

Measuring, monitoring and managing sustainability in Indian coastal areas: the socioeconomic dimension*

Maria do Rosário Jorge¹, Nelson Lourenço², Carlos Russo Machado³, Luís Rodrigues³

¹Researcher / Universidade Nova de Lisboa/FCSH, Av. de Berna, 26, 1069-061 Lisboa, rosarioj@uatla.pt

²Professor / Universidade Nova de Lisboa/FCSH, Av. de Berna, 26, 1069-061 Lisboa, nelson.lourenco@netcabo.pt

³Researcher / Universidade Atlântica, Antiga Fábrica da Pólvora de Barcarena, 2745-615 Barcarena, cmachado@uatla.pt and lrodrigues@uatla.pt

Abstract

Some of the most profound changes in the littoral have arisen from direct decisions by man concerning land use, and these have affected both the quality of environmental resources, such as soils and water and the sustainability of coastal ecosystems. Land use decisions in coastal areas are based on opportunities and constraints affected by both biophysical and socioeconomic drivers, being land use and land use changes one of the main issues integrating the large debate on sustainable development.

The need to integrate natural and social sciences in order to identify questions and eventually find solutions, concerning measuring, monitoring and managing the development of coastal areas has been the main purpose of the interdisciplinary research project held in India: "Measuring, monitoring and managing sustainability: the coastal dimension".

The research was conducted in accordance with the Driver-Pressure-State-Impact-Response framework and the main drivers analysed were tourism, intensive agriculture/aquaculture and industry.

1. INTRODUCTION

In historical terms, coastal locations have been the favourite destination of population movements for defence, commercial and other economic reasons. About 20% of the population of India live in coastal areas, a larger percentage of this being in coastal cities, such as Mumbai, Chennai and Calcutta. One of the major factors responsible for the degradation of coastal ecosystems is the growth in human population that requires space for settlement and other resources, like soil and water.

The need of Integrated Coastal Management in India is well known, on account of the growing population pressure due to accelerated urbanisation, itself fuelled by demographic growth and industrialisation. Fragile coastal ecosystems are simultaneously attacked by organic and chemical pollution and the degradation of natural resources is sometimes irreversible. In fact, coastal zones are vulnerable areas in different parts of the world, but in developing countries the impacts of degradation can be worse than in other countries.

Sustainable development demands an integrated and interactive approach that allows for the understanding of the complex relationship between society and nature, simultaneously respecting human rights and assuming that environment is a vital dimension of the future of the human kind. The need to consider equity, security and environment as key elements for the definition of sustainable development is defended by N. Lourenço (2001). Moreover, the complex and conflicting interactions of social equity, human security and environmental sustainability within

the social process of shaping and building development for present and future generations are important issues to address.

Scientific and technological knowledge can make a significant contribution to alleviate and eventually prevent the unsustainable use of natural resources, such as those of coastal zones. There is a need for research on how societal driving forces (social and demographic, political and institutional, economic and commercial, cultural and technological) affect the nature and distribution of human activities on coastal zones of India and its impacts on coastal ecosystems associated with the prevailing and possible alternative patterns of human activity.

2. THE NATURAL/SOCIAL SCIENCES INTEGRATED APPROACH IN COASTAL AREAS RESEARCH¹

Some considerations on integrated analysis of natural and social sciences in coastal areas are presented below, in search for a scientific expression of the political need to develop an integrated coastal zone management. Therefore, it is of great importance to establish the limits of what is considered to be coastal areas.

For physical researchers, coastal areas are related to the influence of the presence of the sea. According to this conception, coastal areas are regions with large variations in terms of limits,

¹ The authors of this paper are developing an integrated methodology to understand the nature/society interactions.

which include the coastal plain, the coastal cliff and the coastal plateau. In the immense area the limits could also comprehend the continental shelves. Therefore, demarcation is deeply related to the influence (present or past) of the sea in shaping these areas.

The coastal dimension analysis clearly implies the integration of spatial/biophysical data with the socio-economic data type. In the framework of this kind of studies, coastal areas should be considered as the regions located near the sea, where we can notice rapid and intense socio-economic and environmental changes. These sort of changes are requiring fast and appropriate policy responses, as well as acting as important driving forces over hinterland regions.

This approach to coastal areas reflects a distinctive way of understanding these areas. In articulation with the relationships studied by physical researchers, which give more importance to the land-ocean interactions, these studies, which relate to the coast-hinterland interactions, are emerging.

This complexity involves significant processes of population dynamics, which are expressed in population growth, demographic stress and in rapid and intense migrations (hinterland-coast, rural areas-coastal areas).

The importance of these areas also involves complex land-use and land-cover dynamics. These dynamics are shaped by different factors, which allow us to see the importance of physical drivers (such as geomorphologic, extreme events and natural hazards) and social drivers (population dynamics, industrialisation, external market forces, cultural and life style patterns and policies regulations).

