Training Resource Material:

Communicating Coastal and Marine Biodiversity Conservation and Management Through the Media

Module 2

Setting the context: Why are the coasts important?

For Media Professionals, Students and Trainers

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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Summary

This is the most comprehensive and time-intensive module of the course, and it sets the foundation of the issues of coastal and marine conservation for media. This module places the topic of coastal and marine biodiversity conservation into the overall development context, and looks into the interrelationship of conservation and economic development, the positive benefits that coastal and marine biodiversity brings to human societies via ecosystem services, the challenges in balancing conservation with the economic development, and a detailed understanding of the threats that the coastal and marine ecosystems are facing.

Imprint

Training Resource Material:
Communicating Coastal and Marine Biodiversity Conservation and Management Through the Media

Module 1: Introduction to biodiversity and ecosystem services
Module 2: Setting the context: Why are the coasts important?
Module 3: Coastal and marine protected areas
Module 4: Governance, law and policy framework for coastal and marine biodiversity
Module 5: Why do we not hear more about the coast?
Module 6: Mainstreaming coastal and marine biodiversity into overall development and environmental planning
Module 7: Interlinkages between coastal and marine biodiversity, climate change, natural disasters and coastal livelihoods

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Acronyms

BMT	Bohol Marine Triangle
CBD	Convention on Biological Diversity
CMFRI	Central Marine Fisheries Research Institute
COP	Conference of the Parties
CRZ	Coastal Regulation Zone
EEZ	Exclusive economic zone
FAO	Food and Agriculture Organization
GISP	Global Invasive Species Programme
MDGs	Millennium Development Goals
SDG	Sustainable Development Goals

Learning outcomes

After completing this module, the participants are able to:

- outline the economic benefits that coastal and marine biodiversity provides to different sectors
- appraise different development activities on the coast and their relationship with the ecosystem
- appreciate the concept of sustainability
- describe different types of coastal and marine habitats and summarize the threats that they face
- analyse the environmental challenges along the coast from the ecological as well as the economic viewpoints.

Key messages

- The eight Millennium Development Goals (MDGs), which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015—formed a blueprint agreed to by all the countries and all the leading development institutions. They have galvanized unprecedented efforts to meet the needs of the world's poorest. The MDGs have been replaced by the Sustainable Development Goals from 2015.
- At the Rio+20 meeting, two decades after the Earth Summit in Rio de Janeiro in 1992, it was decided to institute Sustainable Development Goals (SDGs) from 2015. Targets for achieving these goals have been set for either 2020 or 2030. Eradicating poverty was, once again, seen as the greatest challenge to humankind. Changing unsustainable patterns of production and consumption and promoting sustainable ones were major priorities, and managing the natural resource base was seen as essential to achieving such sustainable practices.
- It is estimated that nearly 250 million people live within 50 km of the coastline in India and are dependent on the rich coastal and marine resources. Therefore, the ecological services of the marine and coastal ecosystems play a vital role in India's economic growth and the welfare of its citizens.

- Today, human activities are threatening the seas and coasts greatly through overfishing, destructive fishing practices, pollution and waste disposal, agricultural runoff, invasive alien species and habitat destruction. Global climate change will make matters worse. Sea levels will rise, water temperatures will increase, oceans will become acidified and there will be more storms and natural disasters.
- India is one of the 12 mega biodiversity countries and has a few of the 25 biodiversity hotspots, which are the richest eco-regions of the world. Hotspot is indicative of being highly endangered, as well as rich in endemic species.
- Approximately 60 per cent (15 out of 24) of the ecosystem services evaluated in the Millennium Ecosystem Assessment (including 70 per cent of regulating and cultural services) are being degraded or used unsustainably. The loss of biodiversity at the habitat, species and genetic levels is enormous.
- The consequences of the biodiversity loss and resulting ecosystem services loss have a far-reaching impact on the livelihoods and overall well-being of human communities.
- Valuing ecosystem services will provide policymakers with a strong rationale to improve coastal and marine ecosystem management and invest in conservation for its risk management value and economic benefits. In order to fully leverage the ecological and economic knowledge of ecosystems and services, there is a need to generate and provide access to better data regarding ecosystem services.

Key terms

Millennium Development Goals; Sustainable Development Goals; threat to marine biodiversity; invasive species; coastal pollution; marine debris; economics, ecosystems and biodiversity sustainable development; ecosystem services; livelihood security; ecosystem valuation; coastal infrastructure development; threats to coastal and marine biodiversity.

2.1 The overall development context

2.1.1 WHAT ARE THE SUSTAINABLE DEVELOPMENT GOALS?

The sustainable development goals (SDGs) are a new, universal set of goals, targets and indicators that UN member states are expected to use to frame their agendas and political policies over the next 15 years. The SDGs follow, and expand on, the Millenium Development Goals (MDGs).

The Millennium Development Goals (MDGs) consisted of eight international development goals established after the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration. The MDGs have been replaced by the Sustainable Development Goals from 2015.

There is broad agreement that while the MDGs provided a focal point for governments on which to hinge their policies and overseas aid programmes to end poverty and improve the lives of poor people – as well as provide a rallying point for NGOs to hold them to account – they have been criticised for being too narrow.

From an economic perspective, the coastal and marine ecosystems are of great importance as they provide a wide range of ecosystem goods and services. Approximately 20 per cent of India's population lives in coastal areas, with a large proportion based in coastal urban centres such as Mumbai, Chennai and Kolkata. For those who live along the coast, the fisheries sector is vital, providing employment to over 6 million people, and accounts for 1.07 per cent of India's total GDP.

The eight MDGs – failed to consider the root causes of poverty, or gender inequality, or the holistic nature of development. The goals made no mention of human rights, nor specifically addressed economic development.

2.1.2 WHAT ARE THE PROPOSED 17 SDG GOALS?

1. End poverty in all its forms everywhere
2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
3. Ensure healthy lives and promote wellbeing for all at all ages
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation
10. Reduce inequality within and among countries
11. Make cities and human settlements inclusive, safe, resilient and sustainable
12. Ensure sustainable consumption and production patterns
13. Take urgent action to combat climate change and its impacts (taking note of agreements made by the UNFCCC forum)
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Strengthen the means of implementation and revitalise the global partnership for sustainable development

Within the goals are a proposed 169 targets. Proposed targets under goal 1, for example, include reducing by at least half the number of people living in poverty by 2030, and eradicating extreme poverty (people living on less than $1.25 a day). Under Goal 5, there's a proposed target on eliminating violence against women. Under Goal 16 sits a target to promote the rule of law and equal access to justice.

2.1.3 HOW WERE THE GOALS CHOSEN?

Establishing post-2015 goals was an outcome of the Rio+20 summit in 2012, which mandated the creation of an open working group to come up with a draft set. The open working group, with representatives from 70 countries, had its first meeting in March 2013 and published its final draft, with its 17 suggestions, in July 2014. The draft was presented to the UN general assembly in September. Alongside the open working group, the UN conducted a series of "global conversations", which included 11 thematic and 83 national consultations, and door-to-door surveys. It also launched an online My World survey asking people to prioritise the areas they'd like to see addressed in the goals. The results of the consultations fed into the working group's discussions.

On the next page, we see the goals and specific targets that are specifically relevant to conserving coastal and marine biodiversity.

Goal 12: Ensure sustainable production and consumption.

Target 12.4: By 2020, achieve environmentally sound management of chemicals and all wastes throughout their life cycle and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment.

Marine pollution occurs when harmful impacts arise from the entry into the ocean of chemicals; particles; or industrial, agricultural and residential waste or the spread of invasive organisms. Most marine pollution originates from the land. It often comes from farm runoff, which contains fertilizers and pesticides. The ocean can also be contaminated by excessive inputs of nutrients such as untreated sewage and other biological waste. This is a primary cause of eutrophication of surface waters, in which excess nutrients, usually nitrogen or phosphorus, stimulate the growth of algae.

Goal 13: Take urgent action to combat climate change and minimize its impacts.

At the UN climate change conference in Copenhagen in 2009, political leaders agreed to limit the temperature rise to 2°C to contain the catastrophic impacts of climate change. Failure to do so could, among other consequences, raise sea levels by up to 1 m, flooding low-lying coastal areas, including mega cities such as New York and Mumbai, which are located in such areas.

Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Target 14.1: By 2025, reduce marine pollution of all kinds, particularly from land-based activities.

Target 14.2: By 2020, manage and protect marine and coastal ecosystems, including by strengthening their resilience.

Target 14.3: Address the impacts of ocean acidification.

Target14.4: By 2020, regulate fishing, end overfishing, illegal fishing and destructive fishing practices and implement management plans to restore fish stocks.

Target 14.5: By 2020, conserve at least 10 per cent of coastal and marine areas.

Target 14.6: By 2020, prohibit certain forms of fisheries subsidies.

Target 14.7: By 2030, increase the economic benefits to least developed countries from the sustainable use of marine resources, including through management of fisheries, aquaculture and tourism.

Target 14.a: Increase scientific knowledge, develop research capacities and transfer marine technology to improve ocean health and enhance the contribution of marine biodiversity to the development of developing countries.

Target 14.b: Provide access to marine resources and markets to small-scale artisanal fishers.

Target 14.c: Ensure the full implementation of international laws.

See more at https://sustainabledevelopment.un.org/

2.2 Inter-linkages between ecosystem services and overall human well-being

2.2.1 Sustainable coastal livelihoods

A livelihood is a means of making a living and comprises the necessary capabilities, assets (stores, resources, claims and access) and activities required for a means of living (Chambers and Conway, 1991). In coastal areas, the major determinants of livelihood security are the availability of natural resources and access to these resources.

Over 500 million people in developing countries depend, directly or indirectly, on fisheries and aquaculture for their livelihoods.[1] There are approximately 15 million fish workers employed aboard decked and undecked fishing vessels in the marine capture fisheries sector.

