. It has been issued in the exercise of the powers conferred by Section 3(I) and (2)(V) of the Environmental Protection Act, 1986, read with Rule 5(3)(d) of the Environment Protection Rules, 1986. The regulation provides that construction of new projects and activities or expansion or modernization of existing projects at the time of this notification will not be undertaken on and from the date of its publication (14 September 2006) without the prior

environmental clearance from the central government or by the State Level Environmental Impact Assessment Authority (SLEIAA) duly constituted under this regulation. Thirty different categories of projects require clearance from the central government. Some of them are offshore and onshore oil and gas exploration, mining, airport, river valley, soda ash industry, pesticide industry and complex, chemical fertilizer, integrated paint industry and many others.

One of the reasons to adopt the EIA model in India is the Bhopal gas catastrophe, known to be the world's worst industrial disaster. In the course of time, the public also became aware of the requirements, and the central government with a notification in 1994 introduced EIA for the projects cited therein.

9.5.2 EIA of coastal projects: What are the indicators to look out for?

Coastal states are required to prepare Coastal Zone Management Plans as per the provisions of the Coastal Regulation Zone (CRZ) Notification 1991, identifying and categorizing the coastal areas for different activities and submit them to the ministry for approval.

For the purpose of protecting and conserving the coastal environment, the ministry declares coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (on the landward side), up to 500 metres from the high tide line and the intertidal zone as the CRZ. This notification was issued under Section 3(I) and Section 3(2)(V) of the Environment Protection Act, 1986, and Rule 5(3)(d) of the Environmental Protection Rules, 1986. The notification imposes restrictions on the

1. Setting up and expansion of industries
2. Operations or processes in the CRZ

Based on the environmental results and the probable perturbations due to the proposed project, the impact of various activities on marine ecology will be assessed during construction as well as operational phases of the project. Suitable mitigation measures in terms of the marine environmental management plan will be suggested to minimize the adverse impact identified.

Severity of impacts of infrastructure development in the coastal zone varies widely depending on many factors such as the extent, period and type of disturbance, manmade perturbations, capacity of the receiving water to assimilate requirements for assessing such impacts as general baseline information. Tides will be assessed with available data in the area. The currents will be measured at the proposed release location for around one week. Water quality would be assessed at several locations to evolve a general background for the coastal sea off the project site. Intertidal and subtidal sediments off the project site would be studied for texture, selected metals (chromium, iron, cobalt, nickel, copper, zinc, lead, cadmium and mercury), organic carbon, phosphorous and pH. The status of flora and fauna of the project area would be established based on phytoplankton pigments, population and genetic diversity, zooplankton biomass, population and growth diversity, fisheries, mangroves and intertidal corals.

9.5.3 Biodiversity in EIA: Challenges and way forward

The inclusion of biodiversity in EIA is a two-way process. It not only draws on information on biodiversity but also generates useful biodiversity data. There is no debate on the immediate need for biodiversity conservation, although debate regarding the best methodology to address biodiversity continues. The focus of discussion is on the best ways to address this problem. The main difficulties in inclusion of biodiversity in EIA include:

- absence or inadequate representation of the effect on ecosystem functions due to lack of biodiversity data; and knowledge about it
- poor data on biodiversity baseline in the coastal and marine areas
- lack of consideration of cumulative effects of projects;
- inadequate mitigation and post-project monitoring;
- issues with of quality control; and
- poor stakeholder participation.

There is a need to enhance the focus on developing impact prediction tools for biodiversity, which will not only standardize the impact prediction process for biodiversity but will also help the decision makers in making accurate decisions on the impacts of projects on biodiversity. Second, a standardized approach for biodiversity monitoring based on scientific criteria and carefully selected indicators is also needed. Third, the task of transferring the knowledge and information related to good practices in biodiversity impact prediction and monitoring methods needs to be undertaken by the established scientific organizations. Fourth, adapting a long-term and more sustainable approach to impact assessment, which provides information on the potential risks at an early stage itself, and increasing the time and cost efficacy of mitigation measures. One such tool is SEA.

9.5.4 The steps in the EIA of a project in India

All the projects and activities are broadly categorized into 'A' or 'B' category on the basis of spatial extent of potential impacts and potential impact on human health and natural and manmade resources. According to para 7 of the regulation, there are following stages:

1. **Project proposal**

   Any proponent embarking on any major development project will notify the Impact Assessment Agency (IAA) in writing by the submission of a project proposal. The project proposal will include all relevant information available including a land-use map in order for it to move to the next stage, which is screening. The submission of a project proposal signifies the commencement of the EIA process.

2. **Screening**

   Screening is done to see whether a project requires environmental clearance as per the statutory notifications.

3. **Scoping and consideration of alternatives**

   Scoping is a process of detailing the terms of reference of EIA. It has to be done by the consultant in consultation with the project proponent and guidance, if need be, from the IAA. The MoEFCC has published guidelines for different sectors, outlining the significant

A precautionary approach is necessary to make preventive decisions in the face of uncertainty and to drive actions that will protect public health and the environment. One of the most important expressions of the precautionary principle internationally is the Rio Declaration from the 1992 United Nations Conference on Environment and Development, also known as Agenda 21. Application of the precautionary principle recognizes the merit of delaying development consent until the best available information can be obtained through consultation with local stakeholders/experts and/or new information can be consolidated. Its use promotes action to avert risks of serious or irreversible harm to the environment (Cooney and Dickson 2006). The principle in a way provides an 'escape route' to anticipate and prevent threats to the environment and 'buy time' for developing appropriate and effective mitigation.

issues to be addressed in the EIA studies. Quantifiable impacts are to be assessed on the basis of magnitude, prevalence, frequency and duration, and for nonquantifiable impacts (such as aesthetic or recreational value), significance is commonly determined through the socioeconomic criteria. After the areas where the project could have significant impact are identified, the baseline status of these should be monitored and then the likely changes in these on account of the construction and operation of the proposed project should be predicted.

4. **Baseline data collection**

   Baseline data describe the existing environmental status of the identified study area. The site-specific primary data should be monitored for the identified parameters and supplemented by secondary data if available.

5. **Impact prediction, evaluation and assessment of alternatives**

   Impact prediction is a way of mapping the environmental consequences of the significant aspects of the project and its alternatives. For every project, possible alternatives should be identified and environmental attributes compared. Alternatives should cover both project location and process technologies. Alternatives should then be ranked for selection of the best environmental optimum economic benefits to the community at large.

6. **Environment Management Plan (EMP)**

   Once alternatives have been reviewed, a mitigation plan should be drawn up for the selected option and supplemented with an EMP to guide the proponent towards environmental improvements. The EMP is a crucial input to monitoring the clearance conditions, and therefore details of monitoring should be included in the EMP.

7. **EIA report**

   An EIA report should provide clear information to the decision maker on the different environmental scenarios without the project, with the project and with project alternatives. The proponent prepares a detailed project report and provides information in a logical and transparent manner. The IAA examines if procedures have been followed as per MoEF notifications.

