18 Managing Diverse Land Uses in Coastal Bangladesh: Institutional Approaches

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Abstract

Land use in coastal Bangladesh is diverse, competitive and conflicting. Agriculture, shrimp farming, salt production, forestry, ship-breaking yards, ports, industry, settlements and wetlands are some of the uses. Land uses have gone through major changes. Land use in the 1950s had been mainly for paddy cultivation, but salinity intrusion and tidal flooding prevented further intensification. Hence, in the 1960s–1980s, the World Bank and others helped with large-scale polderization in order to boost rice production. A decade later, drainage congestion inside and heavy siltation outside the polders made the southwestern area unsuitable both for agriculture, and, in extreme cases, even for human habitation. However, as the region has a history of traditional shrimp farming, polders provided an opportunity for intensive shrimp farming. Crop land and mangroves were transformed to shrimp farming. This created social conflict. Planned management of diverse land use, including zoning, has been recommended since. This chapter focuses on the complexities of land use in Bangladesh and the adopted institutional approaches.

Introduction

Land uses in coastal Bangladesh[1] (Fig. 18.1) have gone through major changes over the last half century. The land is intensively used for agriculture, settlements, forests, shrimp ponds (known locally as *ghers*), water bodies and fisheries, salt production, industrial and infrastructure developments, tourism and preservation and management of environmentally important and special areas. With the continually increasing population, the following features emerge:

- demand for expansion in all land uses (urban area, settlement, shrimp, etc.),
- increasing demand for new uses (tourism, export-processing zones and others), and
- encroachment and conversion of land from one use to another.

The above-mentioned circumstances call for planned management of land resources, including zoning. Though land zoning and regulations of land use have been advocated for a long time, actions and/or steps in this regard are almost totally lacking (Brammer, 2002). A start was made recently to bring

[1] The coastal zone of Bangladesh consists of 19 southern zilas and the EEZ (Exclusive Economic Zone).

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relevant agencies together to discuss and develop a proposal for land zoning (PDO-ICZMP, 2004a). The complexities of land use and the institutional approaches adopted to define indicative land zoning are described in this chapter.

Land and Land Use

Land – a declining resource

Land is the basic natural resource that provides habitat and sustenance for living organisms, as well as being a major focus of economic and livelihood activities. Bangladesh has a population of 123 million living on a land area of 147,000 km^2 (PDO-ICZMP, 2004b). The population is increasing and the land is being converted from directly productive purposes, such as crop cultivation, to other uses such as housing, roads and urban development, and this trend is expected to continue. Some of the statistics provide an alarming picture:

- Some 220 ha of arable land is being lost daily to uses such as road construction, industry, houses, etc. (Islam *et al*., 2004).
- At least 86,000 ha of land was lost to river/estuarine erosion between 1973 and 2000 (MES, 2001), though this is compensated by land generated through accretion.
- Some 70% of the land of Barisal and Khulna divisions is affected by different degrees of salinity, which reduces agricultural productivity (Rahman and Ahsan, 2001).
- Some 50% of the coastal lands face different degrees of inundation, thus limiting their effective use. This situation is expected to worsen further because of the effects of climate change.

In the coastal zone also, the population is expected to increase from 36.8 million in 2001 to 43.9 in 2015, and to 60.8 million by 2050 (PDO-ICZMP, 2005a). Present per capita agricultural land of 0.056 ha will decrease to 0.025 ha by 2050. On top of this, about 54% of the people of coastal Bangladesh are functionally landless and more than 30% are absolutely landless. Among the landholders, 80% are small farmers, 18% are medium farmers and only 2% are large farmers (PDO-ICZMP, 2004b). These have decisive impacts on major economic and livelihood activities, on land use and subsequently on the quality of land.

Present land use

Land use in Bangladesh is generally determined by physiography, climate and land height in relation to water level (Brammer, 2002). These together make a highly complex environment characterized by five main land types related to depth of seasonal flooding: 30 or more agro-ecological zones encompassing differences in soils, climate and hydrology; and areas with varying degrees of risk of disastrous floods, drought and cyclones. About 60% of the lands are inundated to a depth of 30 cm or more. The Bangladesh Bureau of Statistics publishes land-use statistics regularly. Emphasis is mainly on agriculture. Land uses are classified as net cropped area, current fallow, current waste, forest and area not available for cultivation. Along this line, SRDI (Soil Resources Development Institute) produces agricultural land-use maps for the country identifying many different types of agricultural land use.