A livelihood is sustainable and secure when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation. It contributes net benefits to other livelihoods at the local and global levels and in the short and long term.[2] A livelihood is socially sustainable when it is able to cope with stress (declining resources, climate variability) and shocks (natural disasters), and retains its ability to continue and improve or, in other terms, when it is less vulnerable to stresses and shocks. A livelihood is environmentally sustainable when the natural resources and ecosystem services are being utilized for livelihood activities at a rate and in a manner that do not pose any threats to the natural ecosystems and the ecosystem services.

Both aspects of livelihood sustainability—social and environmental—are fundamentally affected by the type, amount and sustainability of ecosystem services. The consequences of biodiversity loss and

1 Partnership on Climate Change, Fisheries and Aquaculture. 2009. Fisheries and aquaculture in our changing climate. UNEP.
2 Chambers, R., Conway, G.R. 1991. *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century.* Institute of Development Studies DP 296. University of Sussex, Brighton.

ecosystem disruption, therefore, are often harshest for the rural poor, who are highly dependent on these local services for their livelihoods and who are often the least able to access or afford alternatives when these become degraded. These impacts are highest in mountain and coastal communities and these ecosystems are also the most vulnerable as far as the negative impacts of climate change are concerned. In fact, the Millennium Ecosystem Assessment has confirmed that biodiversity loss poses a significant barrier to meeting the needs of the world's poorest, as set out in UN Sustainable Development Goal 1 (to end poverty everywhere) and Target 1.1 (by 2030, to eradicate extreme poverty, currently measured by the number of people living on less than $1.25 a day).

The Millennium Ecosystems Assessment uses the concept of well-being, which is much more inclusive than livelihood (Figure 2.1).

The consequences of biodiversity loss and the resulting loss of ecosystem services have a far-reaching impact on livelihoods and overall well-being of human communities. Human well-being has multiple constituents, including basic material for a good life, freedom of choice, health, good social relations and security. Well-being is at the opposite end of a continuum from poverty, which has been defined as a 'pronounced deprivation in well-being.' The constituents of well-being, as experienced and perceived by people, are situation-dependent, reflecting local geography, culture and ecological circumstances.

Marine fish and invertebrates are among the last sources of wild food on the planet, providing over 2.6 billion people with at least 20 per cent of their average per capita protein intake. Moreover, the world's oceans host 32 of the 34 known phyla on Earth and contain somewhere between 500,000 and 10 million marine species. Species diversity is known to be as high as 1000 per square metre in the Indo-Pacific Ocean, and new oceanic species are continuously being discovered, particularly in the deep sea. It is therefore not surprising that the genetic resources in the oceans and coasts are of actual and potential interest for commercial uses.

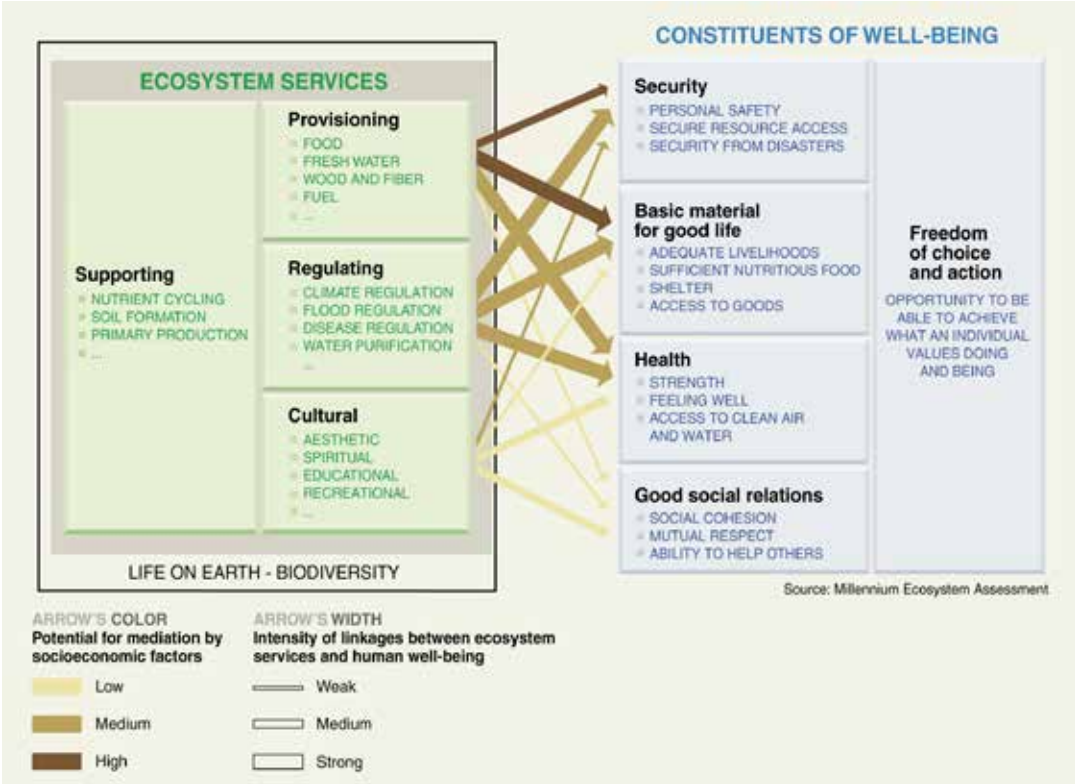


Figure 2.1: Ecosystem services and their inter-relationships with overall human well-being

2.2.2 Loss of biodiversity and ecosystem services

Approximately 60 per cent (15 out of 24) of the ecosystem services evaluated in the Millennium Ecosystem Assessment (including 70 per cent of regulating and cultural services) are being degraded or used unsustainably. Loss of biodiversity at the habitat, species and genetic levels is enormous.

The ecosystem services that have been degraded over the past 50 years include capture fisheries, water supply, waste treatment and detoxification, water purification, natural hazard protection, regulation of air quality, regulation of regional and local climate, regulation of erosion, spiritual fulfilment and aesthetic enjoyment. The use of two ecosystem services—capture fisheries and fresh water—is now well beyond levels that can be sustained even at current demands, much less future ones. At least one quarter of important commercial fish stocks are overharvested (high certainty). The quantity of fish caught by humans increased until the 1980s but is now declining because of the shortage of stocks.

From 5 per cent to possibly 25 per cent of global freshwater use exceeds long-term accessible supplies. It is now met either through engineered water transfers or overdraft of groundwater supplies (low to medium certainty). Some 15–35 per cent of irrigation withdrawals exceed supply rates and are therefore unsustainable (low to medium certainty).

Out of 24, only 4 ecosystem services have been enhanced in the past 50 years, 3 of which involve food production: crops, livestock and aquaculture. Terrestrial ecosystems were on average a net source of CO_2 emissions during the 19th and early 20th centuries, due to widespread deforestation, but became a net sink around the middle of the last century due to reforestation efforts. Thus, in the last 50 years, the role of ecosystems in regulating global climate through carbon sequestration has also been enhanced.

The Ecological Footprint

MEASURES

how fast we consume resources and generate waste

2.3 Concept of sustainable development

2.3.1 Basics of the concept of sustainable development

- It is defined in many ways, but the most frequently quoted definition is from Our Common Future, also known as the Brundtland Report [http://www.un-documents.net/wced-ocf.htm]:

  'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

- It contains within it two key concepts:
  - the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
  - the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

"To sustain progress in human development, far more attention needs to be paid to the impact human beings are having on the environment.

The goal is high human development and a low ecological footprint per capita. Only a few countries come close to creating such a globally reproducible high level of human development without exerting unsustainable pressure on the planet's ecological resources."

[The United Nations Human Development Report 2013]

The report prominently featured countries' performance as proposed by Global Footprint Network: how much human well-being do countries generate (as measured by the UNDP's Human Development Index (HDI)) at what level of resource demand (as measured by the Ecological Footprint).

HDI is an indicator of human development that measures a country's achievements in the areas of longevity, education, and income. The Ecological Footprint is a measure of a population's demand on nature and can be compared to the available biocapacity. The basic premise of integrating the two into one science-based measurement framework is that sustainable human development depends on achieving great lives for all, within the resource budget available to the population. The latter means adequate access to ecological assets over the long-term. We are increasingly reminded that human welfare is critically dependent on healthy ecological assets.

For further details, and to view the Human development Index Report 2015 visit the website http://hdr.undp.org/en

2.3.2 An interesting example to understand the concept of sustainable development: Ecological Footprint

2.3.2.1 WHAT IS AN ECOLOGICAL FOOTPRINT?

The biologically productive area needed to produce the resources used and absorb the waste generated by that organism

Just as a bank statement tracks income against expenditures, Ecological Footprint accounting measures a population's demand for and ecosystems' supply of resources and services.

Ecological Footprint is widely used as an indicator of environmental sustainability. It is used to explore the sustainability of individual lifestyles, goods and services, organizations, industry sectors, regions and nations. It is a way of determining relative consumption for the purpose of educating people about their resource use and, sometimes, triggering them to change how they consume.

In this context development can be considered sustainable when it 'meets the needs of the present without compromising the ability of future generations to meet their own needs.

Ecological Footprint Accounting thus addresses whether the planet is large enough to keep up with the demands of humanity.

Our current global situation: Since the 1970s, humanity has been in ecological overshoot with annual demand on resources exceeding what Earth can regenerate each year.

The Ecological Footprint measures the supply of and demand on nature. On the supply side biocapacity represents the planet's biologically productive land areas including our forests, pastures, cropland and fisheries. These areas, especially if left unharvested, can also absorb much of the waste we generate, especially our carbon emissions.

The Ecological Footprint represents the productive area required to provide the renewable resources humanity is using and to absorb its waste. The productive area currently occupied by human infrastructure is also included in this calculation, since built-up land is not available for resource regeneration

At our current rates of consumption and waste production, it takes the Earth one year and six months to regenerate the resources what we use in a year [Source: Global Footprint Network website http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_basics_overview/]

2.3.2.2 CAN WE CALCULATE HOW BIG OUR ECOLOGICAL FOOTPRINT IS?

- We can measure most of the resources we consume and many of the wastes we generate.
- These measurements can be converted to corresponding areas of productive land or sea.