8. **Public hearing**

   After completion of the EIA report, the law requires that the public must be informed and consulted on a proposed development. The State Pollution Control Boards will conduct the public hearing before the proposals are sent to MoEF for obtaining environmental clearance. Any one likely to be affected by the proposed project is entitled to have access to the executive summary of the EIA. The affected persons may include a) Bona fide local residents; b) Local associations; c) Environmental groups active in the area; and d) Any other person located at the project site/sites of displacement. They are to be given an opportunity to make oral/written suggestions to the State Pollution Control Board as per Schedule IV.

9. **Decision-making**

   The decision-making process involves consultation between the project proponent (assisted by a consultant) and the impact assessment authority (assisted by an expert group if necessary). The decision on environmental clearance is arrived at through a number of steps including evaluation of EIA and EMP.

Cost–benefit analysis

The cost–benefit effect simply compares all the expected present and future benefits of a project or policy with its present and future costs. It evaluates the practicability and viability of the project in relation to economic gains and the likely adverse effects of the project on the environment. Now it is felt that real value must be given to environmental components which must be recognized and considered in EIA. 'Direct value' must be given to the natural forces like air, water, vegetation cover; commercial or noncommercial, for example, output of a forest would include both lumber (commercial) and recreational amenity value (noncommercial). The 'indirect value' like the ecological functions of the ecosystem, such as climate stabilization and nitrogen fixation, must also be considered in cost–benefit effects. Recently, an innovative new approach has been evolved to be considered in EIA, known as the generational cost–benefit analysis. This approach discounts net benefits from the perspective of progeny involved. This approach was adopted by the courts also.

10. Monitoring the clearance conditions

Monitoring has to be done during both the construction and operation phases of a project. It is done not just to ensure that the commitments made are complied with, but also to observe whether the predictions made in the EIA reports are correct or not. Where the impacts exceed the predicted levels, corrective action should be taken. Monitoring also enables the regulatory agency to review the validity of predictions and the conditions of implementation of the EMP. The project proponent, IAA and Pollution Control Boards should monitor the implementation of conditions. The proponent is required to file once in six months a report demonstrating the compliance to IAA.

9.6 Strategic Environmental Assessment (SEA)[2]

9.6.1 What is SEA ?

SEA refers to a range of 'analytical and participatory approaches that aim to integrate environmental considerations into policies, plans and programmes and evaluate the inter-linkages with economic and social considerations.'

2 Source: OECD, 2006

SEA can be described as a family of approaches which use a variety of tools, rather than a single, fixed and prescriptive approach. A good SEA is adapted and tailor-made to the context in which it is applied. This can be thought as a continuum of increasing integration: at one end of the continuum, the principal aim is to integrate environment, alongside economic and social concerns, into strategic decision-making; at the other end, the emphasis is on the full integration of the environmental, social and economic factors into a holistic sustainability assessment.

SEA is applied at the very earliest stages of decision-making both to help formulate policies, plans and programmes and to assess their potential development effectiveness and sustainability. This distinguishes SEA from more traditional environmental assessment tools, such as the EIA, which have a proven track record in addressing the environmental threats and opportunities of specific projects but are less easily applied to policies, plans and programmes. SEA is not a substitute for, but complements, EIA and other assessment approaches and tools.

CASE STUDY

Integration of Biodiversity Aspects in Strategic Environmental Assessment of Nepal Water Plan and Environmental Impact Assessment of Operational Forest Management Plans in Nepal

This case study focuses on inclusion of biodiversity aspects in the Strategic Environmental Assessment (SEA) report of the Nepal Water Plan (NWP) finalised in July 2003, and separate plan-level Environmental Impact Assessment (EIA) reports of the Operational Forest Management Plan (OFMP) of Bara, Rautahat, and Dhanusha districts prepared in 1995, 1996 and 2000 respectively. The EIA report of OFMPs is taken into consideration as they are of plan level impact assessment. Nepal has prepared OFMPs of 20 Terai districts, and has included EIA as a separate chapter with a view to inform the decision-makers and the implementers to integrate environmental aspects including biodiversity conservation during their implementation (of OFMPs). The EIA report of OFMPs has more or less similar contents, issues, impacts, mitigation measures and monitoring requirements. The NWP is of national character, and OFMPs are location specific, i.e., within the administrative jurisdiction of the District Forest Office. The districts are the administrative units of His Majesty's Government of Nepal (HMGN). Each District Forest Office administers forest conservation and management activities including biodiversity aspects in forests, protected areas and wetlands. At present, about 39.6% of Nepal's total area (of 147,181 km2) is under forest cover and the forestry organisations administer it. The plan level EIA has been conducted only for the forestry sector. The SEA of NWP is the first of its kind in the water resources sector. https://www.cbd.int/impact/case-studies/cs-impact-nl-iaia-np-sea-en.pdf

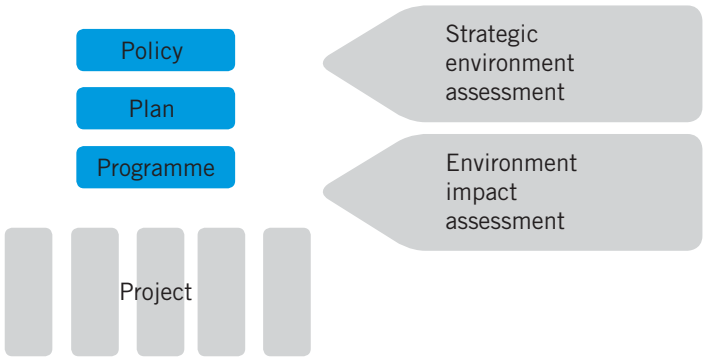
[Source: Upreti 2005]

Table: 9.1 SEA and EIA compared

EIA	SEA
Applied to specific and relatively short-term (life-cycle) projects and their specifications.	Applied to policies, plans and programmes with a broad and long-term strategic perspective.
Takes place at early stage of project planning once parameters are set. Considers limited range of project alternatives.	Ideally, takes place at an early stage in strategic planning. Considers a broad range of alternative scenarios.
Usually prepared and/or funded by the project proponents.	Conducted independent of any specific project proponent.
Focus on obtaining project permission, and rarely with feedback to policy, plan or programme consideration.	Focus on decision on policy, plan and programme implications for future lower-level decisions.
Well-defined, linear process with clear beginning and end (e.g. from feasibility to project approval).	Multi-stage, iterative process with feedback loops.
Preparation of an EIA document with prescribed format and contents is usually mandatory. This document provides a baseline reference for monitoring.	May not be formally documented.
Emphasis on mitigating environmental and social impacts of a specific project, but with identification of some project opportunities, offsets, etc.	Emphasis on meeting balanced environmental, social and economic objectives in policies, plans and programmes. Includes identifying macro-level development outcomes.
Limited review of cumulative impacts, often limited to phases of a specific project. Does not cover regional-scale developments or multiple projects.	Inherently incorporates consideration of cumulative impacts.