In 2003, an estimate was made (Table 18.1) capturing a broader perception of land use and recognizing seasonal variations (ASB, 2003). Two complications were identified: areas under river and water bodies increased greatly in the wet season and estuarine/riverine wetlands (known locally as *chars*) cultivated during the dry season went under water in the wet season.

In coastal Bangladesh, agriculture, shrimp farming, salt production, forestry, ship-breaking yards, ports, industry, human habitation and wetlands are some of the uses in an area of only 47,000 km^2 inhabited by 36.8 million people. Land use in the coastal zone is diverse, competitive and conflicting.

Early 20th century land use

A vivid description of how modifications were being made to the natural levees beside some rivers was given by Mukerjee (1938):

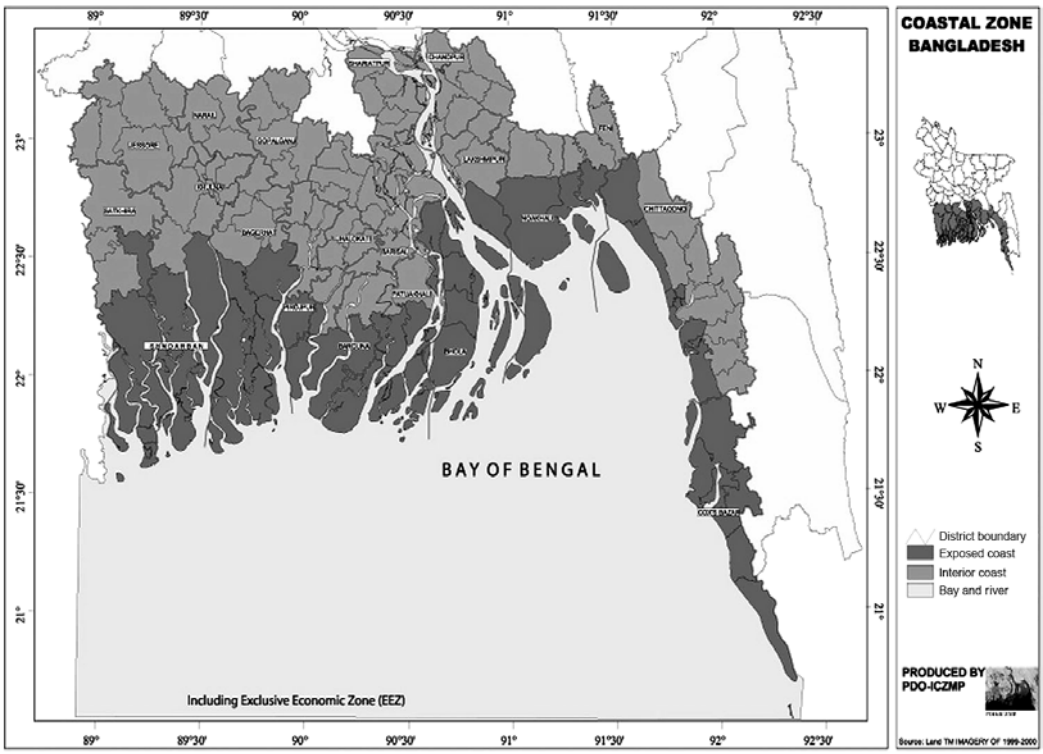

Fig. 18.1. Map of the coastal zone of Bangladesh.

Small embankments were constructed and gaps in them were closed at high tide and opened at low tide so as to achieve partial drainage of the land behind, along with reduced salinity. Thus the human intervention of embankment construction has interacted with the delicately balanced natural processes, and has drastically hastened the raising of riverbed levels.

Local landlords, since the 17th century, constructed small dykes or embankments around individual land to limit saline water overflow and prevent crop damage. This traditional mechanism of construction of embankments through local efforts practically ceased in 1947. Land use, at that stage, was for paddy cultivation, especially low-yielding locally adapted varieties. In very limited areas of the southwest, traditional shrimp culture was practised.