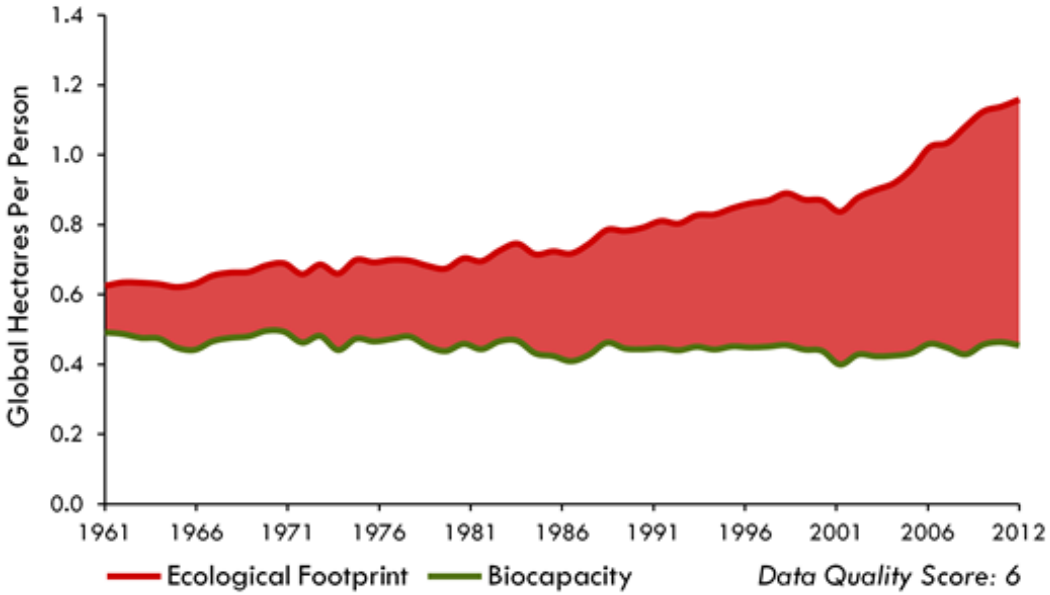


Figure 2.2: Ecological Footprint and biocapacity in India since 1961. Both are measured in global hectares. Biocapacity per person varies each year with ecosystem management, agricultural practices (such as fertilizer use and irrigation), ecosystem degradation, weather, and population size. Footprint per person varies with consumption amounts and production efficiency

[Source: http://www.footprintnetwork.org/en/index.php/GFN/page/trends/india/]

2.3.2.3 THINGS INCLUDED IN YOUR ECOLOGICAL FOOTPRINT

1. To produce your food:
    - croplands and orchards
    - forests
    - pastures and rangelands
2. Your energy requirements:
    - fuel for vehicles for transport and cooking food
3. Your housing requirements:
    - land, bricks, cement, electricity and water
4. Fertilizers and pesticides
    - land required for production plant
5. Drugs and medicines
    - land required for production plant
    - raw material
6. Packaging and refrigerating food
    - packaging material and refrigeration plant
7. To absorb the waste you generate
    - paper
    - plastic
    - glass
    - biological waste

2.3.2.4 SOME EXAMPLES OF HOW TO CALCULATE THE ECOLOGICAL FOOTPRINT

Example 1: A cooked meal of fish and rice would require bioproductive land for the rice, bioproductive sea for the fish and forested 'energy' land to absorb the carbon emitted during the processing and cooking.

Example 2: Driving a car requires built land for roads, parking and so on, as well as a large amount of forested energy land to absorb the carbon emissions from petrol use. In addition, energy and materials are used for construction and maintenance.

2.3.2.5 WHY WOULD WE WANT TO KNOW HOW BIG OUR FOOTPRINT IS?

For system analysis:

- ecosystem services
- organisms and the ecosystem
- human demand vs ecological supply

How do I know my individual ecological footprint?

http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/

2.3.2.6 HOW CAN WE REDUCE OUR ECOLOGICAL FOOTPRINT?

- Reduce the use of fossil fuel.
- Buy organic food.
- Use less packaging.
- Buy fresh instead of processed food.
- Eat less meat.
- Eat food grown locally, rather than transported.

Water footprint: http://waterfootprint.org/media/downloads/Hoekstra2008-Ecological-versus-WaterFootprint.pdf

Carbon footprint: http://www.carbonfootprint.com/calculator.aspx

Watch this film:

Green Ninja:
Footprint Renovation

www.youtube.com/watch?v=UeYOZgbgG1Q

Watch this film:

How much Nature do we have? How much do we use? | Mathis Wackernagel | TEDx-SanFrancisco

www.youtube.com/watch?v=3M29BY86bP4

Be AWARE!!

The Earth Overshoot Day !

Global overshoot occurs when humanity's annual demand for the goods and services that our land and seas can provide—fruits and vegetables, meat, fish, wood, cotton for clothing, and carbon dioxide absorption—exceeds what Earth's ecosystems can renew in a year. Overshoot means we are drawing down the planet's principal rather than living off its annual interest. This overshoot leads to a depletion of Earth's life-supporting natural capital and a buildup of carbon dioxide in the atmosphere

http://www.overshootday.org/

2.4 The Indian situation vis-à-vis coastal development and biodiversity: Key information and statistics

India accounts for less than 0.25 per cent of the world's total coastline. However, 60 million people live along these coasts (approximately 11 per cent of the world's coastal population). The 77 coastal districts (out of the total of 593 in the country) house 17 per cent of the total population of India. Of India's 8100 km long coast, 5423 km is in peninsular India and 2094 km in the Andaman, Nicobar and Lakshadweep islands. The exclusive economic zone (EEZ) extends over 2.02 million km^2. In terms of the marine environment, India has a coastline of about 8000 km. The EEZ of the country has an area of 2.02 million km^2, comprising 0.86 million km^2 on the west coast, 0.56 million km^2 on the east coast and 0.6 million km^2 around the Andaman and Nicobar Islands. An estimated 4.06 million people depend on marine fisheries for their livelihoods in India and the sector contributed ₹573.69 billion to the GDP (at current prices) during 2010-2011

Adjoining the continental regions and the offshore islands are a wide range of coastal ecosystems such as estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches and coral reefs, which are characterized by unique biotic and abiotic properties and processes.

The natural habitats of India constitute the major repository of biological diversity in the country. They include treeless stretches of hot and cold deserts, open boulder-strewn areas, areas covered with permanent ice, wet and dry grasslands, swamps and bogs. Tree cover—made up of isolated patches of trees greater than 1 ha in extent— with a density of more than 10 per cent are considered together and referred to as forest and tree cover. According to this definition, many coastal ecosystems also contain forests.

According to the Zoological Survey of India, India is perhaps the only Asian country that has a long record of inventorying coastal and marine biodiversity, going back at least two centuries. For instance, an authoritative 'short history' of the Laccadive and Minicoy Islands was written by R.H.

Ellis in 1924. However, there is so much diversity in space, time and taxonomical diversity that it is almost impossible to review all the records and reports. The synthesis of what is known about the coastal and marine biodiversity of India that is attempted in this overview relies mainly on systematic accounts, records and reports of two major institutions concerned with surveying and inventorying fauna and flora, the Zoological Survey of India, and the Botanical Survey of India as well as other research organizations such as the Central Marine Fisheries Research Institute (CMFRI) and the National Institute of Oceanography.

It is estimated that nearly 250 million people live within 50 km of the coastline. There are 77 cities along the coasts of India, including some of the largest in the country—Kolkata, Mumbai, Chennai, Kochi and Vishakhapatnam. Large cities and townships also support a large section of poverty-ridden people, the section most vulnerable to climate change. Thus, coastal areas in India are of great economic importance.

2.5 The economic importance of coasts and ways to give them value

2.5.1 Overview

From time immemorial, human beings have been drawn towards nature and its services. However, the non-judicious use of natural resources has led to a stage of evolution when the rate of natural extinction has surpassed all previous rates. The causes of ecosystem degradation and biodiversity loss have been well documented in the Millennium

Ecosystem Assessment of 2005 (MEA 2005), which also lists the many kinds of values delivered to society and the economy by nature. It also includes some of the ecosystem services. Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services (such as providing food and water); regulating services (such as flood and disease control); cultural services (such as spiritual, recreational, and cultural benefits); and supporting services (such as nutrient cycling), which maintain the conditions for life on Earth. [Refer to Module 1]

On the question of why there is a need for measuring the value of nature, the most appropriate answer would be that the aim of defining and measuring the value of the natural environment is to better inform management choices, and influence human behaviour. Valuing ecosystem services would provide policy-makers with a strong rationale to improve coastal and marine ecosystem management and invest in conservation for its risk management value and economic benefits. In order to fully leverage ecological and economic knowledge of ecosystems and services, it is necessary to generate and provide access to better data regarding ecosystem services.

2.5.2 Economic value of biodiversity and its valuation

Economic valuation offers a way to compare the diverse benefits and costs associated with ecosystems by attempting to measure them and expressing them in a common denominator—typically a monetary unit. The main framework used is the Total Economic Value (TEV) approach. The breakdown and terminology vary slightly from analyst to analyst, but generally include (i) direct use value, (ii) indirect use value, (iii) option value, and (iv) non-use value. The first three are generally referred to together as 'use value'.

Environmental valuation is largely based on the assumption that individuals are willing to pay for environmental gains and, conversely, are willing to accept compensation for some environmental losses. The individual demonstrates preferences, which, in turn, place values on environmental resources. That society values environmental resources is certain; monetizing the value placed on changes in environmental assets such as coastal areas and water quality is far more complex. Environmental economists have developed a number of market and non- market-based techniques to value the environment.

2.5.2.1 DIRECT USE VALUES

Direct use values refer to ecosystem goods and services that are used directly by humans. These include the value of consumptive uses such as harvesting of food products, timber for fuel or construction, and medicinal products and hunting of animals for consumption, and the value of non-consumptive uses such as the enjoyment of recreational and cultural activities that do not require harvesting of products. Direct use values are most often enjoyed by people visiting or residing in the ecosystem itself.