9.6.2 Why SEA?

Applying SEA to development cooperation has benefits for both decision-making procedures and development outcomes. It provides the environmental evidence to support more informed decision-making, and to identify new opportunities by encouraging a systematic and thorough examination of development options. SEA helps to ensure that the prudent management of natural resources and the environment provides the foundations for sustainable economic growth which, in turn, supports political stability. SEA can also assist in building stakeholder engagement for improved governance, facilitate transboundary cooperation around shared environmental resources, and contribute to conflict prevention.



SEA is a continuous, iterative and adaptive process focussed on strengthening institutions and governance. It is not a separate system, nor a simple linear, technical approach. Instead, it adds value to existing country systems and reinforces their effectiveness by assessing and building capacity for institutions and environmental management systems.

9.6.3 How is SEA conducted?

Where SEA is applied to plans and programmes, a structured approach to integrating environmental considerations can be used. Key stages for carrying out an SEA on the level of plans or programmes include establishing the context, undertaking the needed analysis with appropriate stakeholders, informing and influencing decision-making, and monitoring and evaluation. SEA applied at the policy level requires a particular focus on the political, institutional and governance context underlying decision-making processes.

Some examples of tools that could be used in SEA

Tools for ensuring full stakeholder engagement:

- Stakeholder analysis to identify those affected and involved in the PPP decision
- Consultation surveys
- Consensus building processes

Tools for predicting environmental and socioeconomic effects:

- Modelling or forecasting of direct environmental effects
- Matrices and network analysis
- Participatory or consultative techniques
- GISs as a tool to analyse, organize and present information

Tools for analysing and comparing options:

- Scenario analysis and multicriteria analysis
- Risk analysis or assessment
- Cost–benefit analysis
- Opinion surveys to identify priorities

9.6.4 Basic Steps of SEA

1. Establishing the context for SEA
   a. Screening
   b. Setting objectives
   c. Identifying stakeholders
2. Implementing the SEA
   a. Scoping
   b. Collecting baseline data
   c. Identifying alternatives
   d. Identifying how to enhance opportunities and mitigate negative impacts
   e. Reporting
3. Informing decision-making
   a. Making recommendations
   b. Communication
4. Monitoring and evaluation

Strategic Environmental Assessment (SEA): Intensive training course for national and international specialists and managers offered by GIZ and partners

GIZ offers a SEA training course on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ)

- to support partner countries in strengthening their respective capacities
- to establish and to implement their own SEA strategies or
- to cope with existing legislation.

It is based on both practical perennial experiences with impact assessment tools in development cooperation and the official OECD "Good Practice Guidance on Applying SEA in Development Cooperation".

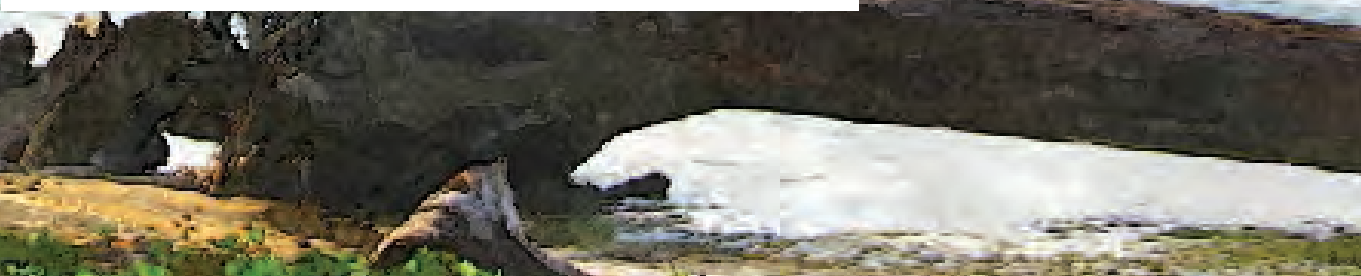
https://www.giz.de/fachexpertise/downloads/giz2011-en-environmental-assessment.pdf

9.7 Marine Spatial Planning (MSP)[3]

9.7.1 What is marine spatial planning?

Marine spatial planning (MSP) is a practical way to create and establish a more rational organization of the use of marine space and the interactions between its uses, to balance demands for development with the need to protect marine ecosystems, and to achieve social and economic objectives in an open and planned way.

3 Source: Ehler, C., and F. Douvere, (2009)



Marine spatial planning (MSP) is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process. It is important to remember that we can only plan and manage human activities in marine areas, not marine ecosystems or components of ecosystems. We can allocate human activities to specific marine areas by objective, e.g., development or preservation areas, or by specific uses, e.g., wind farms, offshore aquaculture, or sand and gravel mining.

Characteristics of effective marine spatial planning

- Ecosystem-based, balancing ecological, economic, and social goals and objectives toward sustainable development
- Integrated, across sectors and agencies, and among levels of government
- Place-based or area-based
- Adaptive, capable of learning from experience
- Strategic and anticipatory, focused on the long-term
- Participatory, stakeholders actively involved in the process

9.7.2 Why do we need marine spatial planning?

Designation of zones in coastal and marine areas for a number of activities such as maritime transportation, oil and gas development, offshore renewable energy, offshore aquaculture and waste disposal is a common practice. However, the problem is that usually this is done on a sector-by-sector, case-by-case basis Consequently, this situation has led to two major types of conflict:

- Conflicts among human uses (user-user conflicts);
- Conflicts between human uses and the coastal marine environment (user-environment conflicts).

These conflicts weaken the ability of the coastal and marine ecosystems to provide the necessary ecosystem services. Furthermore, a sectoral approach also provides a challenging situation for decision-making at the higher levels. Marine spatial planning is a future-oriented process and provides solution for bringing the concern of people and environment together by bringing different sector planning at a common place.

MSP brings together multiple users of the ocean (e.g., energy, industry, government, conservation and recreation) to make informed and coordinated decisions about how to use marine resources sustainably. It uses maps to create a more comprehensive picture of a marine area—identifying where and how an ocean area is being used and what natural resources and habitats exist. Its principal objective is to plan the equitable and sustainable use of our oceans as a whole, and balance ecological, economic and social interests.

9.7.3 What are the benefits of marine spatial planning?

When developed properly, marine spatial planning can have significant economic, social, and environmental benefits. The box below shows some of the most important benefits of marine spatial planning.