Land use in the 1950s–1960s

In the 1950s–1960s, existing embankments deteriorated for lack of proper maintenance so that salinity intrusion and tidal surges caused routine crop damage. Crop failures caused by saline inundation or monsoon flooding were reported in most areas once every 3 years (Nishat, 1988). The Green Revolution at that time called for more intensive rice cultivation. Hence, the government recognized the need for protection of the coastal areas and construction and development of embankments started in 1961. The Coastal Embankment Project (CEP) was established, with assistance from the World Bank, in 1967. The Dutch term 'polder' was used to designate areas that are surrounded by dykes or embankments, separating them hydrologically from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. The embankments include regulators and other structures to control water intake and drainage of the empoldered area.

The primary purpose of empolderment was to increase agricultural production. During the first phase, 92 polders were constructed with 4022 km of embankments and 780 drainage sluices. The gross polder area

Table 18.1. Land use in Bangladesh showing seasonal variation (from ASB, 2003).

Classification	Area (km^2)	
	Dry season	Wet season
Rivers	6,400	7,700
Main rivers	2,860	3,940
Rivers in Sundarban	1,660	1,660
Other rivers	1,880	2,100
Standing water bodies	4,245	9,500
Haors	450	3,700
Beels	177	1,500
Baors	55	60
Ponds, tanks, ditches	3,000	3,500
Kaptai Lake	563	740
Forest	19,610	19,610
Cultivated	77,600	73,500
Field crops	51,000	17,140
Tree crops	4,900	4,900
Seasonal fallow	17,000	16,760
Current fallow	4,100	4,100
Seedbed only	600	600
Brackish-water aquaculture	1,900	1,900
Salt beds	50	0
Rural build-up	7,000	7,000
Non-cropped village land	8,400	8,400
Urban	7,000	7,000
Infrastructure	2,100	2,100
Estuarine area	8,600	8,600
Total	147,570	147,570

protected by June 1971 was 1.01 million ha (Talukder, 1991). Though no evaluation of the impact of the CEP on agricultural production has been performed, it became apparent that empoldering has increased the scale of production. Crops were saved from salinity and flooding; some yields increased by 200–300% (Nishat, 1988). The dominant land use during this period was paddy cultivation, primarily traditional local varieties. Modern paddy varieties and technological packages were introduced. Other uses remained the same: salt production, mangrove forest and traditional shrimp farming.

Land use in the 1970s–1980s

In the 1970s–1980s, the World Bank and other donors helped to continue large-scale polderization of coastal Bangladesh. Polders became part of the natural setting of coastal Bangladesh (Fig. 18.2), with a total of 123 coastal polders implemented (PDO-ICZMP, 2004b). To further enhance agricultural production, it was soon realized that internal water management had to be established within these polders. Changes in land use occurred because of the intensification of paddy cultivation with the attempted expansion of modern varieties and conversion of agricultural land to non-agricultural use (Sereno, 1981). During this time, coastal afforestation started with the objective of protection from cyclones and foreshore erosion.

Land use in the 1990s

In the 1990s, southwestern coastal Bangladesh experienced drainage congestion inside and heavy siltation outside the pold-