2.5.2.2 INDIRECT USE VALUES

Indirect use values are derived from ecosystem services that provide benefits outside the ecosystem itself. Examples include natural water filtration which often benefits people far downstream, the storm protection function of mangrove forests which benefits costal properties and infrastructure, and carbon sequestration which benefits the entire global community by abating climate change.

2.5.2.3 OPTION VALUES

Option values are derived from preserving the option to use in the future ecosystem goods and services that may not be used at present, either by oneself (option value) or by others/heirs (bequest value). Provisioning, regulating, and cultural services may all form part of option value to the extent that they are not used now but may be used in the future.

2.5.2.4 NON-USE VALUES

Non-use values refer to the enjoyment people may experience simply by knowing that a resource exists even if they never expect to use that resource directly themselves. This kind of value is usually known as existence value (or, sometimes, passive use value).

2.5.3 Valuation techniques

There are three families of valuation techniques: market based techniques, revealed preference and stated preference.

2.5.3.1 MARKET-BASED TECHNIQUES

These use evidence from markets in which environmental goods and services are traded, markets in which they enter into the production functions for traded goods and services, or markets for substitutes or alternative resources.

Example: To understand the economic benefits generated from coastal and marine habitats and ecosystems in Bohol Marine Triangle (BMT) in the Philippines as a basis for sustaining the use of natural resources in the area. BMT area has rich biodiversity and the local community is dependent on the coastal and marine resources of the area. The study combined market-based valuation of economic activities (fisheries, tourism, and seaweed farming) and value transfer methods for nonmarketed impacts (biodiversity conservation, flood protection, fish nursery function). The accumulated total net benefit for the BMT natural resources over a 10-year period was found to be US$11.54 million (with a 10% discount rate). This led to officials in allocating resources for maintaining the ecosystems of BMT.

2.5.3.2 REVEALED PREFERENCE METHODS

These are based on deducing the value of ecosystem services by interpreting observed human behaviour.

Example: The decision-makers were faced with the issue of eutrophication in the Stockholm archipelago. They carried out the analysis of the benefits and costs of reducing the eutrophication in the Stockholm archipelago. For this evaluation, it was assumed that a reduction in eutrophication would lead to an increase in water transparency, which would increase both ecological health and human enjoyment of the area. It was also assumed that a 40 per cent reduction in nitrogen load was needed to achieve a one-metre increase in transparency, through a combination of measures including increased sewage water treatment and reduced fertilizer use. The total costs of such measures were estimated to be SEK 57 million per year. The benefits of the reduction of eutrophication were estimated to be about SEK 60 million per year for recreational benefits (travel cost method) and SEK 500 million per year for all conservation benefits (contingent valuation method). However, the analysis indicates that the costs of reducing eutrophication could be justified purely by the recreation values and that when taking a full range of values into account the benefits could outweigh the costs by a ratio of 8:1 or more.

2.5.3.3 STATED PREFERENCE TECHNIQUES

These methods are based on surveys in which people give valuation responses in hypothetical situations. Some of the popular valuation methods are contingent valuation, choice experiments, value transfer.

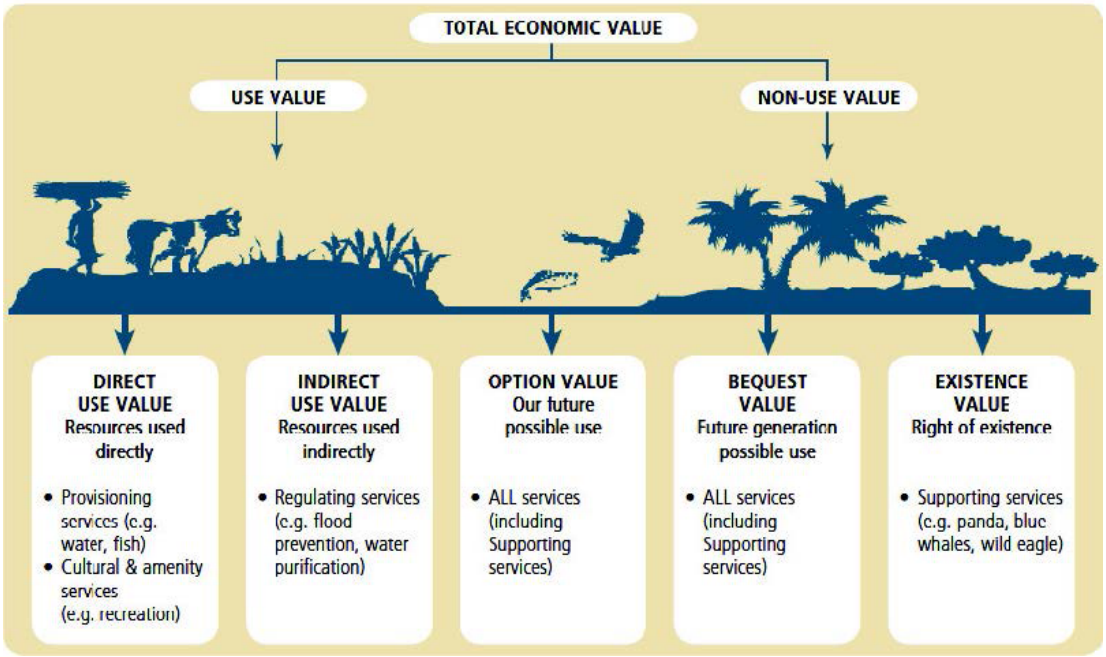


Figure 2.3: Total Economic Value

‘The economics of ecosystems and biodiversity’ (TEEB)

Key concepts

- Natural resources make important contributions to long-term economic performance and should be considered economic assets.
- We cannot manage what we do not measure. The loss of ecosystem services is often overlooked because most of them, such as soil retention or spiritual values, are public goods and services.
- Subsidies to fisheries, fossil fuel industries and other potentially harmful activities should be measured and reported annually; the perverse components of these subsidies should be tracked, reduced, and eventually phased out altogether.

Three stages

- Demonstration– the identification and measurement of the flow of ecosystem services and their values.
- Appropriation–capturing some or all of the demonstrated and measured values of ecosystem services so as to provide incentives for their sustainable provision.
- Benefit sharing–appropriation mechanisms are designed in such a manner that the captured ecosystem services benefits are distributed to those who bear the costs of conservation.

Put a Value on Nature! Pavan Sukhdev TED Talk

http://www.youtube.com/watch?v=oU9G2E_RYJo

TEEB–India

- Launched a national study in February 2011.
- The process aims to recognize and harness the economic valuation of biodiversity and ecosystem services.
- Action at three levels:
  - Policy making
  - Business
  - Citizen awareness.
- Three sectoral areas:
  - Forest ecosystems
  - Inland wetland ecosystems
  - Coastal and marine ecosystems.
- Three-tier structure to implement TEEB—India project:
  - Steering committee
  - Scientific and technical advisory group
  - Expert working groups

http://www.indo-germanbiodiversity.com/sub2-project-details-teeb_india_initiative_(tii).html

2.6 Status and trend: Loss of biodiversity and ecosystem services

2.6.1 Current status of biodiversity loss:

Changes being made in ecosystems are increasing the likelihood of nonlinear changes (including accelerating, abrupt and potentially irreversible changes), with important consequences for human well-being:

- Fisheries collapse
- Eutrophication and hypoxia (deprivation of oxygen)
- Disease emergence
- Species introductions and losses
- Climate change and natural disasters

The loss of marine biodiversity is increasingly impairing the ocean‘s capacity to provide food and other market and non-market services, and the trend of biodiversity loss is accelerating on a global scale. Coastal habitats are under pressure, with approximately 20% of the world’s coral reefs lost and another 20% degraded. Mangroves have been reduced to 30 to 50% of their historical cover12, impacting biodiversity, habitat for inshore fisheries, and carbon sequestration potential. 29% of seagrass habitats are estimated to have disappeared since the late eighteen hundreds. Over 80% of the world’s 232 marine ecoregions reported the presence of invasive species which is the second most significant cause of biodiversity loss on a global scale and the marine bio-invasion rates have been reported as high as up to one invasion every nine weeks. As with non-point source pollution, the challenge is as much institutional inertia as it is scientific consensus in terms of dealing with loss of biodiversity and habitat, and increasing both protection and restoration efforts.

According to the findings of Millennium Ecosystem Assessment"

- Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history.
- This has resulted in a substantial and largely irreversible loss in the diversity of life on earth.

Unprecedented change in ecosystems

- More land was converted to cropland in the 30 years after 1950 than in the 150 years between 1700 and 1850. 20 per cent of the world's coral reefs were lost and 20 per cent degraded in the last several decades.
- 35 per cent of the mangrove area has been lost in the last several decades Amount of water in reservoirs quadrupled since 1960.
- Withdrawals from rivers and lakes doubled since 1960.

Unprecedented change: Biogeochemical Cycles since 1960:

- Flows of biologically available nitrogen in terrestrial ecosystems doubled. Flows of phosphorus tripled.
- > 50 per cent of all the synthetic nitrogen fertiliser ever used has been used since 1985.
- 60 per cent of the increase in the atmospheric concentration of CO2 since 1750 has taken place since 1959.

Significant and largely irreversible changes to species diversity

- The distribution of species on earth is becoming more homogenous. Humans have increased the species extinction rate by as much as 1,000 times over background rates typical over the planet's history (medium certainty).
- 10–30 per cent of mammal, bird and amphibian species are currently threatened with extinction (medium to high certainty).