Decisions regarding natural resources and land use are based on opportunities and constraints conditioned by both biophysical and socio-economic drivers. Thus, a more integrative approach is needed for human/environmental syntheses, which contributes for a better understanding of the biophysical and social driving forces. Besides, we need to understand the processes, behind the patterns of occupation of a territory and the use of resources.

3. A FRAMEWORK FOR COASTAL AREAS INTEGRATED ANALYSIS

The question is how this integration is possible, and how it can be best achieved. This paper presents the results of the integration of disciplines and it deals with the questions required in order to achieve a suitable integration.

The research used the Driver-Pressure-State-Impact-Response (DPSIR) framework as a means of understanding the connections among the different types of indicators to the establishment of a framework model of these interrelationships. The

DPSIR framework, developed by the European Environment Agency, is being suggested as an advantageous method to define cause-effect relationships, highlighting the connection among the causes of environmental problems, their impact and the society's response to them, in an integrated way (EEA, 1999; Gentile, 1998).

However, it is criticised by some authors because its implied linear causality causes an oversimplification of reality. Furthermore, in terms of sustainability, which must take into account future courses of action concerning development, the fact that no actions are taken before situations deteriorate is criticised. In order to ensure knowledge and understanding of forward and backward linkages between the stock of natural resources, human activities and the consequences of those activities, the DPSIR framework requires very detailed statistics (Shah, 2000).

The DPSIR framework aims at analysing the cause-effect relationship among interacting components of complex social, economic and environmental systems and at organising the information flow between its parts (Figure 1). It structures the environmental information in five groups connected by two types of links: a direct causal chain (Drivers, Pressures, State, Impact, Responses); links between the Responses and their targets (Drivers, Pressures, State and Impacts).

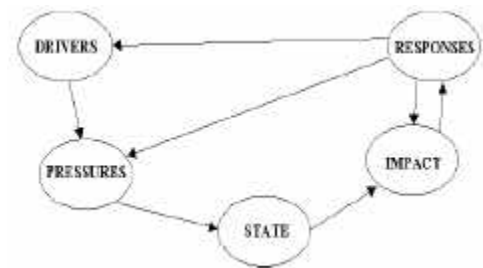


Figure 1: The DPSIR framework for reporting on environmental issues (EEA, 1999).

The five elements constituting the causal DPSIR chain are: Driving forces of environmental change, which constitute the underlying causes and origins of pressures on the environment; Pressures, which describe the variables which directly cause (or may cause) environmental problems; State, which shows environmental conditions; Impacts on population, economy and ecosystems, which describe the ultimate effects of changes of state in terms of damage caused; and Responses, which demonstrates the efforts of society (e.g. politicians, decision-makers) to solve the problems.

The driving forces are represented by the social, demographic and economic activities in societies and the corresponding changes in life styles. They

cause changes in overall levels of production and consumption, exerting pressures on the environment: excessive use of natural resources; changes in land use; and air, water and land emissions (of chemicals, waste, radiation, noise).

The pressure indicators describe information in quantitative and qualitative terms regarding emissions, application of chemical and biological agents and the use of land and other natural resources. The pressures exerted by society's patterns of production and consumption are subsequently transformed in a variety of natural processes that may result in changes in the state of the environment.

State indicators give information on the level, quality and/or quantity of physical phenomena, biological phenomena and chemical phenomena in a given area at a given point in time. They often change very slowly, and their changes may have environmental and economic impacts on ecosystems, on human health and on the economic and social welfare of a whole society.

Impact indicators refer to the consequence of an environment state change. They can be described as the last consequence (to humans and ecosystems) of the chain of reactions of environment change. They are slower than state changes and can't be directly changed by the response.

Response indicators describe the efforts made by society (Government, institutions, groups of people and individuals) in order to prevent or reduce the negative effects of state changes. They should be very fast, as their aim is to change socio-economic systems so as to reduce the pressures causing negative environmental changes.

Responses may seek to change and/or redirect prevailing trends in consumption and production of goods and services, improve monitoring and control of pollutants or develop cleaner technologies. They can be structured in research; regulations; awareness; public investments; policy integration; co-operation with other levels of decision-making or other territories. The responses can send feedback to all the other groups of DPSIR although, as far as sustainability is concerned, it is not very correct to consider the responses to the impacts: reacting against the illness is always worse (and less sustainable) than preventing the disease.

4. A RESEARCH PROJECT ON INDIAN COASTAL AREAS

This paper presents some results of an interdisciplinary joint-research project, involving Indian and European researchers and institutes, entitled Measuring, monitoring and managing sustainability in Indian coastal areas: the socioeconomic dimension (COASTIN).

The cross disciplinary approach developed in the project aims at understanding the current

coastal developments in India and at suggesting a more sustainable course of action for the future, giving particular attention to the societal driving forces which influence the development of coastal areas and modify the landscape by changing land cover and land use. Two main principles are considered in the analysis of the future of Indian coastal zones: the evidence that the demand of coastal resources for economic growth is increasing; and the recognition that coastal natural resources are limited in supply and their continuing healthy existence is crucial to the functioning of coastal zones.