- Identification of biological and ecological important areas
- Biodiversity objectives incorporated into planned decision-making
- Identification and reduction of conflicts between human use and nature
- Allocation of space for biodiversity and nature conservation
- Establish context for planning a network of marine protected areas
- Identification and reduction of the cumulative effects of human activities on marine ecosystems

- Greater certainty of access to desirable areas for new private sector investments, frequently amortized over 20-30 years
- Identification of compatible uses within the same area of development
- Reduction of conflicts between incompatible uses
- Improved capacity to plan for new and changing human activities, including emerging technologies and their associated effects
- Better safety during operation of human activities
- Promotion of the effcient use of resources and space
- Streamlining and transparency in permit and licensing procedures

- Improved opportunities for community and citizen participation
- Identification of impacts of decisions on the allocation of ocean space (e.g., closure areas for certain uses, protected areas) for communities and economies onshore (e.g., employment, distribution of income)"
- Identification and improved protection of cultural heritage
- Identification and preservation of social and spiritual values related to ocean use (e.g., the ocean as an open space)

Source: Ehler, C., and F. Douvere, (2009)

9.8 GIS and remote sensing

Marine protected areas (MPAs) are important tools for the conservation of marine biodiversity but their designation and effective monitoring require frequent, comprehensive, reliable data. Remote sensing (RS), as demonstrated for terrestrial protected areas, has the potential to provide key information to support MPA management, to monitor biodiversity surrogates, e.g. ecological (e.g., primary productivity) and oceanographic (e.g., Sea Surface Temperature) parameters that have been shown to structure marine biodiversity. RS has the potential to inform marine habitat mapping and monitoring, and can be used to track anthropogenic activities and its impacts on biodiversity in MPAs. (Kachelriess et al 2013).

Geographical Information System (GIS) is a tool that helps conservationists acquire, manage, analyze, and visualize spatial and thematic oceanic data through map generation. It is used around the world to map marine habitats; water quality; species distribution, population, and behavior; pollution; fishing grounds; and other factors that impact marine life.

By integrating common database operations such as query and statistical analysis with maps, a GIS enables management of location-based information. Tools for display and analysis of various statistics help in linking databases and maps to create dynamic displays. Thus, distribution of population, vegetation, animal ranges, human–animal interactions, animal migration and transboundary movement of animals are but a few examples of what can be displayed.

Remote sensing and GIS case-studies on tropical coasts

Remote sensing and GIS have been used to study mangrove forests (e.g. Ramachandran et al., 1998), seagrass beds (e.g. Ferguson and Korfmacher, 1997; Pasqualini, 2001) and coral reefs (e.g. Holden and Ledrew, 1999; Lubin et al., 2001). Blasco et al. (1998) reviewed the suitability of various remote sensing technologies in different mangrove research fields and concluded that aerial photography is best suited for investigating the density, phenology, hydrological status, human impact, height and floristics of mangrove forests.

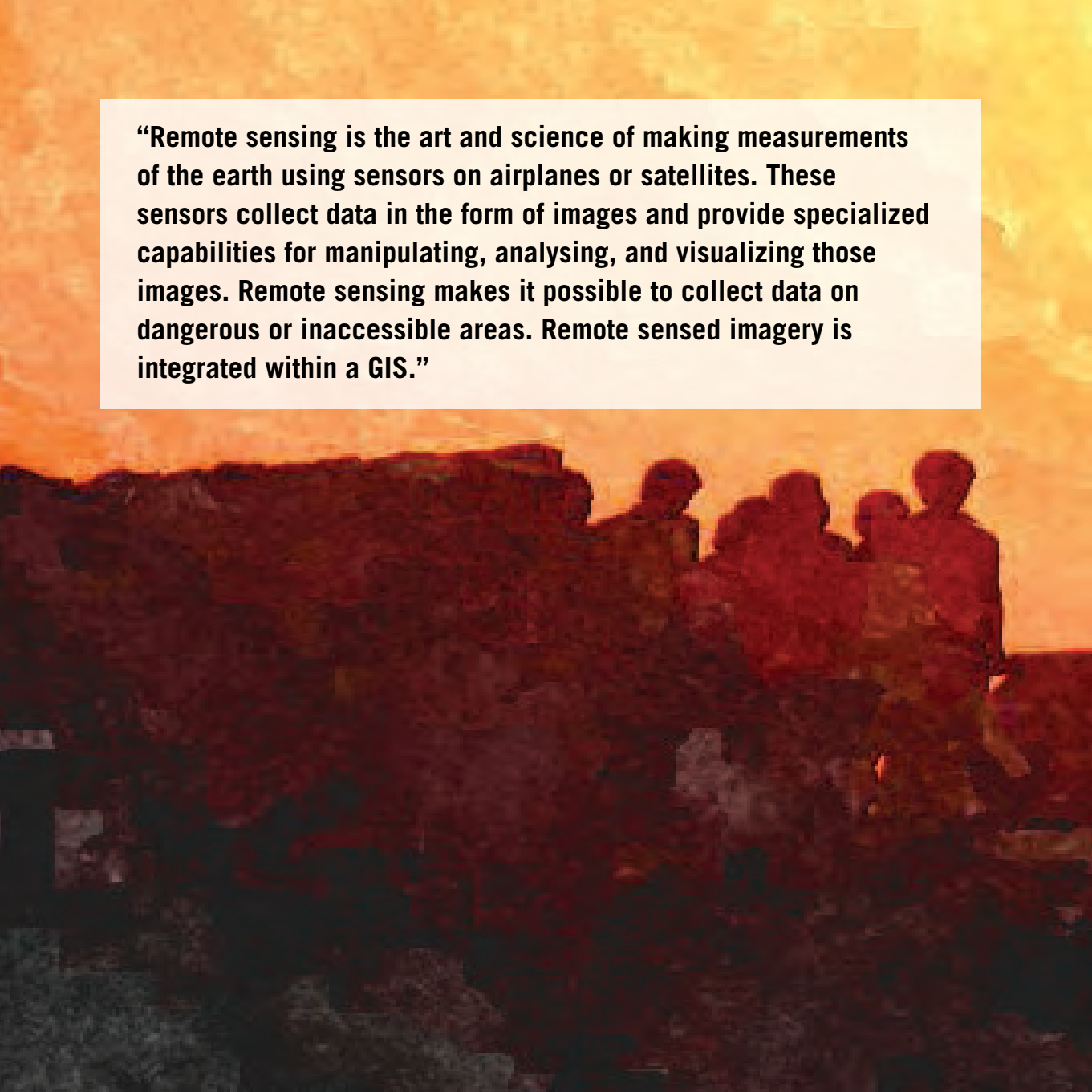
Source: Dahdouh-Guebas, F. (2002)

CASE STUDY: Use of GIS and Remote Sensing

Arial Extent of Erosion and Accretion in and around the Gahirmatha Coast, NW of Bay of Bengal by Remote Sensing and GIS Analysis of Multi-Temporal Satellite Imagery

The shoreline morphology change due to erosion and deposition is a major concern for coastal zone management. Veeraanarayanaa, et. al. (2015) found in their study that, a highly dynamic coast of Gahirmatha on Bay of Bengal in northeast India is experiencing active erosion, which is mainly wave and tide erosion related hazard threat ending human habitation and sustainability of the coast. In this study, high resolution satellite imagery of time series provided detailed sequence of coastal morphology and their changes in all respects. Comparison study of relative shoreline positions on time series satellite data spanning three decades from 1973 to 2004 covering for the years of 1973, 1983, 1987, 1990, 1998, 2000 and 2004, provided regional changes with accelerated erosion and accretion. The result of the studies have revealed that the areas of severe erosion found along the coast are confined to the promontories of the present day mouths itself of the Baitarani at Dhamra and Brahmani at Maipura inlets. In this background, it is significant to understand the magnitude of factors that are responsible for prograding or retrograding of coast. The present study is an attempt in this direction.