2.6.2 Facts and figures on marine biodiversity:

- By the year 2100, without significant changes, more than half of the world's marine species may stand on the brink of extinction.
- Today 60% of the world's major marine ecosystems that underpin livelihoods have been degraded or are being used unsustainably.
- Approximately 12% of the land area is protected, compared to roughly 1% of the world ocean and adjacent seas.
- Ocean acidification may threaten plankton, which is key to the survival of larger fish.
- If the concentration of atmospheric CO2 continues to increase at the current rate, the ocean will become corrosive to the shells of many marine organisms by the end of this century. How or if marine organisms may adapt is not known.
- Ocean acidification may render most regions of the ocean inhospitable to coral reefs, affecting tourism, food security, shoreline protection, and biodiversity.
- Commercial overexploitation of the world's fish stocks is so severe that it has been estimated that up to 13 percent of global fisheries have 'collapsed.'
- Agricultural practices, coastal tourism, port and harbour developments, damming of rivers, urban development and construction, mining, fisheries, aquaculture, and manufacturing, among others, are all sources of marine pollution threatening coastal and marine habitats.
- Excessive nutrients from sewage outfalls and agricultural runoff have contributed to the number of low oxygen (hypoxic) areas known as dead zones, where most marine life cannot survive, resulting in the collapse of some ecosystems. There are now close to 500 dead zones covering more than 245,000 km² globally, equivalent to the surface of the United Kingdom.
- Between 1980 and 2005, 35,000 square kilometers of mangroves were removed globally. Between 30 and 35 percent of the global extent of critical marine habitats such as seagrasses, mangroves and coral reefs are estimated to have been destroyed.
- Technological change and the emergence of new economic opportunities such as deep sea mining, more intensive fishing, and deeper oil and gas drilling increase risks to areas that historically were not under threat.

Source: http://www.unesco.org/new/en/natural-sciences/ioc-oceans/focus-areas/rio-20-ocean/blueprint-for-the-future-we-want/marine-biodiversity/facts-and-figures-on-marine-biodiversity/

2.7 Challenges in managing coastal and marine biodiversity

2.7.1 Overview and DPSIR Framework

This tremendous wealth of biodiversity and ecosystem services is not infinite. Today, human activities are greatly threatening the seas and coasts through overfishing, destructive fishing practices, pollution and waste disposal, agricultural runoff, invasive alien species, and habitat destruction. Global climate change will make it worse. Sea levels will rise, water temperature will increase, oceans will acidify, and there will be more storms and natural disasters.[1]

Let's take a closer look at how these stress factors generate impacts on the coastal and marine ecosystems and consequently on the life and livelihoods of coastal communities.

1 IYB CBD Factsheet on Marine and Coastal Biodiversity

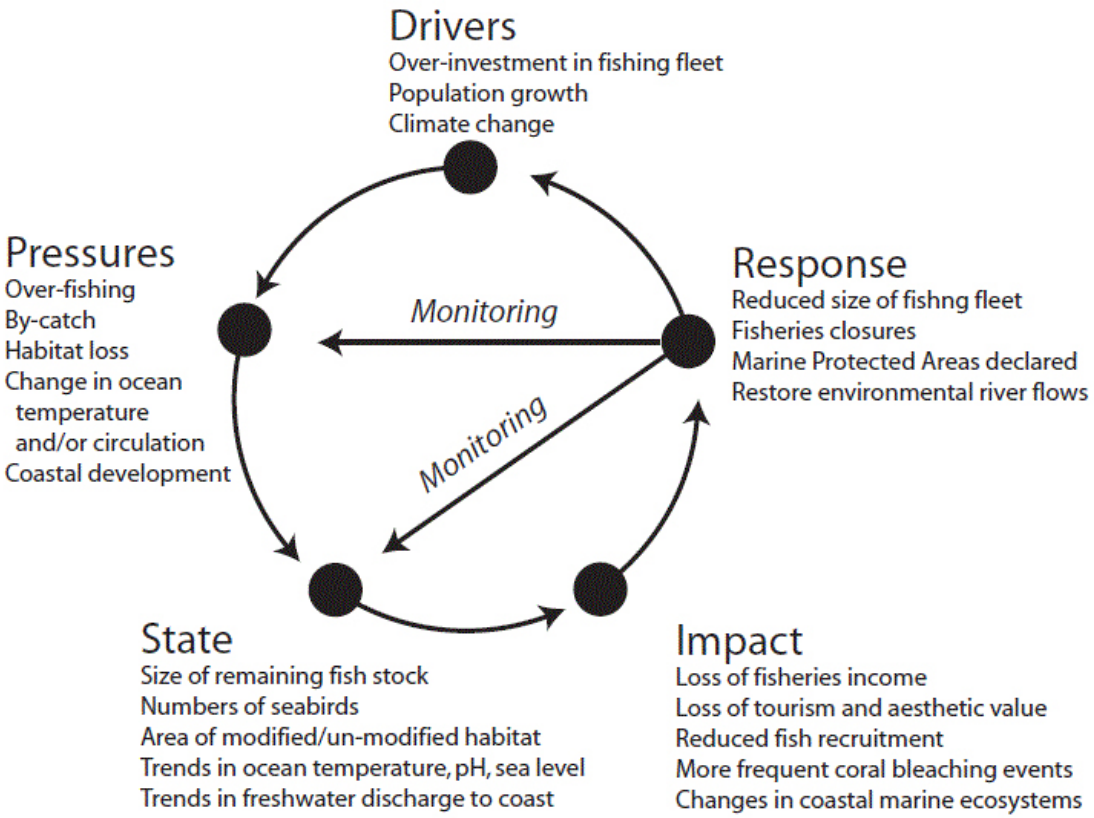


Figure 2.4: DPSIR in the context of coastal and marine ecosystems

[Source: http://www.worldoceanassessment.org/wp-content/uploads/2012/06/DPSIR9.gif]

2.7.2 Unsustainable fishing

There are many inter-related issues affecting the sustainability of fisheries, including overcapacity in fishing fleets and a related increase in illegal, unregulated and unreported (IUU) fishing, a failure to take into consideration ecosystem effects of fishing into management plans (e.g. bycatch, discards, destructive fishing practices), lack of incentives-based management, weak monitoring, control and surveillance capacity and inability and/or unwillingness to accept short-term costs for long-term benefits. The continuing contribution of fisheries to sustainable development depends on the health of functioning, productive ecosystems and on their optimal utilisation.

Coastal fish farming is increasing and will continue to increase and expand in the marine environment as the demand for food fish increases and as freshwater becomes more limited. Mariculture with fed species, if not managed properly, could impact on biodiversity and ecosystem functions through the release of nutrients beyond the recycling capacity of ecosystems and through the release of farmed species, diseases and chemicals. The improvement in, and expansion of, green technologies for mariculture together with adoption of an ecosystem approach to aquaculture that includes identification and management of risks, can ensure sustainable increase in fish production from the seas.

About 80 per cent of world fish stocks, for which assessment information is available, are fully exploited or overexploited and thus require effective and precautionary management

According to the United Nations Food and Agriculture Organization (FAO), Fishing may alter or affect:

- the target resource (especially if it is overfished);
- species associated with or dependent on the target resource (such as predators or prey);
- trophic relationships within the ecosystem in which the fishery operates; and
- habitats in which fishing occurs.

The benefits lost to fishing nations as a consequence of overfishing are in the order of USD 50 billion per annum.

Overfishing and excessive fishing can reduce the spawning biomass of target species below desired levels such as maximum sustainable or economic yields. When there is sustained overfishing, changes in species composition and biodiversity can occur with a progressive reduction of large, long-lived and high value predator species and an increase in small, short-lived and lower value pelagic prey species, a process described as 'fishing down the food chain'. Intensive fishing can also reduce genetic diversity of wild populations.

Non-selective fishing gear that is not modified to exclude or otherwise deter the entanglement of non-target species may take a significant bycatch of juvenile fish, benthic animals, marine mammals, marine birds, vulnerable or endangered species. These are often discarded dead. While bycatch and discard problems are usually measured in the potential loss of human food, the increased risk of depletion for particularly vulnerable or endangered species (e.g. small cetaceans, turtles) can be significant. Ghost fishing can occur when certain gear such as pots or gillnets have either been lost or abandoned at sea and, although untended, continue to catch and kill fish until the gear falls apart.

Impacts on the sea floor can result from the intense use of trawls and other mobile bottom gear (e.g. dredges) and can change the sea floor structure, microhabitats, and benthic fauna. The activity is particularly damaging in sensitive environments, particularly in the case of long-term trawling/ dredging in the same area.

Fishing with dynamite and poisons can have severe and broad-reaching impacts, particularly on coral reefs.

Global Fisheries watch data website and video

http://www.globalfishingwatch.org/

https://www.youtube.com/watch?v=fn2JXmCUo30

2.7.3 Tourism

Tourism is a double-edged activity. It has the potential to contribute in a positive manner to socio-economic achievements but, at the same time, its fast and sometimes uncontrolled growth can be the major cause of degradation of the environment and loss of local identity and traditional cultures.

Coastal tourism is a key component of coastal and marine economies. It is, in many countries, the fastest growing area of contemporary tourism, which has placed increasing pressure on the coast. These are often areas in which uses may already be highly concentrated in the form of agriculture, human settlements, fishing, industry, etc.

Tourism provides 43% of jobs in French coastal regions, generating more revenue than fishing or shipping (UNEP 2009)

A lack of land-use planning and building regulations in many destinations has led to sprawling developments along coastlines, leading to habitat fragmentation. The sprawl includes tourism facilities themselves and supporting infrastructure such as roads, housing, parking, service areas and waste disposal. Habitat degradation is another negative impact of tourism development. For example, coastal wetlands are often drained and filled and mangroves cut due to a lack of more suitable sites for construction of tourism facilities and infrastructure. Apart from this, many tourism activities such as anchoring, snorkeling or sport fishing and tourism related littering can cause direct harm to species (e.g. marine mammals) and degradation of marine habitats with subsequent impacts on coastal erosion and fisheries.

Tourists and suppliers, often unknowingly, can bring in species (insects, wild and cultivated plants and diseases) that are not native to the local environment, which can cause enormous disruption and even destruction of ecosystems. Although an important tool for environmental education and increasing awareness, wildlife viewing can stress the animals and alter their natural behaviour when tourists come too close and create noise, e.g. with their motorised vehicles and lights.

The Convention on Biological Diversity (CBD) website contains a very good case study on this topic, which can be accessed here http://www.cbd.int/doc/case-studies/tour/cs-tour-pa-01-en.pdf

2.7.4 Threat from invasive alien species

Alien invasive species are non-native species that invade new habitat; that is, they become established in natural or semi-natural ecosystems or habitats, are agents of change and threaten native biological diversity.