Therefore, the purposes of the project were to identify and analyse, through an intensive study at three locations: how societal driving forces impact coastal resources of India; which are the key variables affecting the use of coastal resources; what are the policy options faced by decision makers and the information requirements and decision-making instruments necessary for effective coastal zone management; to what extent might changes under alternative scenarios of economic development and urbanisation affect coastal land use and land cover².

The final goal was to develop a system for the integrated analysis of the economic, biological, hydro-geological, ecological, and human dimensions of coastal use, to examine the policy and the institutional matrix, within which development in coastal areas occurs in the country and to develop a framework for decision-making regarding coastal management, which incorporates the concept of sustainability.

The methodology was developed in six phases: (1) Analysis of the driving forces which modify the landscape by changing land uses, and a review of Indian policies (sector-based and cross sector-based) laws, rules and restrictions which govern the use, obligations and management of coastal resources; (2) Analysis of the interactions between the socio-economic system and the coastal ecosystems in the selected locations; (3) Analysis of coastal vegetation systems in these locations with view to developing a methodology and software tools to describe the vegetation system at different scales and to use it as an indicator of the state of the environment and of human and development pressure; (4) Analysis of coastal groundwater systems in the selected locations, including the research of intrinsic groundwater vulnerability to pollution, aiming at minimising environmental risks posed to groundwater; and the development of appropriated management mathematical models and practices towards the optimisation of the existing groundwater resources; (5) Analysis of coastal environmental systems, with the purpose

² Land-cover refers to the patterns of occupation of a territory and land-use implies understanding the processes of occupation. (Turner et al, 1995).

of collecting and evaluating data on coastal land use changes and pollution in the selected locations; (6) The integration of socio-economic data and information with biophysical data, focusing on how to project the conceptual model of the coastal system to a geographic information system.

4.1 Tourism, aquaculture/agriculture and industry: the driving forces and the state of environment

The first objective of the COASTIN project was to understand how societal driving forces impact coastal areas and ecosystems and how these can be measured, monitored and managed in order to achieve sustainable development. The literature survey of what constitutes stressed and vulnerable environments enabled the development of indicators of 'Relative Vulnerability'. These indicators were used to rank the coastal districts on the East and the West Coast of India into 'hot spot districts' based on a regression analysis, using the pressure indicators (TERI, 2000).

From the five major societal driving forces affecting coastal ecosystems in India (urbanisation, intensive aquaculture and agriculture, industrial activity, port activity and tourism) the research focused on three: tourism, intensive aquaculture and agriculture, and industrial activity.

The identification and district analysis of the societal driving forces was used as a starting point to select the case study areas for a deeper understanding of the social and natural processes. The main drivers were analysed in three case study areas in which tourism, intensive agriculture/aquaculture and industry have a stronger influence on change: tourism in North Goa, intensive agriculture/aquaculture in East Godavari and industry in Thane (Figure 2).

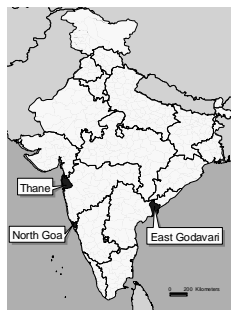


Figure 2: Case study areas situation

Within the three selected coastal districts, the villages situated around the coastal regulation zone were used to actually select the regions that were intensively analysed in order to study the interrelationships among population, development and environment. These locations were the sites

for intensive primary data collection, study and analysis, and assessment of future options for economic and social development.

4.1.1 Coastal Tourism

The study of tourism is the study of people away from their usual habitat, having certain requirements which are met by the creation of facilities that result in a change on the economic, physical and social well being of their host (Figure 3).

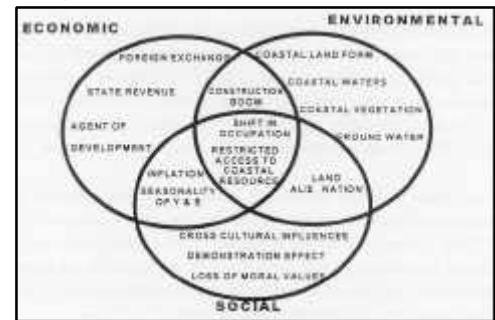


Figure 3: Tourism: towards a sustainable paradigm

It also involves the interactions between the host and the tourist, the motivations and experience of tourists, the expectations and adjustments made by residents of reception areas and the roles played by the numerous agencies and institutions which act as intermediates between them. Further, during their stay at the tourist destination, tourists spend money, which has been earned/derived from home (TERI, 2000).

However, more important than the above factors are the three basic components that make up coastal tourism (Sun, Sea and Sand) which lead to an interaction between two systems i.e. the tourism system (comprising the human system), and the coastal system, which comprises the environmental system (TERI, 2000).