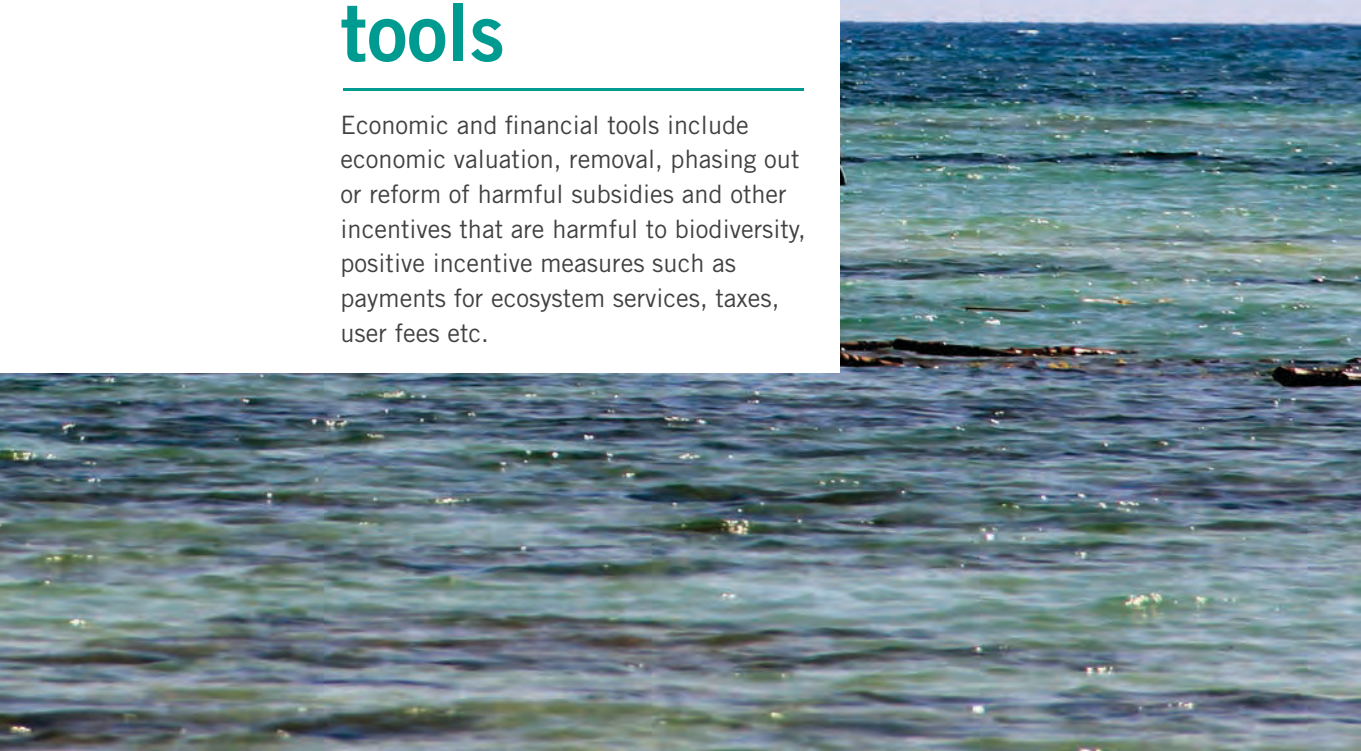
Source: Veeraanarayanaa, et. al. (2015).



“Remote sensing is the art and science of making measurements of the earth using sensors on airplanes or satellites. These sensors collect data in the form of images and provide specialized capabilities for manipulating, analysing, and visualizing those images. Remote sensing makes it possible to collect data on dangerous or inaccessible areas. Remote sensed imagery is integrated within a GIS.”

9.9 Economic and financial tools

Economic and financial tools include economic valuation, removal, phasing out or reform of harmful subsidies and other incentives that are harmful to biodiversity, positive incentive measures such as payments for ecosystem services, taxes, user fees etc.



Case Studies: Economic Valuation of biodiversity and ecosystem services

The Economics of Ecosystems and Biodiversity – India Initiative

(TII) aims at making the values of biodiversity and linked ecosystem services explicit for consideration and mainstreaming into developmental planning.

Under the TII, 14 case studies in three different ecosystems (forests, inland wetlands, and coastal and marine ecosystems) were selected in order to highlight evidences for ecosystems values and their relation to human well-being.

In case of The Ashtamudi estuary, a 61 sq km Ramsar Site, provides livelihood for about 3,000 locals. The estimated value of fishery resources of the lake is `985 million (US$ 16.4m), of which 51% comes from clams. The amount of nutrients released in the water where clam beds exist was thrice as much as nonclam zones. With more clams, it takes 139 days to filter the lake water completely, as opposed to 277 days when clam abundance is poor. The estimated cost of the Marine Stewardship Council (MSC) certification [please refer to the next section for details on MSC certification] is `3 million (US$ 50,000) and fishery management is `161.7 million (US$ 2.7m).

A change in processing and marketing of clams can improve livelihood security for fishers and boost the export value from the present US$ 1 million. With MSC certification, it is feasible to shift to new export markets such as Europe and Japan. A change in product from clam meat to whole clams can lead to 75% increase in revenue.

To read this case study in detail, and to refer to other similar case studies, in the form of a story map can be found here http://indo-germanbiodiversity.com/story-page.html

9.10 Sectoral standards, codes of conduct, guideines, certification schemes and good practices

9.10.1 An overview:

Standards are policy guidelines that regulate the effect of human activity upon the environment. Standards may specify a desired state (e.g. lake pH should be between 6.5 and 7.5) or limit alterations (e.g. no more than 50% of mangrove forest may be damaged).

Guidelines provide voluntary and practical advice and streamlining on how to undertake particular processes. Guidelines, for example the CBD Tourism guidelines, are usually relatively general and can be applied to a number of circumstances.

Codes of Conduct can be very detailed, and set out standards of behaviour for responsible practices with a view to ensuring sustainable resource use. A good example of a sector specific code of conduct is the FAO Code of Conduct for Responsible Fisheries.

Good practices (or best practices) are informal examples of actions that can be undertaken to achieve certain sustainability goals, or points that need to be kept in mind towards this end. The best practices for conserving traditional knowledge related to sustainable fisheries, or good practices for community-based coastal tourism are some of the examples.

9.10.2 Marine products certification:

The Marine Stewardship Council (MSC) is an international non-profit organisation established to address the problem of unsustainable fishing and safeguard seafood supplies for the future. It's vision is for the world's oceans to be teeming with life – today, tomorrow and for generations to come.

Marine Stewardship Council (MSC)

Our fisheries, our future. Sustainable fishing in the developing world

https://www.youtube.com/watch?v=Vq5I3pNCUzY

The marine stewardship council's fishery certification programme and seafood ecolabel recognizes and rewards sustainable fishing. It is a global organization working with fisheries, seafood companies, scientists, conservation groups and the public to promote the best environmental choice in seafood[4].