Over 80 per cent of the world's 232 marine eco-regions report the presence of invasive alien species which is the second most significant cause of biodiversity loss on a global scale; and marine bio-invasion rates have been reported to be as high as up to one invasion every nine weeks (IOC/UNESCO, IMO, FAO, UNDP, 2011). Ballast water from the ships plays a major role in the spread of invasive species. Visit Module 5 for information on impacts of ballast water on spreading invasive alien species and the possible solution.

In order to find a solution to the problem of alien invasive, the Global Invasive Species Programme (GISP) has been designated as an international thematic focal point for invasive alien species under the clearing-house mechanism of the CBD.

To ensure stability on the water, most large commercial vessels have ballast tanks that can be filled with water or emptied to safely balance the weight distribution of their load or to compensate for reductions in cargo or fuel. However, ballast water taken on board in one port may be released in another port, inadvertently releasing non-native species that the water may contain.

Case Study: Ballast water management in the Great Lakes

Invasive plants and animals from foreign freshwater ports are those most likely to thrive in the fresh waters of the Great Lakes. Ballast water exchange, where ships' crews exchange coastal port water in ships' ballast tanks with oceanic salt water during the voyage, is used to reduce the risk of species invasions by physically removing coastal organisms from the tanks. Second, the high salinity of the ocean water would be inhospitable for many coastal organisms that had not been removed from tanks.

Third, any marine organisms drawn into the ballast tanks along with salt water in mid-ocean are unlikely to survive if released in a coastal port. Used globally, ballast water exchange is particularly effective for reducing the risk of invasion to freshwater ports such as those in the Great Lakes.

Between 1959 and 2010, at least 56 non-native aquatic species were reported in the Great Lakes, with 34 of them attributed to transoceanic shipping. For example, ballast water is the original vector by which Zebra and Quagga mussels, Tubenose and Round gobies, spiny water fleas and Blood Red Shrimp were transported to the Great Lakes. Since their original introduction, these aquatic invaders have spread further through river systems and from lake to lake by other means such as on fishing equipment, in bait buckets, or on the hulls of recreational boats that may not have been cleaned properly.

Between 1989 and 1993, ballast water exchange was voluntary. In 1993, it became mandatory for ships destined for the Great Lakes to exchange ballast water loaded at or near a port with salt water from mid-ocean (at least 200 miles offshore and in water at least 2000 m deep).

In 2006, Canada added a new measure for ships with empty ballast tanks to help prevent the arrival of non-native species. In addition to mid-ocean ballast water exchange, the new regulations require that empty tanks be flushed or rinsed in mid-ocean to make sure any leftover organisms are also given the salt water treatment.

These regulations are supported by intensive inspection and compliance efforts. All vessels entering the St. Lawrence Seaway from outside Canada's Exclusive Economic Zone are inspected by Transport Canada or the U.S. Coast Guard under a unique binational inspection programme when they reach the Port of Montreal. Annually, no more than 3 per cent of vessels are non-compliant, and all of these ships are required to take corrective actions before proceeding. The programme has been heralded around the world as a model of effective management and bilateral regulatory cooperation.

Source: Government of Canada, Fisheries and Oceans,
http://www.dfo-mpo.gc.ca/science/publications/article/2011/06-13-11-eng.html
http://www.uscgnews.com/external/content/document/4007/1444375/1/Document.pdf

2.7.5 Pollution

More than 80 per cent of all marine pollution originates from land-based sources which are primarily industrial, agricultural and urban. Pollution in all its forms – air, water, chemical, sewage and municipal solid waste – ultimately enters the ocean through water channels. The disposal of waste is also a serious constraint to sustainable development. Agricultural practices, coastal tourism, port and harbour developments, damming of rivers, urban development and construction, mining, fisheries, aquaculture, and manufacturing, among others, are all sources of marine pollution threatening coastal and marine habitats. The occurrence of marine and coastal hypoxic areas or 'dead zones' has been increasing at a massive rate in recent years.

In addition to land based and marine pollution, plastic materials and other litter are widespread in the ocean. Much of the trash that enters the ocean is made up of plastics: plastic bags and food packaging, and straws and lids from our to-go cups. In the ocean, these plastics break down into tiny, toxic particles that are ingested by marine life, which in turn is consumed by us. This plastic may be from tourists or from the municipal waste of local populations dumped in the coastal waters or from ships dumped in the open sea.

2.7.6 Marine debris[2]

Oceans are filled with things that do not belong there, such as huge amounts of consumer plastics, metals, rubber, paper, textiles, derelict fishing gear, vessels, and other lost or discarded items.

Marine debris is defined as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes. Marine debris is a global problem, and is a threat to our environment, navigation safety, the economy, and human health.

Plastic and synthetic materials are the most common types of marine debris and cause the most problems for marine animals and birds. At least 267 different species are known to have suffered from entanglement or ingestion of marine debris, including seabirds, turtles, seals, sea lions, whales and fish.

The scale of contamination of the marine environment by plastic debris is vast. It is found floating in all the world's oceans, everywhere, from polar regions to the equator. The seabed, especially near coastal regions, is also contaminated – predominantly with plastic bags. Plastic is also ubiquitous on beaches everywhere from populous regions to the shores of very remote uninhabited islands.

2.7.6.1 SOURCES OF MARINE DEBRIS

It has been estimated that around 80 per cent of marine debris is from land-based sources and the remaining 20 per cent is from ocean based sources. The sources can be categorised into four major groups:

- **Tourism related litter at the coast:** This includes litter left by beach goers such as food and beverage packaging, cigarettes and plastic beach toys.

2 This section is adapted from the following publication of Greenpeace: http://www.greenpeace.org/austria/Global/austria/dokumente/Studien/meere_Plastic_Debris_Study_2006.pdf

- **Sewage related debris:** This includes water from storm drains and combined sewer overflows which discharge waste water directly into the sea or rivers during heavy rainfall. These waste waters carry with them garbage such as domestic, medical and industrial waste products.
- **Fishing related debris:** This includes fishing lines and nets, fishing pots and strapping bands from bait boxes that are lost accidentally by commercial fishing boats or are deliberately dumped into the ocean.
- **Wastes from ships and boats:** This includes garbage which is accidentally or deliberately dumped overboard.
- **Huge volumes of non-organic wastes, including plastics and synthetics:** Plastic is non-biodegradable and extremely durable. Days, weeks, and even decades in the ocean will do little to break down most plastics. Studies have found that it takes a plastic water bottle nearly 450 years to dissolve at sea. Plastic grocery bags, industrial pellets, and product packaging are all flowing into our waters every day.

2.7.6.2 HARM TO MARINE WILDLIFE

Countless marine animals and sea birds become entangled in marine debris or ingest it. This can cause them serious harm and often results in their death.

Entanglement in marine debris

Marine debris which is known to cause entanglement includes derelict fishing gear such as nets and lines and also six-pack rings and fishing bait box strapping bands. This debris can cause death by drowning, suffocation, strangulation, starvation through reduced feeding efficiency, and injuries. Particularly affected are seals and sea lions, probably due to their very inquisitive nature of investigating objects in their environment. Entanglement rates in these animals of up to 7.9 per cent of a population have been recorded.

Furthermore, in some instances entanglement is a threat to the recovery of already reduced population sizes. An estimated 58 per cent of seal and sea lion species are known to have been affected by entanglement including Hawaiian monk seals, Australian sea lions, New Zealand fur seals and other species in the Southern Ocean.

Whales, dolphins, porpoises, turtles, manatees and seabirds have all been reported to have suffered from entanglement. Many different species of seabirds, whale and turtle have been reported to have been tangled in plastic. Derelict fishing gear also causes damage to coral reefs when nets or lines get snagged by the reef and they break off.

Discarded or lost fishing nets and pots can continue to trap and catch fish even when they are no longer in use. This phenomenon is known as ghost fishing and can result in the capture of large quantities of marine organisms.

Ingestion of marine debris

Ingestion of marine debris is known to particularly affect sea turtles and seabirds but is also a problem for marine mammals and fish. Ingestion is generally thought to occur because the marine debris is mistaken for prey and most that is erroneously ingested is plastic of different types including plastic bags, plastic pellets and fragments of plastic that have been broken up from larger items. The biggest threat from ingestion occurs when it blocks the digestive tract or fills the stomach, resulting in malnutrition, starvation and possibly death.

Studies show that a high proportion (about 50 to 80%) of sea turtles found dead, are known to have ingested marine debris. This can have a negative impact on turtle populations. In young turtles, a major problem is dietary dilution in which debris takes up some of the gut capacity and threatens their ability to take on necessary quantities of food. For seabirds, 111 out of 312 species are known to have ingested debris and it can affect a large percentage of a population (up to 80%). Moreover, plastic debris is also known to be passed to the chicks in regurgitated food from their parents.

Potential invasion of alien species

Plastic debris which floats on the oceans can act as rafts for small sea creatures to grow and travel on. Plastic can travel for long distances and therefore there is a possibility that marine animals and plants may travel to areas where they are non-native. Plastic with different sorts of animals and plants have been found in the oceans in areas remote from their source. This represents a potential threat for the marine environment should an alien species become established. It is postulated that the slow speed at which plastic debris crosses oceans makes it an ideal vehicle for this. The organisms have plenty of time to adapt to different water and climatic conditions.

2.7.6.3 MARINE DEBRIS AROUND THE WORLD

Litter enters the sea from land-based sources, from ships and other installations at sea, from point and diffuse sources, and can travel long distances before being deposited. While plastic typically constitutes a lower proportion of the discarded waste, it represents the most important part of marine litter with sometimes up to 95 % of the waste, and has become ubiquitous even in remote polar regions (Galgani et al 2015).

2.7.6.4 SOLUTIONS

Tackling marine debris will require behavioral change via a mix of education, incentives, and regulation. Human behaviour needs to change from the current throwaway culture being status quo, and accountability is a fundamental ingredient in this change. Media has an important role to play in explaining the people the negative impacts of marine debris, and making them aware on how intentionally and unintentionally one is contributing to this global problem, and sharing the possible solutions.