Coastal areas are being increasingly used for the development of tourism. Beach tourism has been growing in India, and there has been a large increase in terms of tourist infrastructures along various parts of the coast. These activities disturb traditional fishing activities and fishers; interfere with marine life and cause degradation of near-shore habitats. One of the major impacts has been caused on the quantity and quality of groundwater resources, mainly due to increased salt intrusion in consequence of the heavy quantities of water pumped by hotels or other tourism infrastructures located in coastal areas.

Tourism can also result in spreading of urbanisation in coastal areas, which will increase the density of population, as well as the growth of ports (recreational or not) and of intensive agriculture and aquaculture. The shift of people from

the primary and secondary sectors to the tertiary sector has been the result of the labour demand in tourism and services, which also fulfils people's aim to find non-farm employment.

This stage is characterised by improvements in terms of infrastructures, such as accommodation and road facilities. Construction of tourist facilities is conducted at a rapid pace, resulting in chaotic and unrestrained development. Large-scale growth continues without adequate regulations and the degradation of resources becomes a major concern. In India, the emphasis of policy has been largely placed on how to increase the number of tourists without any corresponding measures designed to enhance environmental ability to support tourism in the long run.

4.1.2 Agriculture and aquaculture activities

A number of coastal areas and ecosystems in India are under stress due to growing aquaculture and agriculture activities.

Agricultural development in India underwent two phases: until the mid-sixties, production increased on account of the expansion of the area dedicated to crop production; during and after the mid-sixties, emphasis has been laid on increasing land productivity through increased input use.

... and saved forest and land resources by improving productivity, creating direct and indirect employment opportunities and improving the agrarian economy. India has become self-reliant in food-grains. The success of the *Green Revolution* lay primarily in its increased use of fossil energy for fertilisers, pesticides and irrigation to raise crops, as well as in the use of improved seeds (TERI, 2000). The environmental effects of intensive agriculture are summarised in Figure 4.

Intensive agriculture that uses high yielding varieties of seeds has an adverse effect on the environment because of its greater dependence on the use of chemical inputs and water. Among the coastal states of India, rise in water table, groundwater depletion and soil salinity are reported in different areas (TERI, 2000).

Water resources get depleted and genetic resources are lost. Although irrigation makes arid land productive, the soil becomes saline and alkaline. Similarly, fertilisers and pesticides increase agricultural production, but their intensive use can create harmful effects.

There are negative impacts on human health because of agricultural inputs such as fertilisers and pesticides. Although enhancing agricultural production is important for maintaining food security, the maintenance of the ecosystems, particularly coastal ecosystems is equally important (TERI, 1995).

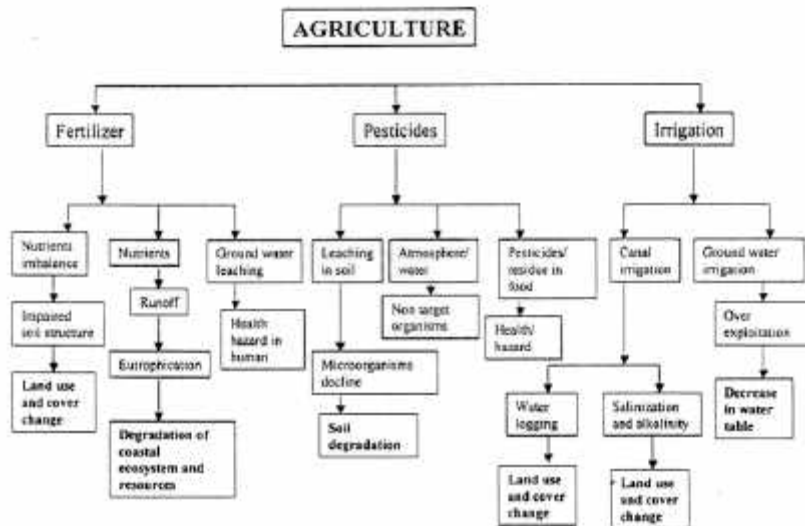


Figure 4 Environmental effects of intensive agriculture

High yielding varieties of crops, which were highly responsive to fertilisers and irrigation, were introduced in Indian agriculture in a process that came to be known as the *Green Revolution*. The *Green Revolution* led to increased crop production, increased food production and food security.

Intensive aquaculture, as an activity located in coastal areas, also has an impact on coastal ecosystems. This activity, as well as intensive agriculture, depend heavily on inputs. With the increasing demand for fish due to expanding population, the world has to depend on aquaculture to meet the demand-supply gap for future years. Out

of a total fish production of 4,95 million tonnes in India, aquaculture contributes with over 1,6 million tonnes. From 1984 to 1994, the production has increased 215% (TERI, 2000). Aquaculture provides inexpensive source of nutrition to the locals, foreign exchange earning potential, increasing economic activity and employment opportunities offered to the economically deprived and weaker sections of the society.

rised in Figure 5. The environmental impacts of aquaculture in turn affect the social and economic life of local communities.