India is one among the top ten fish producing countries in the world contrlbuting over 5% (7.5 million t) of the world fish production. In the context of globalization and challenges of global competition in trade and economics, there is urgent need for policy interventions at the state and national levels which will ensure sustainable exploitation of the marine resources as well as better livelihood opportunities for the fisherfolk.

One example of this has been reported in the TII case study (please refer to the box in the previous section) where eco-labelling through sustainable fishing practices resulted in premium prices and ecological gains for short-neck clam fisheries of Ashtamudi, which garnered an eco-label from the Marine Stewardship Council (MSC), a first in India. One of the recommendations of this case study is that more fishworkers should be made aware of eco-labelling as a tool for resource management in smallscale fisheries.

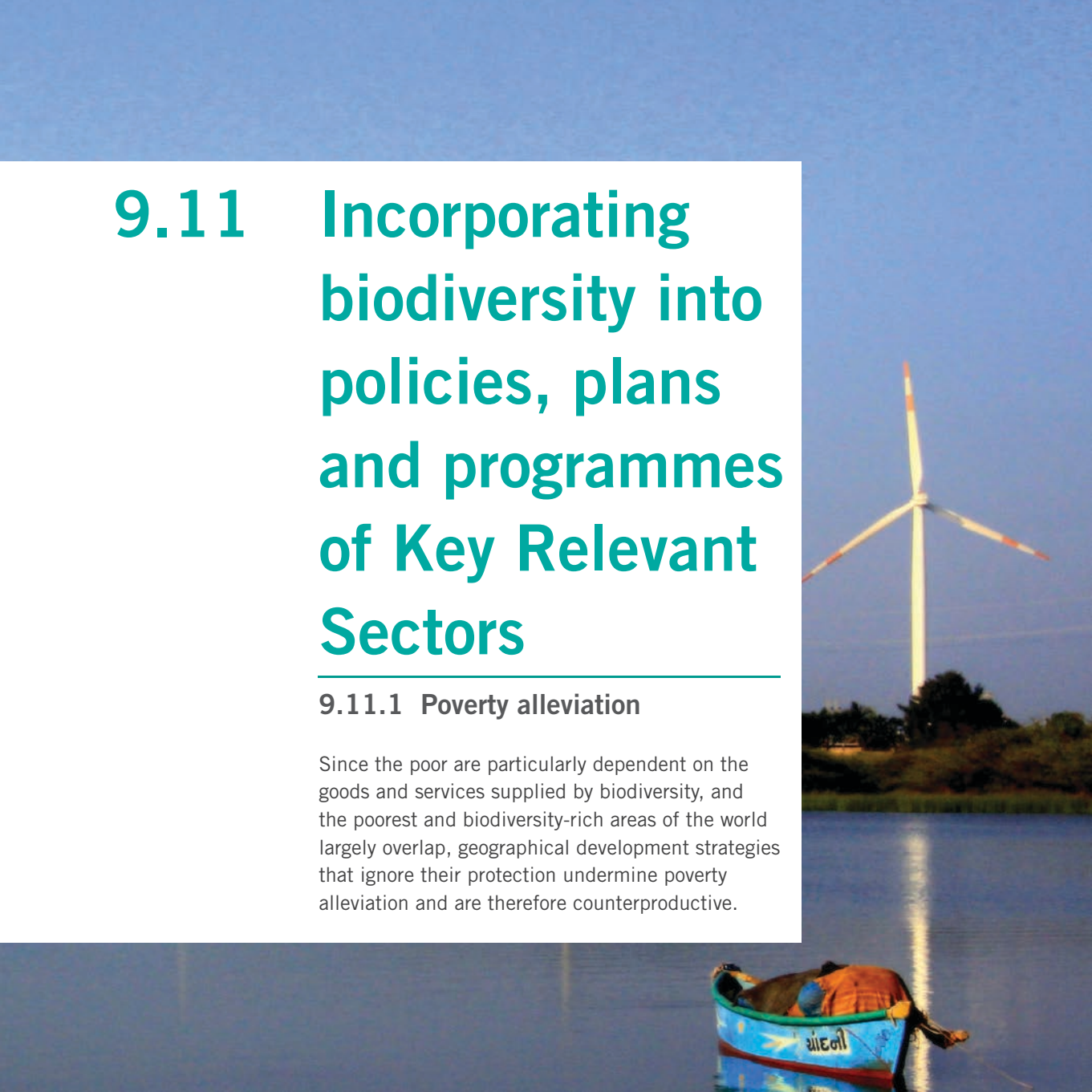
And indeed, this task of raising awareness can be accomplished only by Media, through various facets such as reports, short films, adversing campaigns, and social media.

4 http://www.msc.org; Washington and Ababouch, 2011

9.11 Incorporating biodiversity into policies, plans and programmes of Key Relevant Sectors

9.11.1 Poverty alleviation

Since the poor are particularly dependent on the goods and services supplied by biodiversity, and the poorest and biodiversity-rich areas of the world largely overlap, geographical development strategies that ignore their protection undermine poverty alleviation and are therefore counterproductive.



For this reason, it is crucial for development and poverty alleviation strategies and programmes to prioritize biodiversity (CBD cross-cutting programme on biodiversity for development) *https://www.cbd.int/development*. The imperative to integrate biodiversity concerns into development plans and policies of relevant sectors and programmes is enshrined in the CBD and other biodiversity conventions, and reinforced by the findings of Millennium Ecosystem Assessment (2003) and Global Biodiversity Outlook (CBD 2006). In 2007, the 2010 biodiversity target was integrated into the Millennium Development Goals as target 7 B4, which was a clear indication of the perceived contribution that biodiversity may provide for achieving the global development goals.

9.11.2 Urban development

Another sector is urban development, which is becoming more and more important for mainstreaming biodiversity, not only because of the increase in the proportion of the world's population and more concentrated human assemblages in the urban areas, but also because these urban areas are expanding into the natural ecosystems in the peri-urban areas. Ecosystems in urban areas are, most often, in a highly fragmented and stressed form and are therefore not able to meet the tremendously increasing demand for the ecosystem services required by city dwellers—in the form of clean air and water, spiritual and stress-releasing activities, and most importantly, disaster risk reduction.

According to CBD's Cities and Biodiversity Outlook, by 2050 almost three billion additional people will inhabit the world's cities and the world will have undergone the largest and fastest period of urban expansion in history. (https://www.cbd.int/subnational)

While discussing cities, it is important to bear in mind that 13 out of the 20 most populated cities in the world in 2005 are coastal cities. These cities are highly vulnerable to natural disasters like cyclones and urban flooding, which are becoming more frequent due to climate change. A study published by OECD focussing on the threats from coastal flooding in 136 port cities around the world concludes that by the 2070s, the total population exposed could grow more than three-fold to around 150 million people due to the combined effects of climate change (sea level rise and increased storminess), subsidence, population growth and urbanization. Two Indian metropolitan cities are among the top 10 vulnerable port cities according to this study. Realizing the need to conserve biodiversity in the cities and also to involve local governments and other stakeholders in this process, several initiatives have been taken under the umbrella of CBD.