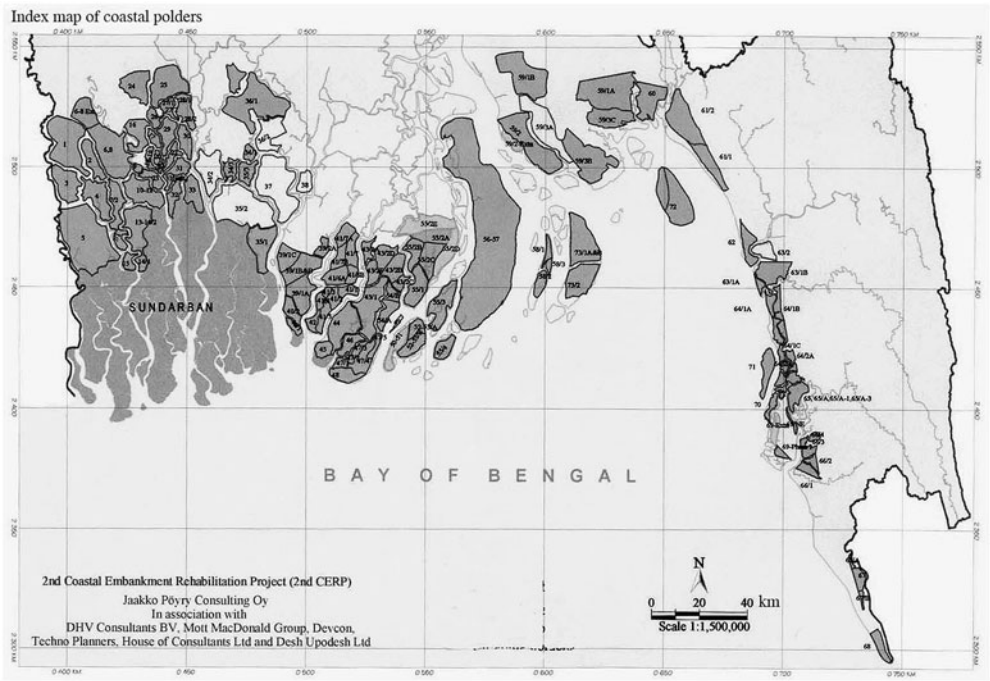

Fig. 18.2. Polders in coastal Bangladesh.

ers because of extensive polderization of the hydro-dynamically active delta, and subsequently the achievements from polderization gradually evaporated. The area became unsuitable both for agriculture and, in extreme cases, even for human habitation. This was termed a 'man-made disaster' (Rahman, 1995). Poverty and out-migration from the area occurred. The Khulna–Jessore Drainage Rehabilitation Project was conceived, with emphasis on structural solutions, including the construction of large regulators. Local people did not support a structural solution and resorted to wide-scale protest. The traditional system of allowing natural siltation under the concept of 'tidal river management' was adopted and land became suitable again for cultivation.

Emergence of commercial shrimp farming

Around the same time, increased demand and a high price for shrimp on the international market occurred. As the southwest had a history of limited-scale traditional shrimp farming, polders provided an opportunity for intensive shrimp farming. Many coastal polders constructed to protect agricultural land from inundation of salt water were turned into large shrimp *ghers*. The priority was reversed and salt water was willingly being allowed in the *ghers* to raise shrimp. Land previously used for agriculture and mangroves was transformed, often forcibly, to shrimp farming. Wide-scale land-use conflict emerged and created social unrest. Shrimp farming is now established as an important industry, contributing 5.2% to GDP, and the second-highest foreign exchange earner of the country. Shrimp areas expanded from 51,812 ha in 1983 to 137,996 ha in 1994 and to 141,353 ha in 2002 (DoF, 1995, 2003).

Land-use Conflicts

Most coastal lands are suitable for more than one use. Hence, the many diverse uses of

limited land have created conflict. Many studies have highlighted these conflicts, especially between shrimp farming and other uses (Nuruzzaman, 1979; Karim and Stellwagen, 1998). In addition, one land use or another has manifold implications for socio-environmental conditions. The introduction of shrimp farming has gradually changed the land-use patterns of the surrounding farms, transforming agriculture and mangrove areas into shrimp-farming areas (Haque, 2004 and Fig. 18.3). Several studies reported a reduction in land for cattle grazing (Maniruzzaman, 1998), death of trees and other vegetation (Alauddin and Tisdell, 1998), increased salinity of soil and water and a reduction in the drinking-water supply because of the introduction of shrimp farming.

Firoze (2003) and Majid and Gupta (1997) elaborated upon the social and environmental impacts of commercial shrimp culture. As agricultural lands were turned into shrimp polders, the share-croppers and landless wage labourers found themselves losing their livelihoods, and began movements to resist the introduction of shrimp in their areas. This often resulted in violence. During the last two decades, more than 150 people have been killed and thousands injured in shrimp-related violence (Firoze, 2003). Influential and rich shrimp farmers, to harass leaders of the anti-shrimp movements, also initiated thousands of court cases, many of which are still pending.