Socio-economic effects of aquaculture are mainly due to the conversion of land that was previously used for other purposes and provided food and employment to a large number of people. Mangrove forests are being replaced on a large scale by aquaculture.

Coastal dwellers depend on mangrove forest

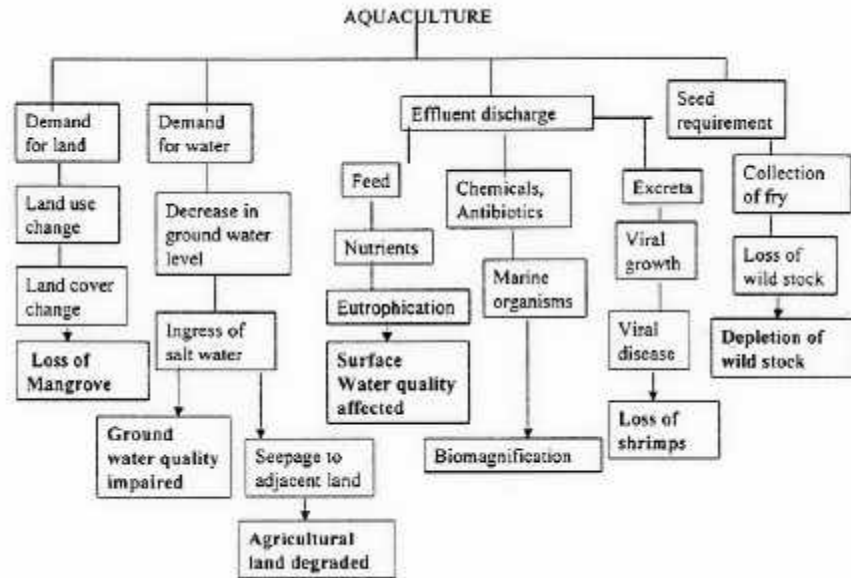


Figure 5 Effects of Intensive Aquaculture

Coastal aquaculture has been identified as one of the potential food producing sectors in India.

Governmental interest and support is encouraging this activity, but during the last years some problems have been arising: groundwater abstraction and consequent pressures for water for local communities; pollution due to effluent discharge; depletion of the wild stock due to disease outbreak and the collection of wild fry in association with the introduction of exotic species.

Aquaculture farms require large areas of land. It makes land, which is unfit for any other agricultural purposes, productive (TERI, 2000). Development of aquaculture in the coastal areas has led to the destruction of vast areas of mangroves. In India, 32,000 hectares of land of the world's largest mangrove forest has developed into extensive shrimp farms (TERI, 2000).

Further, the life cycle of an intensive shrimp farm is 5-10 years, after which it is abandoned. Abandoned ponds can no longer be used for any other alternative purpose of livelihood like agriculture (TERI, 2000). These effects, which have been found in the literature review, are summarized

for their daily needs of fuel wood, food etc. Even agricultural lands are being lost because of aquaculture farms (TERI, 2000). The increasing need of coastal land for aquaculture led to a dramatic rise in land prices in many areas. While local farmers can no longer afford to purchase the land, the landholders are tempted to sell their land, thereby losing their only source of livelihood. Aquaculture thus creates massive unemployment.

4.1.3 Industry

Industries remain one of the major competitors for the use of coastal areas. For industries, the major advantages of the location on the coast are transportation, water use and waste disposal.

The importance of the industrial sector in the Indian economy has risen over the years. The contribution of industries to the gross domestic product has improved, along with a rise in the share of employment in the secondary sector. The New Economic Policy, with its package of globalisation, liberalisation and privatisation, changed the entire scenario of the Indian industrial sector. These policies gave encouragement to the industrial sector. A sharp rise in foreign investment was also witnessed.

Thus the coastal states together represented 55% of the foreign investment in India during this period. In India, industrial activity has concentrated in certain specific areas, causing a regional imbalance. Maharashtra and West Bengal were the most industrialised states even before independence. Cities like Mumbai, Ahmedabad, Chennai and Calcutta had large-scale industrialisation during the colonial period.

in terms of economic activity. Industries draw foreign exchange, improve the standard of living and create employment. However, the adverse impacts of industries on the coastal ecosystems cannot be neglected. Adequate legal structure for coastal zones and strict implementation of the existing laws are required to collect the benefits without compromising ecology.