URBAN BIODIVERSITY
Securing a green future of our cities

Relationship of human beings with the physical environment has many dimensions and facets. This relationship manifests itself in the form of life-supporting Ecosystem Services that we derive from the stable and intact ecosystems. Ecosystem services are the benefits that people obtain from the ecosystems, including provisioning (timber, fodder, food, fuelwood, medicinal plants etc), regulating (air quality maintenance, climate regulation, carbon sequestration, regulation of human diseases, pest and disease control, water purification, natural hazard and disaster risk reduction, climate amelioration, pollination etc), cultural (spiritual and education services, aesthetic value etc), and supporting services (water cycling, provisioning of habitat, production of atmospheric oxygen etc).
These life-supporting ecological services can be ensured on a sustainable basis only if the ecosystems are stable and resilient. So, what determines the stability and overall health of the ecosystems?..... It's Biodiversity—the backbone of ecosystems. Most of the critical and life-supporting ecosystem services needed by the urban dwellers such as clean air and a disease-free environment are being contributed by urban biodiversity.

In the urban context, habitat biodiversity would mean presence of different types of habitats like wetlands, rivers, forests, gardens, open greens, homestead gardens and roadside plantings. Different types of habitats are required to maintain the flow of various ecosystem services. For examples, a very important ecosystem service is reduction of disaster risk, which essentially means that a network of greenspaces, avenue plantation, wetlands and river flood plain reduce the flow of water and absorb excess water in case of heavy rainfall and reduce the threat of a flash flood or general urban flooding.

Species biodiversity- different types of species of plants, animals, birds, insects, amphibians- is essential for maintaining the required stability and resilience in the urban ecosystems. High species biodiversity acts as an insurance against changes in climate and species loss due to anthropogenic pressure; even if some species do not survive, others will be present in the ecosystem to quickly take up the task of the lost species, a function referred to as 'ecological niche'. A good example for the importance of maintaining different species in the urban

ecosystems is the relationship between mosquitos and frogs; arguably, the loss of frog due to their habitat loss is one of the main reasons for the exponentially growing mosquito population in the urban areas in several parts of India.

There is mounting evidence cross the globe that urban biodiversity and healthy urban ecosystems contribute to health and overall wellbeing of the citizens, and accordingly the urban local governments and citizens are coming together to act for conserving biodiversity and urban ecosystems.

The Global Partnership on Cities and Biodiversity under the umbrella of the global Convention on Biological Diversity (CBD) bring focus to urban biodiversity and engaging citizens and local authorities for conserving this important resource. Local Action for Biodiversity (LAB) is a global urban biodiversity programme coordinated by ICLEI – Local Governments for Sustainability; recently, LAB India programme was launched, which joins a global network of cities committed to conserving urban biodiversity. In India, these are cities of Hyderabad, Thane, Delhi-NCT, Guntur, Shimla, Anantapur District, Kurunegala, Matale and Varanasi.

Management of urban biodiversity is not a new concept. Historically, the foremost criteria for human settlements used to be presence of clean water bodies and healthy ecosystems. The high-paced development of human settlements and the changing relationship of humans with nature have posed a challenge today on the urban managers to find new and innovative ways to sustain healthy urban ecosystems. Predicted impacts of climate change and ever increasing threat from natural disasters only add to this challenge. Investing in urban biodiversity seems to be the future right now to tackle the situation and to continue to receive the ecosystem services for our own health and overall wellbeing.

[Source: Khera 2013]

9.11.3 Fisheries and aquaculture

Increasing pressure on fish stocks, overcrowding of boats, pollution, degradation of habitats and destructive fishing practices threaten the ecosystem and livelihoods of millions. Fisheries and aquaculture have had damaging impacts on both commercially harvested fish stocks, and nontarget species and habitats. Here are some examples of how fisheries as an activity can have a negative implication on biodiversity:

- The use of trawl nets has been reported to cause major disturbances to ocean floor and benthic fauna
- Negative impacts on nontarget species
  - Use of gillnets for fishing may lead to accidental capture of juvenile individuals of large fish species
  - Use of small gauge gillnets leads to increased accidental capture of juvenile fish
  - Placement of gillnets across river mouths leads to massive catch, including nontarget species, leading to population decline
  - Capture of undersized individuals of molluscs for commercial utilization, reduction of population levels and breeding success
- Use of explosives and poisons for fishing causes massive and unselective mortality of aquatic fauna and has led to the destruction of coral reefs

The Code of Conduct for Responsible Fisheries, of the Food and Agriculture Organization of the United Nations, which is still voluntary in nature, seeks to ensure that the fisheries sector commits itself to biodiversity-friendly fisheries practices.

A good example of integrating biodiversity concern into fisheries sector:

Central Institute of Fisheries Technology's (CIFT's) semipelagic trawl system (SPTS)

SPTS was developed by scientists of the Fishing Technology Division of CIFT as an alternative to bottom trawling, which causes high impacts on the sea bottom and also is nonselective. This gear system has been developed and optimized taking into consideration the biological, behavioural and distribution characteristics of tropical demersal and semipelagic finfish and cephalopod resources and the technical capabilities of the small-scale mechanized trawler fleet, operating in Indian waters. The system consists of a four-panel semipelagic trawl with double bridles, front weights and vertically cambered high aspect ratio otter boards that can selectively harvest fast-swimming demersal and semipelagic finfishes and cephalopods, which are generally beyond the reach of conventional bottom trawls, currently used in commercial trawl fisheries in India. Indian Ranger Forest Officers—participants of the WII-GIZ training course on coastal and marine biodiversity and MPA management—getting information on the newly introduced SPTS developed by CIFT, along with the team of Mangrove Cell Maharashtra and UNDP-GEF project team (Malvan Jetty, Maharashtra, January 2015)

Fishing for the Future:

A majority of people living in the coastal region of Sindhudurg, Maharashtra rely on fishing for livelihood. Watch how newly adopted sustainable fishing technology, introduced by UNDP and Government of Maharashtra, has drastically reduced unwanted catch and is conserving the region's rich marine biodiversity

https://www.youtube.com/watch?v=1-dGOANBo9s

9.11.4 Shipping and trade

Risks are increasing due to growing global trade, transport, tourism and climate change. One specific case is where the shipping industry is responsible for the spread of invasive species carried by the ships in the ballast water. Ballast water is the water that a ship pumps into tanks in the hull to add weight and improve stability. The ballast water is pumped in or discharged at ports to balance the load that the ship has taken in or delivered.

In the process the ship can take in aquatic species from one location and discharge it in the other. Problem arises if any of the aquatic species thus taken in turns hypercompetitive in the new environment and destroys other species populations. In other words, the imported species turns into an invasive species.

Biodiversity concerns are being integrated in the shipping sector via the Ballast Water Management Convention,[5] adopted in 2004, which aims at preventing the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Under the convention, all ships in international traffic are required to manage their ballast water and sediments to a certain standard, according to a ship-specific ballast water management plan.