Brackish-water shrimp cultivation, on a commercial scale, has brought large-scale environmental degradation. Shrimp polders retain saline water for months at a time, and the salinity seeps on to adjacent farms and spreads soil salinity. The loss of mangrove areas to aquaculture is a common feature, with Chakoria Sunderban being the classic example (Chowdhury *et al*., 1994; Brown, 1997). From 1967 to 1988, the total area of Chakoria Sundarban mangroves decreased from 7500 ha to only 973 ha (Fig. 18.4) (Chowdhury *et al*., 1994).

Management Approaches

To accommodate diverse land uses, changed patterns of land use and land suitability, zoning has been proposed as a management approach. Hossain and Lin (2002) suggested that, to reduce social conflicts and promote effective and sustainable resource use, land

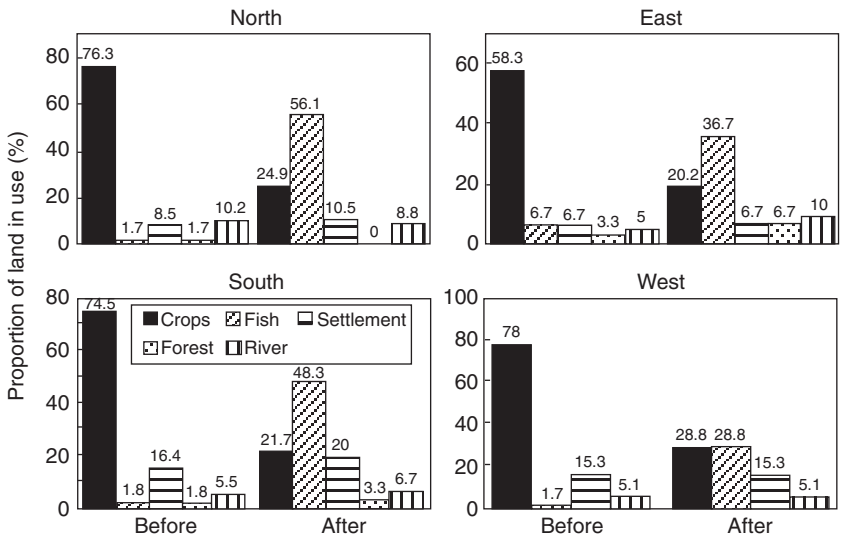

Fig. 18.3. Induced changes in land use around a farm, before and after the introduction of shrimp (from Haque, 2004).

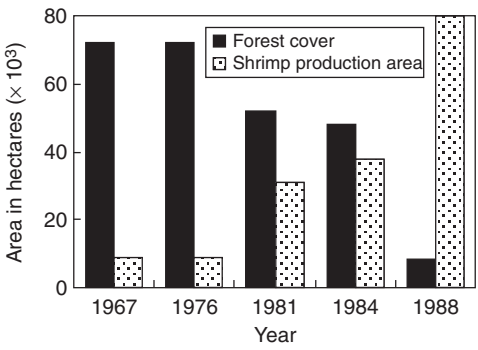

Fig. 18.4. Changes in area under forest and shrimp production in the Chakoria Sundarbans, 1967–1988 (after Choudhury *et al.*, 1994).

should be zoned on the basis of suitability: the most suitable zone, a moderately suitable zone and an unsuitable zone. Zoning can also be coupled with time-sharing: for example, shrimp farming during monsoon months and salt production during summer months. This will minimize the unplanned horizontal expansion of any land use, particularly shrimp farming or salt production, and maximize productivity from smaller areas through vertical integration. In the southwest, the pattern emerging is integrated rice–shrimp/fish farming. This will improve the socio-economic condition of the people as well as maintain the ecological balance in the coastal region.