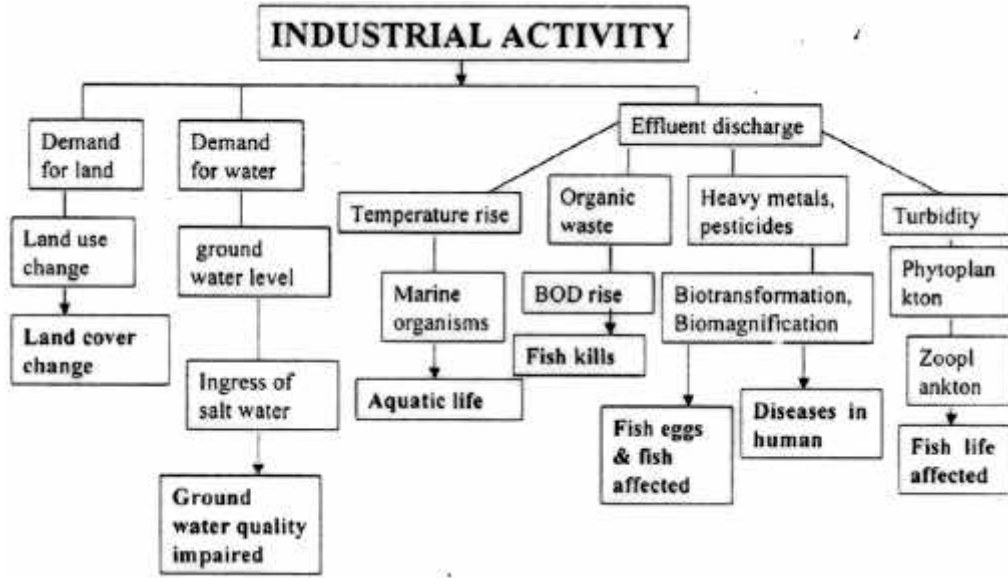


Figure 6 Environmental effects of industry

Since the industrial policy of 1956, the Central Government has also promoted an industrial policy with a strong regional component (TERI, 2000). The effects of industrial activity on the environment, which have been found in the literature review, are summarised in Figure 6.

Many of the highly polluting industries are located in the coastal areas. Dumping industrial waste is common in many parts of those areas. Some of the industrial effluents are toxic and can remain in the sea for a long time and accumulate in the organisms. Several pollutants have detrimental effects on most life forms and affect their breeding, growth, reproduction and survival.

Industrial and port activity tend to affect coastal ecosystems due to a number of reasons: wrong location can be the most obvious reason; choice of technology that is not environmentally friendly; no preventive approach to pollution in place, the tendency is always to look for end of pipe solutions; poor enforcement of standards and rules and sometimes poor ability to judge whether they comply to norms.

The coastal areas attract an increasing number of industrial investments, resulting in an increase

5. MANAGING SUSTAINABILITY ON COASTAL AREAS

The coastal zone and its resources bring about multidimensional problems for the management of the various systems and subsystems in a region. Understanding these complexities requires a thorough understanding of the issues and constraints involved – human, sociological, environmental, physical and economic, as well as local needs and aims. Planning and policy-making for coastal areas is difficult due to the conditions of uncertainty, complexity, and scale of ecosystems.

Coastal areas are undergoing a high human pressure. Anthropogenic activities have a growing impact on these areas, and the degree of impact varies according to the degree of use of natural resources and environmental loads. The multiple uses of coastal zones pose excessive and competing demands on the limited resources. Fundamentally, two types of conflicts can be observed: those between the natural and the socio-economic systems; and those within the economy itself, in terms of conflicts among the users of the limited available coastal resources, as in the case of traditional and modern fishermen, small shack owners and large hoteliers as they compete for tourists;

and between sectors, as in the case of allocating coastal land for setting power plants or reserving it for residential and tourist use.

The COASTIN project had to deal with different aspects of the complex and conflicting interaction between social and environmental sustainability within the social process of shaping and building development for present and future generations. It was assumed that sustainable development requires an integrated and interactive approach that allows for the understanding of the complex relationship between society and nature, simultaneously respecting human rights, and assuming that environment is a vital dimension of the future of the human kind. Whilst environmental sustainability is concerned with the biophysical limits of social activities, social sustainability is related to the internal organisation of individual societies as well as of the world community as a whole.

5.1 The definition of scenarios: the example of tourism activity in Goa

The alternative scenarios developed by the socioeconomic analysis in Goa are presented below. The presentation of the scenarios is organised in two parts: description of the present situation and definition of three alternative scenarios.

More than any other sector, tourism depends on a healthy natural environment to sustain it. Goa is a region, which has natural and cultural assets - its beaches and exotic life - to attract visitors and generate tourist income. Local communities and state and national governments all stand to benefit from an increase in global tourism. However, there is also a potential loss. Too rapid, unplanned, or uncontrolled development all have the potential to create associated environmental degradation on the long term, eroding the quality of the very assets on which such development is based.

Tourism activity in the area is based on a fragile offer and demand, i.e., the infrastructures offer a deficient quality and the demand is searching for low prices. The absence of sewage systems and the deficient waste management has important impacts on the water quality. Besides, the non-existence of water treatment and distribution infrastructure is preventing the assurance of water quality for public consumption. These are apparently the cause for the spread of diseases and health problems among inhabitants and eventually tourists.