There are a number of global, international and national initiatives in place that are aimed at protecting the oceans from marine debris. The most far reaching of these is the International Convention for the Prevention of Pollution from Ships (MARPOL).

Other measures to address marine debris include manual clean-up operations of shorelines and the sea floor as well as school and public education programmes.

While the above measures are important for preventing or reducing the problem of marine debris, the ultimate solution to waste prevention is to implement a responsible waste strategy, with the concept of "Zero Waste" . Such a strategy encompasses waste reduction, reuse and recycling as well as producer responsibility and ecodesign. Ultimately, this would mean reduction of the use of plastics and synthetics such that they are only used where absolutely necessary and where they have been designed for ease of recycling within the existing recovery infrastructure. It is possible that biodegradable plastics could be used where plastic was deemed necessary but could not be seen as an environmentally sound alternative unless they are known to break down rapidly to non- hazardous substances in natural environments.

Case Study: Fishing for Litter

Fishing for Litter is a German initiative in cooperation with fisheries associations. Fishermen bring ashore, voluntarily, all the litter that was collected in their nets during the normal fishing operations. There is no financial compensation for this engagement. The disposal logistics, however, are for free. The project started in 2000, in two harbours on the Baltic Sea. Today, six harbours and about 60 fishermen have joined the scheme. They are given special big plastic bags to store the litter collected at sea.

All litter collected is analysed in cooperation with partners from the waste industry in order to investigate its composition, amount and potential recyclability.

Source: MARLISCO

www.marlisco.eu/fishing-for-litter-in-germany.en.html

Plastics are the most common form of marine debris. They can come from a variety of land- and ocean-based **SOURCES**, **ENTER THE WATER** *in many ways, and* **IMPACT** *the ocean and Great Lakes. Once in the water, plastic debris never fully biodegrades.*

COMMONLY FOUND PLASTICS

HOW TO HELP?

PLA

OC

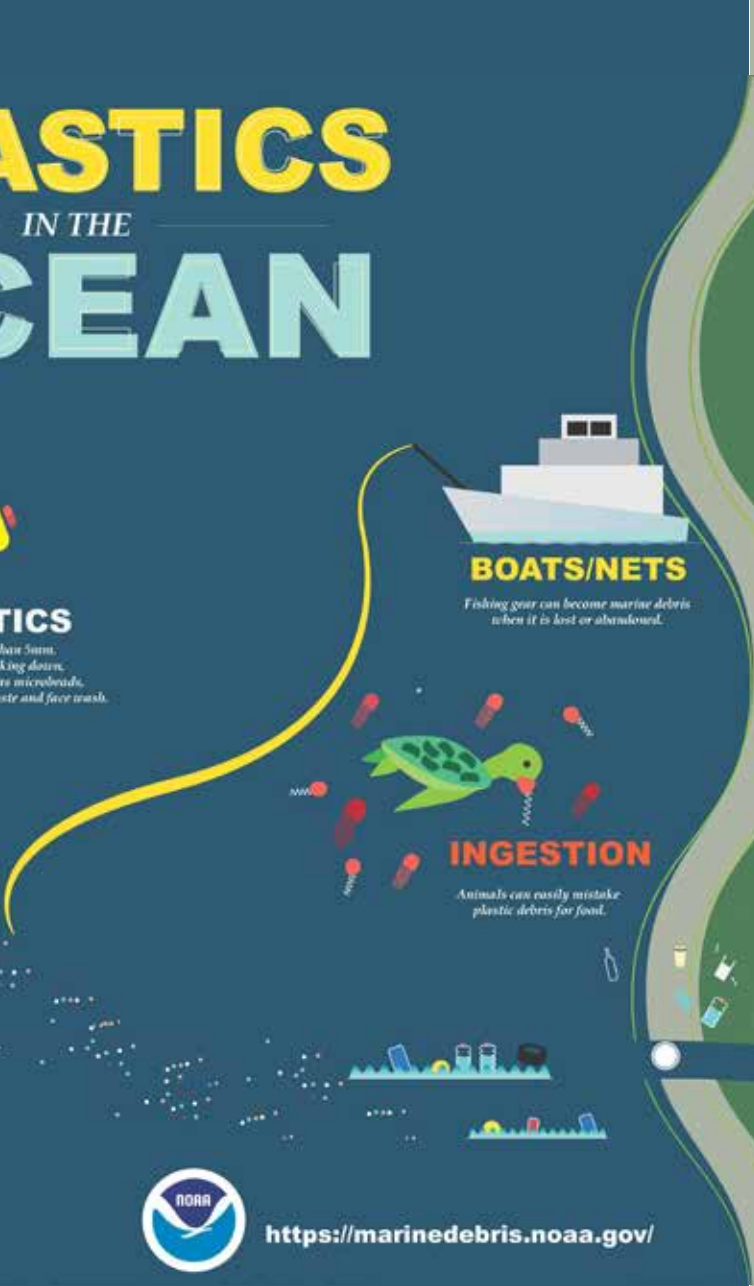
MICROPLAST

Microplastics are small plastics less t
They can come from large plastics brea
or can be produced as small plastics such
which can be found in products such as toothpa

ENTANGLEMENT

Marine life can get caught and killed in derelict fishing nets and other plastic debris.

ASTICS
IN THE
CEAN



TICS

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...King down.
...s microbeads,
...ste and face wash.

BOATS/NETS

Fishing gear can become marine debris when it is lost or abandoned.

INGESTION

Animals can easily mistake plastic debris for food.

RAIN & WINDS

Rain and wind can sweep debris into nearby waterbodies.

LITTERING

Intentional littering or improper disposal of trash can cause marine debris.

STREAMS & STORM DRAINS

Streams and storm drains can carry debris directly into the ocean or Great Lakes.

NOAA

https://marinedebris.noaa.gov/

2.7.7 Coastal squeeze

Coastal squeeze is the term used to describe what happens to coastal habitats that are trapped between a fixed landward boundary, such as a sea wall and rising sea levels and/or increased storminess. The habitat is effectively 'squeezed' between the two forces and diminishes in quantity and/or quality.

Prominent sites to observe coastal squeeze are the mega coastal cities, where seawalls are constructed to protect property along retreating beaches. These seawalls confine the wave energy and intensify erosion by concentrating the sediment transport processes in an increasingly narrow zone. Eventually, the beach disappears, leaving the seawall directly exposed to the full force of the waves, and wherever the seawall is not present in this zone, water enters cities leading to urban flooding situations.

One recent estimate found that at least 40 per cent of the global oceans are 'heavily affected' by human activities. This has a direct impact on sustainable development, with the majority of human settlements located on or near the coasts. Many of these 'stresses' to coastal and marine biodiversity develop either due to insufficient information that different agencies working in the coastal areas have on coastal geology and processes, or are intentional due to commercial interests.

See a case study here
http://repository.tudelft.nl/view/ir/uuid%3Ae23ef22d-172a-4c22-9a2b-477d8d294466/

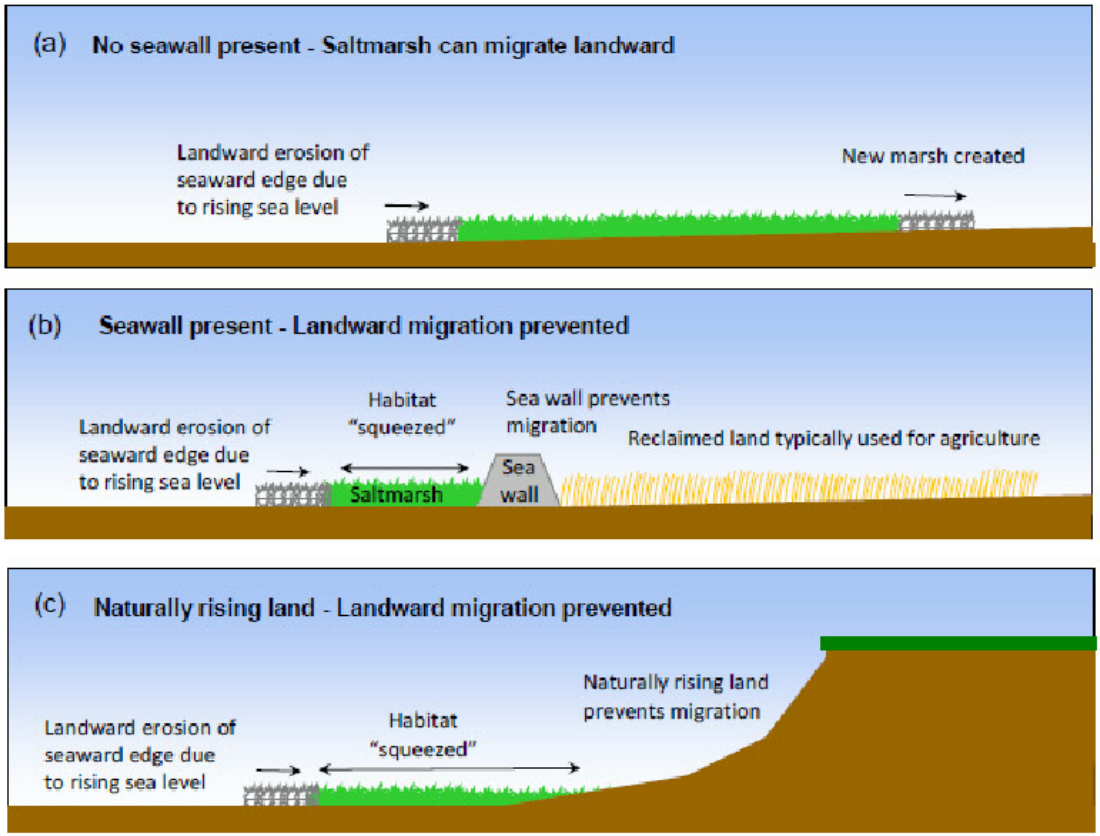

Figure 2.5: A simplified illustration of coastal squeeze as defined by Doody (2012). (a) Unrestricted landward translation of saltmarsh habitat in low lying areas, which maintains coastal habitat extent – sometimes referred to as natural transgression or rollover. (b) Landward translation of saltmarsh is prevented by a sea defence, which results in a reduction in the width of saltmarsh – the most common definition of coastal squeeze. (c) Landward translation of saltmarsh is prevented by rising land, which results in a reduction in the width of saltmarsh – occasionally referred to as 'natural coastal squeeze' by some authors. [Source: Defining coastal squeeze: A discussion (PDF Download Available). Available from: https://www.researchgate.net/publication/259512642_Defining_coastal_squeeze_A_discussion [accessed Jan 24, 2017]

2.7.8 Vulnerability to climate change and natural disasters

According to the Millennium Ecosystem Assessment, climate change is likely to become one of the most significant drivers of biodiversity loss by the end of the century. It will create new hazards such as glacier recession, sea level rise and extreme weather events in frequency and intensity, never seen before. Greater rainfall in some areas will trigger more floods and landslides, with consequent disruption to agriculture, urban settlements, commerce and transport. Climate change will, therefore, further aggravate the existing disaster risks and vulnerabilities and expose millions of people never affected before to risks, around the world.