Land suitability: specific research results

Several studies have dealt with comparative land suitability analyses on present land uses. Hossain and Lin (2002) analysed remote-sensing data of Landsat TM and thematic information of Cox's Bazar to identify suitable areas for mangrove afforestation and shrimp farm and salt bed development. Most of the suitable areas identified in the study actually coincided with the existing land use, which is important for appropriate zoning to optimize resource allocation and minimize conflicts between user groups. Further, the land suitability maps for mangrove afforestation, shrimp farms and salt beds were overlaid together to distinguish the combined land suitability categories as well as land-use conflicts. The results for potential land-use conflicts among salt, shrimp and mangrove areas were not prominent but indicated possible conflicts, mainly between mangrove and salt, as well as between mangrove and shrimp. Combining the present land-use map of the study area with the identified suitable land-use map revealed that most areas of existing shrimp farms and salt beds were developed within the suitable area, except for mangrove afforestation. Similar observations were made by Alam *et al.* (1990), Shahid *et al.* (1992) and Islam *et al.* (1997).

Ibrahim (2004) prepared land suitability maps for both *bagda* (brackish-water shrimp) and *T. aman* (transplanted paddy) crops in three administrative zilas: Khulna, Bagerhat and Satkhira. The land suitability factors for both *T. aman* and *bagda* are similar, except for soil salinity. High salinity increases the yield of *bagda* but reduces the yield of the *T. aman* crop. Based on physical suitability, areas used exclusively for *bagda* could be clearly delineated. Similarly, *T. aman* and other agricultural crops could be separated from *bagda* practices. Present land use for these two indicated mismatched areas in these three districts. Quader *et al.* (2004), using remote-sensing techniques, analysed the suitability of different land uses and found that the Khulna–Satkhira area was more suitable for shrimp farming than Cox's Bazar.

Institutional and other approaches

To reduce conflicting land use, maximize potential land use and facilitate integration of different uses in the coastal zone, several projects began: Coastal Embankment Rehabilitation Project (CERP), Systems Rehabilitation Project (SRP), Delta Development Project (DDP), Khulna–Jessore Drainage Rehabilitation Project (KJDRP) and 3rd and 4th Fisheries Projects. For example, under the Delta Development Project, it was concluded that the combination of rice cultivation and shrimp cultivation on the same land (in rotation) was possible without direct negative effects on rice yields (Nishat, 1988).

These projects have shown that planned management of land uses could offer both economic and environmental benefits.

Recognizing the need for integrated and comprehensive planning and other socio-economic support, the government of Bangladesh established the Program Development Office (PDO) for Integrated Coastal Zone Management. It is a multiministerial and multisectoral initiative led by the Ministry of Water Resources. The PDO is composed of representatives from different ministries and a small number of national experts. The office is supported by focal points, established in 34 government organizations, universities and research organizations, and by three task forces dealing with livelihoods, policy and strategy, and knowledge management issues. The whole set-up is steered by an interministerial technical committee composed of heads of relevant government departments, universities, NGOs, civil and chamber bodies and an interministerial steering committee consisting of secretary-level representatives of different ministries.The PDO, in its preparatory phase, plans to deliver three key outputs: a Coastal Zone Policy, Coastal Development Strategy and a 'priority investment programme', which are backed by supporting outputs in relation to coastal livelihoods, thus enabling the institutional environment and knowledge base. Land use is core to these outputs.

Several government policy documents have highlighted the importance of optimizing land use and land zoning for integrated planning of resource management. These are the National Fish Policy (1998), National Water Policy (1999), National Agricultural Policy (1999), Draft Shrimp Strategy (2004) and Coastal Zone Policy (2005). The National Fish Policy states that 'coastal areas will be demarcated for shrimp farming'. The Draft Shrimp Strategy states further that 'areas suitable for shrimp cultivation will be identified using a land-zoning process which will limit brackish-water shrimp aquaculture to coastal areas' and 'the objective of land zoning is to optimize land use'. The Coastal Zone Policy states that 'actions shall be initiated to develop land-use planning as an instrument of control of unplanned and indiscriminate use of land resources' and 'zoning regulations would be formulated and enforced in due course'.

However, the key policy is the National Land-Use Policy (2001), which describes

- zoning based on land use,
- ensuring the best use of land through zoning, and
- enactment of a zoning law to allow local government institutions to prepare zoning maps.

The National Land Use Policy places special emphasis on coastal areas. Recognizing the complexities of coastal land use, the policy makes provisions for an inter-agency task force to prepare an outline of coastal zoning.