The type of tourism enterprises existent in the area doesn't have financial capacity to build the appropriate equipment for environmental protection. In fact, these units have a low or even nonexistent capacity of investment; therefore, they have a limited ability to invest in sewage systems and waste treatment. As a matter of fact, future

investments in general are strongly limited by the low income and its fluctuation.

Landscape deterioration is also a characteristic of the area that can jeopardise its attractiveness for tourists. The pressure for building constructions is increasing and the vegetated areas are decreasing. The traditional aesthetic value of some of these areas is in danger. The cultural and historic features of Goa are not being developed and the identity values are vanishing.

In view of the degradation of the type of tourist offer, the advantages of Goa are not competitive with other regions. The vulnerability to external drivers is higher.

From the point of view of social sustainability, the situation of local families is not guaranteed. Incomes are low, labour is rather unqualified, so investments in small activities are low and capability to react to change is also limited. Besides, administration (local and regional) gives little support and quality of life is bad.

From environmental sustainability perspective, a common point is highlighted in the alternative scenarios: the need to invest in sewage infrastructures, waste treatment and management, public water supply system, roads and transport networks. These are elementary needs in terms of environmental protection. Even in the present, the situation is not environmentally sustainable. Improved caution in the use and management of the resources is a priority in any scenario.

A Business As Usual scenario (A)

The maintenance of this situation will lead to a high impact over natural resources and environment in general. In the same way, negative impacts over the domestic units will increase. Incomes will become lower because the supply of services to tourists will increase, maintaining a bad quality level.

An Economic Growth scenario (B)

The main orientation of scenario B is based on the support and development of the private sector. Public intervention will promote the interests of big tourism enterprises.

The need of public investment would be lower and the return would be quicker, as private economic agents would do and/or pay for these investments. Private support investment for sewage infrastructures, waste treatment and management, public water supply system, roads and transport networks. Cost transfer to the enterprises will decrease public investment; however, in future, the income will be in the hands of the private investors. The public sector will possibly offer good investment opportunities and the area will be able to attract big companies by having privileges in the access to the coastal areas and exploitation of natural resources. The labour force will have to be trained by the enterprises or/and, depending on the cost benefits analysis, it could be

imported from outside the region. This can contribute to an increase in population flow, mainly of inhabitants who are better prepared for tourism activities.

In terms of social sustainability, this alternative scenario could bring about some problems. The withdrawal of local population from tourism activity and the absence of support to the local domestic economic units could lead to a lower income and worse living conditions among the population. The cultural and historic characteristics of the region could be "sold" like a tourist product by the private sector or, alternatively, these companies might introduce other entertainment facilities, not necessarily related with the cultural values of Goa. This being the case, tourism in Goa would become equal to other sea and sun destinations and its vulnerability would increase in comparison to the national and international fluctuations. Exploitation of natural resources would be freer and more vulnerable to private economy interests.

Socio-Economic Sustainability scenario (C)

The main orientation of this scenario is based on the criteria inherent to creating a strong public intervention by the regional and local governmental structures. In this scenario, public investment would lead the interventions in different directions: support to domestic economy with the reinforcement of its investment capacity, income and professional qualification. The domestic units would receive financial support to develop tourism facilities and training on management and entrepreneurial innovation; public investment for sewage infrastructures, waste treatment and management, public water supply system, roads and transport networks; reinforcement of the cultural and historic characteristics of Goa. For example, renewal of Portuguese houses and ancient blocks, monuments, etc; the infrastructures' improvement would attract quality international tourism agents, not only tourism operators, but also investors with better offers in terms of tourism.

Scenario C is based on a double option: to improve the domestic units offer and, simultaneously, to promote the development and birth of high quality tourism units, by improving public investments. This scenario will lead to social and economic sustainability in the future, i.e. it is not a scenario with immediate results, because its effects will be visible only in the future when the potential for attractiveness of the region increases. The biggest disadvantage of this scenario is the need for a large public investment in the present to avoid environmental problems and to increase the income of the population. An important advantage would be the social sustainability, with the obvious improvement of life conditions for the population. The guarantee that the family economic units would participate actively in the development of tourism would lead to a better

situation for the inhabitants and increase benefits for the families.

A common point in the scenarios B and C is the need to improve public investment in basic infrastructures, but scenario B defends that the private economic agents must pay a significant part of this investment. In a way, this condition can help the public sector to bear the costs. On the other hand, this can have the negative effect of increasing tourism exploitation based mainly on economic interests and income priorities. Additionally, an important part of the profits generated in Goa by these big tourism operators would benefit their own regions or countries.

The environmental, cultural, and economic problems associated with tourism can also be addressed through the infrastructure built and resources generated by tourism itself. However, this statement is only true if the income created by tourism remains in the region. If so, the negative impacts of tourism in society and environment can be solved by these investments.