9.11.5 Tourism

Tourism is one of the world's fastest growing industries. It also a source of increasing stress on fragile ecosystems. Its social, economic and environmental impacts are immense and complex, not least because tourism concentrates on vulnerable natural and cultural sites. The challenge is therefore to ensure that tourism is developed in harmony with environmental considerations. The tourism industry is dependent on a wide variety of ecosystem services. Tourist activities in coastal areas often focus on diverse marine resources such as coral reefs, whales, and birdlife, and require clean water resources for activities such as swimming and scuba diving. Tourism revolving around wildlife viewing (e.g. safari) requires intact and healthy ecosystems in order to support species populations.

5 The Ballast Water Management Convention website, http://www.imo.org/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx

National parks are often located in forested and mountainous areas and rely on the services of functioning ecosystems to provide visitors with opportunities for recreational, educational, and cultural experiences (SCBD 2009).

The CBD Guidelines on Biodiversity and Tourism Development are a comprehensive instrument developed within the framework of the Convention on Biological Diversity to achieve more sustainable tourism development. They are conceived as a practical tool providing technical guidance to policy makers, decision makers and managers with responsibilities covering tourism and/or biodiversity, whether in national or local government, the private sector, indigenous and local communities, nongovernmental organizations and other organizations, on ways of working together with key stakeholders involved in tourism and biodiversity (CBD 2004).

Marine and coastal tourism tourism can also provide a trade opportunity for developing countries to conserve and protect ecosystems and species. Instead of overexploiting marine resources, marine and coastal areas can be used for sustainable tourism and recreation. If carefully designed, activities such as surfing, wind surfing and sea kayaking can be developed into sustainable tourist attractions (Ghosh 2011). MPAs serve to conserve resources and consequently benefit surrounding areas through protecting species migration and enhanced recruitment. MPAs have grown in popularity amongst tourists in recent years (Aas et al. 2008; Hoyt 2001; Hollingworth and Pitcher 2002 | UNEP 2013).

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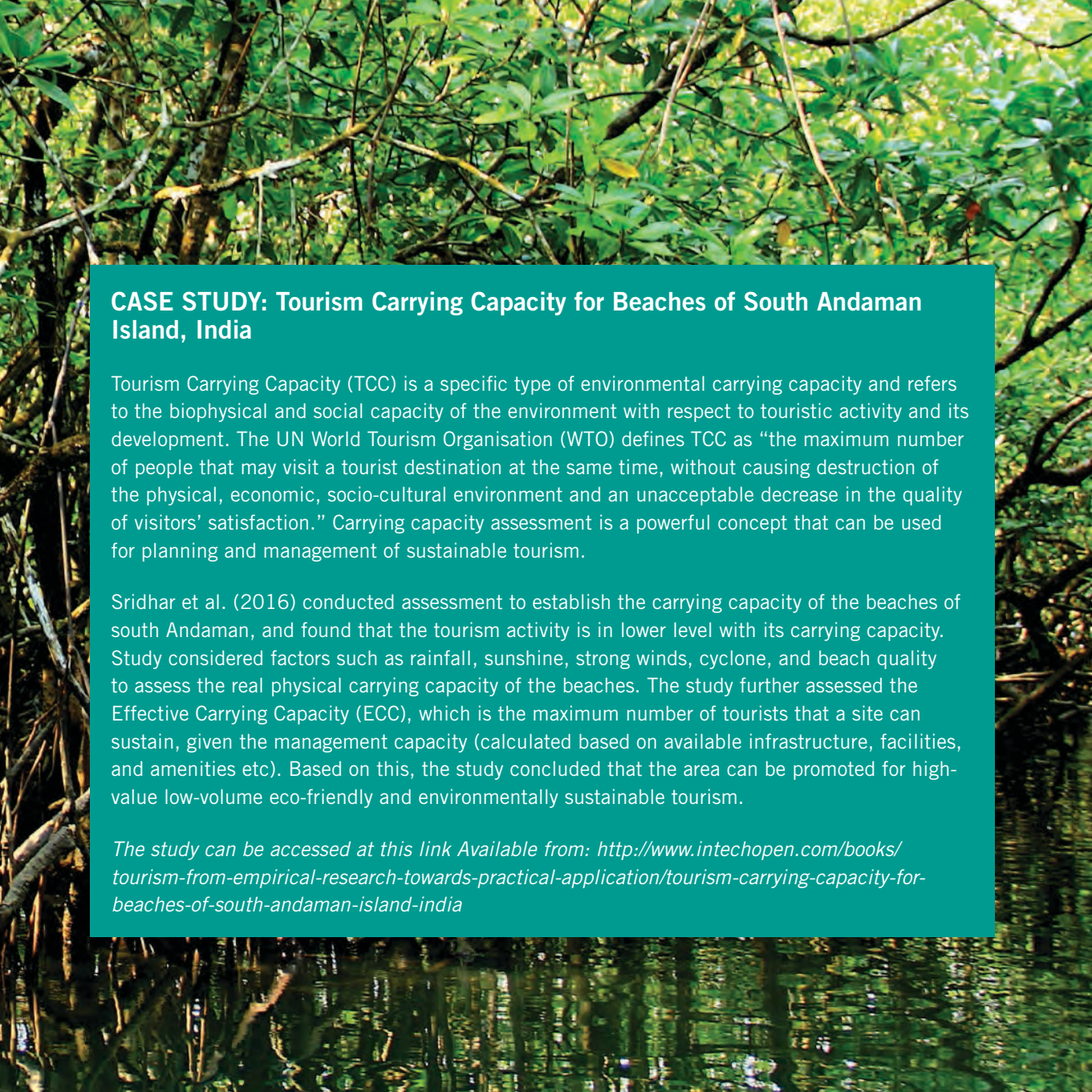

CASE STUDY: Tourism Carrying Capacity for Beaches of South Andaman Island, India

Tourism Carrying Capacity (TCC) is a specific type of environmental carrying capacity and refers to the biophysical and social capacity of the environment with respect to touristic activity and its development. The UN World Tourism Organisation (WTO) defines TCC as "the maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction." Carrying capacity assessment is a powerful concept that can be used for planning and management of sustainable tourism.

Sridhar et al. (2016) conducted assessment to establish the carrying capacity of the beaches of south Andaman, and found that the tourism activity is in lower level with its carrying capacity. Study considered factors such as rainfall, sunshine, strong winds, cyclone, and beach quality to assess the real physical carrying capacity of the beaches. The study further assessed the Effective Carrying Capacity (ECC), which is the maximum number of tourists that a site can sustain, given the management capacity (calculated based on available infrastructure, facilities, and amenities etc). Based on this, the study concluded that the area can be promoted for high-value low-volume eco-friendly and environmentally sustainable tourism.

The study can be accessed at this link Available from: http://www.intechopen.com/books/tourism-from-empirical-research-towards-practical-application/tourism-carrying-capacity-for-beaches-of-south-andaman-island-india

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