No concrete and effective steps had been taken in the country towards restricting or regulating the conversion of agricultural land to non-agricultural uses (Nuruzzaman, 1979; Brammer, 2002). The following laws, however, are aimed at managing public land and water bodies, allocating and managing public and private shrimp land, and conserving the environment:

- Embankment and Drainage Act (1952),
- Bangladesh Water and Power Development Board Ordinance (1972),
- Manual for Land Management (Jalmohal) (1990),
- Shrimp Mohal Management Policy (1992), and
- Shrimp Farm Taxation Law (1992).

The emerging land-zoning concept

As shown above, land zoning has been advocated since the 1980s. Several broad zoning studies have been or are being carried out, notably the agro-ecological zoning of Bangladesh (FAO, 1988) and the SRDI land-zone mapping. Other information bases are organized on a narrower basis, such as SRDI's land suitability assessment for different crops. However, zoning, along sectoral lines, does not provide a basis for choices between often conflicting sectoral objectives. Karim and Stellwagen (1998) emphasized

that 'no efforts have so far been initiated to classify the coastal land into various economic zones and develop them according to their development potential'. Integrated development is the outcome of such choices and multisector zoning should provide a tool for achieving the best choices for economic land use in an area, on the basis of its needs and potentials. Many agencies in Bangladesh already recognize this need for integrated zoning in support of planning for 'best possible' economic land use, while preventing land degradation and protecting the environment. DoF (2002) stated that 'coastal zoning would improve land-use planning, minimize conflicts over land tenure and identify appropriate areas for shrimp farming and areas that need to be protected [for grazing of livestock, common access, etc.]'.

The emerging concept is to formulate land zoning, with administrative boundaries as the unit, in accordance with the (dominant) land use and economic activities, as well as their potentials and vulnerabilities. Hence, this zoning has to be more than just a description of the current situation and must account for major underlying ecological and socio-economic factors and processes that have led to the current situation and that may be important for future trends and hazards. The approach should therefore take into account important ecological and socio-economic factors.

Zoning as a tool for area development is, of course, an ambitious goal that can only be attained in stages. Mutsaers and Miah (2004) have outlined the following conceptual basis for the first stage in the process to delineate an indicative coastal land zoning:

- a stepwise approach with clear intermediate results;
- use of an administrative boundary[2] as the unit for zoning, such as the upazila as the unit for indicative land zoning. Further detailed versions using union and later field blocks will be developed;
- use of only existing data. Field information to be collected for the purpose of validating the zoning (ground-truthing);
- proactive interaction with relevant agencies at different stages of the elaboration process; and
- support and backing of a structured technical support group involving government and non-government agencies. The Ministry of Land will be involved as an implementing agency of the Land-Use Policy.

The expected outputs will be

- zoning of the coastal area within broader zones, such as 'agriculture zone,' 'shrimp zone', etc
- each upazila will be associated preferably with one and only one of the land zones
- a typology will be given for each zone explaining its characteristics in some detail.

Land Zoning – Consensus Building

For the zoning to acquire the status of an accepted planning tool, there has to be a high level of consensus and ownership among relevant agencies. The need for discussion among different line agencies was identified. The Program Development Office (PDO), as a multi-sectoral, multi-agency set-up, provided a platform for relevant stakeholders for such a discussion. A 'Technical Discussion on Coastal Land Zoning' was arranged in August 2004 (PDO-ICZMP, 2004a). The approach and the outputs were discussed and agreed upon.

Moreover, to prepare the proposal of coastal land zoning, it was considered essential to draw on the expertise available among different agencies. A ten-member technical support group was formed, notably with representatives from the following agencies:

- Soil Resources Development Institute;
- Department of Fisheries,
- Forestry Department,
- Bangladesh Agricultural Research Council,
- Bangladesh Shrimp Foundation.

[2] Administratively, Bangladesh is divided into six divisions, 64 zilas, 507 upazilas and 4484 unions. The coastal zone encompasses 19 zilas, 147 upazilas and 1913 unions.

The group met several times during the process to contribute through information and data, participate and review ongoing work. Some of the group members also participated in the ground-truthing visits in the field.