Module 7 of this training material presents further details on the impacts of climate change disasters on coastal and marine ecosystems.

2.8 Is every species liable to become extinct?

2.8.1 Relative risk of extinction[3]

IUCN RED LIST INDEX: AN INDICATOR OF THE RISK THAT A SPECIES IS FACING

The IUCN Red List Index (RLI) reveals trends in the overall extinction risk of species and provides an indicator that is used by governments to track their progress in achieving targets that reduce biodiversity loss. The RLI has been adopted by the United Nations as one of the indicators for the 2015 Millennium Development Goal 7 on environmental sustainability. It is also a useful tool for assessing progress towards achieving Target 12 of the Aichi Biodiversity Targets.

More than 73,600 species on the RLI have been assessed. This figure includes most the known species of amphibian; bird; mammal; angelfish; butterflyfish; crocodilian; freshwater crab and crayfish; grouper; gymnosperm (including cycads and conifers); lobster; mangrove; marine turtle; parrotfish; reef-building coral; sea grass; sea snake; shark and ray; tuna and billfish; and wrass. The results are disturbing – with several species groups facing a severe threat of extinction.

Figure 2.6: Proportion of threatened species in major taxa (Source: IUCN)

3 Source: IUCN Red List Brochure http://cmsdocs.s3.amazonaws.com/IUCN_Red_List_Brochure_2014_LOW.PDF

2.8.2 How is the Red List Index (RLI) used?

The RLI shows where action needs to be taken to save the building blocks of nature from extinction. It provides a straightforward way to factor biodiversity needs into decision-making processes by providing a wealth of useful information on species.

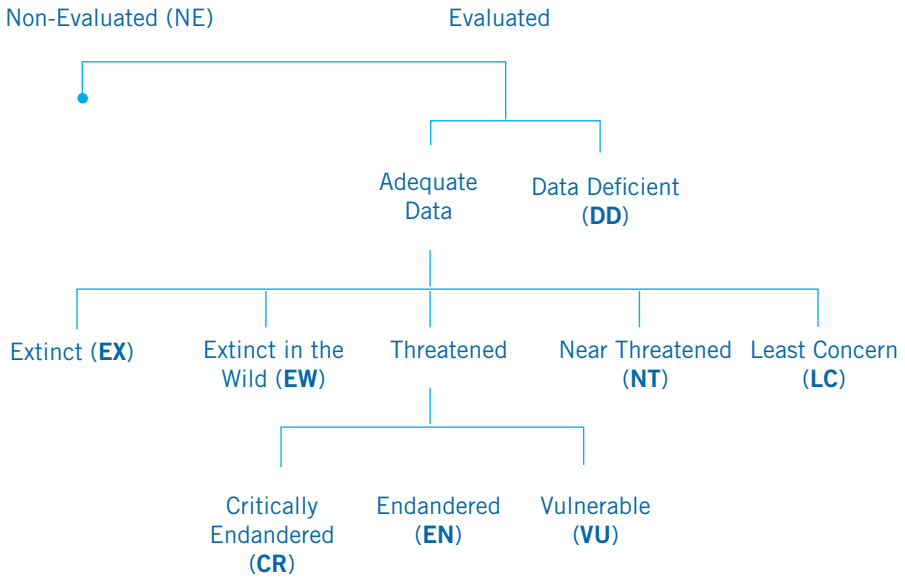

Figure 2.7: Relative risk of extinction of species

2.9 The root cause of conflicts: Trade-offs and low levels of awareness

2.9.1 Trade-offs between different ecosystem services

Stable and bio-diverse ecosystems provide multiple services, which interact in multiple ways. Some ecosystem services co-vary positively (an increase in one service means another also increases) and others co-vary negatively (an increase in one service means another decreases). Focusing on one ecosystem service in isolation from the possible impacts on other critical ecosystems services provided by the same ecosystem leads to a situation of conflict and management failure.

Marine and coastal ecosystems around the world are experiencing an increasing demand for their diverse ecosystem services for different sectors such as fisheries, tourism, biodiversity conservation, climate change, disaster management and so on. The viability of many activities of these sectors is dependent on the services provided by the same ecosystem. In such situations, progress towards one objective such as increasing fish production has often been at the cost of other objectives such as conserving biological diversity or improving water quality (MEA 2005); this is known as a 'trade-off.'

Progress towards one objective such as increasing food production has often been at the cost of other objectives such as conserving biological diversity or improving water quality. A good example of these types of trade-offs is expansion of commercial shrimp farming leading to serious impacts on ecosystems, including loss of vegetation, deterioration of water quality, decline of capture fisheries and loss of biodiversity.

These trade-offs exist even within the 'green sector,' where large scale plantations of exotic species as a measure of carbon sequestration might lead to a situation of land degradation and habitat loss.

Traditional national accounts do not include measures of resource depletion or the degradation of these resources. A country could cut its forests and deplete its fisheries and this would show only as a positive gain in GDP, without registering the corresponding decline in assets (wealth). Losses in the natural world have direct economic repercussions that we systematically underestimate. Making the value of our natural capital visible to economies and society creates an evidence base to pave the way for more targeted and cost-effective solutions (TEEB 2009).

2.9.2 Low levels of awareness on biodiversity and role of media:

There are major gaps in our knowledge and understanding of many aspects of coastal and marine biodiversity and the ecosystem services arising out of it. The gap in understanding exists at many levels such as scientific understanding of the key coastal and marine habitats and their functioning; meager documentation of the traditional knowledge and practices of coastal communities and their potential use for climate change management; low levels of awareness on our dependence and interconnectedness with the coastal and marine biodiversity- ecosystem services; and low levels of awareness on coastal and marine pollution and how is it affecting our own health even if we are in some landlocked metropolitan area.

Awareness on interconnectedness between coastal and marine ecosystem services and wellbeing of coastal communities is necessary to change people's attitudes towards conserving coastal and marine biodiversity, and this can only be done by the dedicated media campaigns and reporting, innovative advertising of the commercial products coming out of coastal and marine resources and exploratory films on key habitats and species of coastal and marine ecosystems.

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Further resources

A photographic journey through ocean biodiversity,
http://ocean.nationalgeographic.com/ocean/photos/starfish/.

Case stories on Ecological Footprint from across the Globe:
http://www.footprintnetwork.org/en/index.php/GFN/page/case_stories/

Website of TEEB

http://www.teebweb.org/

Website of Indo-German Biodiversity Programme

http://www.indo-germanbiodiversity.com/

About the CMPA project

The Project –'Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas (CMPA)', under the Indo-German Biodiversity Programme, is a technical cooperation project jointly implemented by the Governments of India and Germany (2012-17). The Project is commissioned by the German Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB) with funds provided under the International Climate Initiative (IKI), in partnership with the Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India.

The project aims at contributing to conservation of biodiversity through participatory approaches in the management of existing and potential coastal and marine protected areas in India. Project activities are implemented together with the Forest Departments of the project partner states - Gujarat, Goa, Maharashtra and Tamil Nadu, as well as with premier national training institutions.

Our partners

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

The Wildlife Institute of India (WII), Dehradun

WII has a mandate to train Indian Forest Service officers, State Forest Service officers and other key stakeholders such as the Coast Guard and Customs and has recently initiated a one-week refresher course exclusively addressing issues related to integrated management of coastal and marine biodiversity that is targeted at senior forest officials. https://www.wii.gov.in/

Xavier Institute of Communications (XIC), Mumbai

XIC is a professional media centre offering a variety of services in training and production. XIC is an autonomous educational unit of the Bombay St. Xavier's College Society Trust, which comprises St. Xavier's College, the Institute of Management, the Institute of Counseling and the Heras Institute of Indian History and Culture. XIC pilot-tested the curriculum between December 2014 and May 2015 and subsequently decided to integrate the curriculum into its Communication for Development (C4D) diploma course.
www.xaviercomm.org

BMM Department, St. Xavier's College, Mumbai

St. Xavier's College is one of the most prestigious liberal arts colleges in India. The BMM department was established in 2002. The Bachelor in Media Studies, a programme begun by the University of Mumbai in 1999, is being run by St. Xavier's College under the system of academic autonomy. While this is an applied course that seeks to provide industry with qualified media professionals, St. Xavier's believes that an academic grounding is very essential for forming young people for this crucial job of communications.
www.xaviers.edu

St. Paul's Institute of Communication Education (SPICE), Mumbai

St. Paul's Institute of Communication Education (SPICE) is a fast-growing media school in India offering a comprehensive post-graduate diploma in journalism that trains students for a career in print journalism, television journalism and digital journalism. With top-notch media faculty members and excellent infrastructure, SPICE is the go-to destination for Gen Next journalists.
www.stpaulsice.com

Department of Communication, Journalism and Public Relations, Gujarat University

The Department of Communication, Journalism and Public Relations was established in 1987–1988. The department plays a vital role in providing media professionals and communication experts to various fields. Two courses are offered by the department, the Master's in Mass Communication and Journalism (MMCJ) and the Master's in Development Communication (MDC).
http://www.gujaratuniversity.org.in