Scenario C is better able to guarantee sustainable tourism development in all its social, economic and environmental dimensions. It includes the need to ensure environmental integrity; the need to identify and catalyse a process to consider environmental risks, carrying capacities and critical environmental thresholds; identifying funding opportunities; and examining various market-based instruments that encourage sustainable tourist activities.

The implementation of this scenario implies important outreach components to promote exchange of information, as well as opportunities for dialogue and public participation (stakeholders). Outreach will focus on the national, local and community levels. Through consultation, the effective dissemination of information and a focus on national policies and opportunities as well as on local experiences, the implementation of this scenario will provide concrete information to local communities on how to develop successful economic initiatives that rely on sustainable tourism. This could be an important tool for capacity building in small or rural communities. A related priority will be to emphasize public and community education in promoting the benefits of sustainable tourism, and practical steps needed to put the criteria defining sustainable tourism into operation.

6. CONCLUSION

The coastal areas are given special attention, due to the increasing importance that they have assumed in the global context of present economic development. The number and diversity of agents searching for free space in coastal areas increase the need for integrated management so as to re-

duce the negative impacts of the increasing number of activities conflicting in these areas.

The decision to develop tourism in a particular site should be based on the careful consideration of the environmental and socio-economic analysis. This requires that an analysis be carried out to assess the potential for socio-economic benefits and costs of the tourist project, on the one hand, and an environmental impact analysis to assess the type, extent and nature of environmental resources that may be affected or at risk, on the other.

The impact analysis based on different development scenarios helps to explain changes in terms of land use and in the way in which coastal resources are affected. To achieve a level of tourist development appropriate and suitable to local resources, it is important to identify the carrying capacities that enable implementation of preventive management control and maintenance policies. In the scenarios, it is important to consider the performance of local entrepreneurs that holds the key to strengthening and spreading the benefits from tourism. Recent studies favour tourism policies that encourage a bottom-up development strategy. This should be able to bring in economic benefits to the locals, encourage local socio-economic activities and encourage their participation at all levels and in a greater degree.

Integration is the base for the success of the policy-making process, as well as it supports the definition of relevant research priorities in terms of policy decisions. Furthermore, this process needs to involve the stakeholders operating on the landscape: for example, landowners and agricultural managers, local and national regulators, planners and governments, local and national pressure groups, the private and entrepreneurial sector, and the wider public. The scientific basis of this perspective is the belief that integrating physical and socio-economic approaches in the study of coastal areas represents a conceptually correct means of addressing the unifying issue of economic and environmental sustainability.

* The research project "Measuring, monitoring and managing sustainability: the coastal dimension" was funded by the European Union, INCO-DC 1997. The project began in 1998 and the research teams were Tata

Energy Research Institute (India), Goa University (India), National Institute of Oceanography (India), Trieste University (Italy), Socinova/Universidade Nova de Lisboa (Portugal), Laboratório Nacional de Engenharia Civil (Portugal), Instituto Cartographic of Catalunya (Spain).

REFERENCES

- EEA (1999). Environmental Indicators: Typology and Overview. Tech. Report 25. On-line: <http://reports.eea.eu.int>. Access date 20-02-2002.
- Gentile, A.R. (1998). From national monitoring to European reporting: the EEA framework for policy relevant environmental indicators. On-line: <http://www.desertification.it>. Access date 20-02-2002.
- Lourenço, N. (2001). "Equity, human security and environment: key elements of sustainable development". In *Coastin. A Coastal Policy Research Newsletter*, 5, TERI, New Delhi.
- Lourenço, N.; Jorge, R.; Machado, C. R., (1999). "Socio-economic analysis on land use change studies". In *Coastin a Coastal Policy Research Newsletter*, 1, TERI, New Delhi.
- Lourenço, N.; Jorge, R.; Machado, C.; Rodrigues, L. (1999). "Land use change: Methodological approach to understand the interactions Nature/Society in coastal areas". Final report EC, D.G. JRC, ARIS Unit, SAI, UATLA, Oeiras.
- Lourenço, N.; Jorge, R.; Machado, C.; Rodrigues, L. (1999/2000/2001). *Measuring, Monitoring and Managing Sustainability: the coastal dimension*. Progress Reports, DG Research, INCO-DC 1997. FCSH-UNL, Lisboa.
- Lourenço, N.; Jorge, R.; Machado, C.; Rodrigues, L. (2000). "An integrated methodology of biophysical and socio-economic dimensions to understand land-use change processes in coastal areas". In *Coastin - A Coastal Policy Research Newsletter*, 3, TERI, New Delhi.
- TERI (1999/2000/2001). *Measuring, Monitoring and Managing Sustainability: the coastal dimension*. 1st/2nd/3rd Annual Report EC, DG Research, INCO-DC 1997.
- TURNER; B. L. et al (1995). *Land-Use and Land-Cover Change*. Science/Research Plan. IGBP Report No. 35, IGBP and HDP, Stockholm, 132 p.