Indicative Land Zones

An indicative land zoning has emerged (Fig. 18.5, PDO-ICZMP, 2005b), identifying the following eight zones:

- shrimp (brackish-water) zone,
- shrimp (sweet-water) zone,
- salt–shrimp zone,
- forest zone,
- mangrove (including Sundarban) zone,
- urban and commercial zone (industrial, port, export-processing zones and ship-breaking yards),
- tourism zone, and
- agricultural zone.

Results of the indicative land zones have been presented to field-level stakeholders at regional workshops and to policy planners at national workshops. There is now a national consensus on indicative land zoning.

Conclusions

Even with agreement on indicative land zoning among many agencies, only a start has been made. This version of land zoning is expected to be used as a basis for detailed land zoning, as elaborated in the Land-Use Policy (MoL, 2001). The challenge is to give a legal status to this broad zoning. However, the strength of this exercise is that it has brought relevant agencies together on an institutional platform. A consensus has been

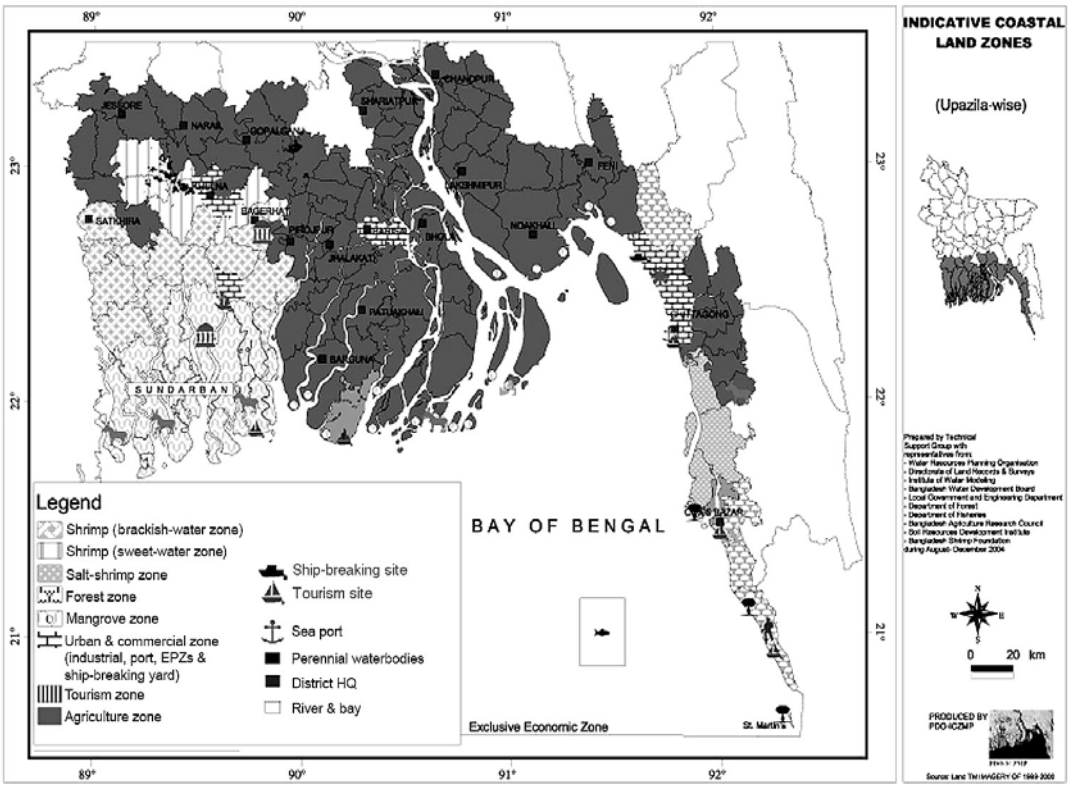

Fig. 18.5. Indicative land zones in coastal Bangladesh.

reached to aim for further detailed land zoning, but taking one step at a time. Land zoning, complemented by policy and investment support, can be instrumental in managing diverse land uses in the coastal zone. Continued research on land use will support optimum, sustainable and environmentally friendly land use and the subsequent modern management of land use through land zoning.

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