

Pre-and post-tsunami coastal planning and land-use policies and issues in Bangladesh

Rafiqul Islam¹

The coastal zone of Bangladesh covers 19 coastal districts and the exclusive economic zone (EEZ); it is prone to multiple threats. The 2004 Indian Ocean tsunami caused no significant damage to the coast. Natural disasters have direct and indirect impacts on land resources and their use. In coastal Bangladesh, the major land uses comprise agriculture, shrimp and fish farming, forestry, urban development and other settlement needs. There is demand for expansion of all current land use, while the need for new exploitation is also emerging. Moreover, land is being degraded or lost due to the effects of increased salinization, flooding and erosion. Since the 1960s, measures to address these problems have been polderization, land reclamation and coastal afforestation. However, new land is being generated through accretion. Newly emerging lands are being captured by local power-brokers and the government's land allocation programme has been implemented slowly. Lately, the government has promulgated the Land Use Policy (2001), Coastal Zone Policy (2005), Tsunami Vulnerability Map (2005) and Coastal Development Strategy (2006). The government has also accepted an indicative land zoning plan. However, much remains to be done in implementing the recently adopted Coastal Zone Policy and the establishment of Integrated Coastal Zone Management (ICZM) — coordination, demarcation of land zoning, mangrove afforestation through community participation, better preparedness against disaster and the introduction of modern land management systems.

1. Background

1.1 The coastal zone of Bangladesh

The coastal zone covers 19 out of 64 districts² facing, or in proximity to, the Bay of Bengal, encompassing 153 *thanas* (subdistricts, formerly called *upazilas*) and the EEZ (MoWR 2005). The zone constitutes 32 percent of the area and 28 percent of the population of Bangladesh (Islam, 2004). In 12 of these districts, 51 *thanas* face a combination of cyclone risk, salinity and tidal water movement above critical levels and are designated as “exposed coast” (Figure 1, green areas). The coastal zone covers an area from the shore of 37 to 195 kilometres, whereas the exposed coast is limited to a distance of 37 to 57 kilometres (Islam *et al.*, 2006).

¹ Integrated Coastal Zone Management program, Dhaka, Bangladesh.

² Administratively, Bangladesh comprises six divisions, divided into 64 districts, 507 *thanas* and 6 888 unions/wards.

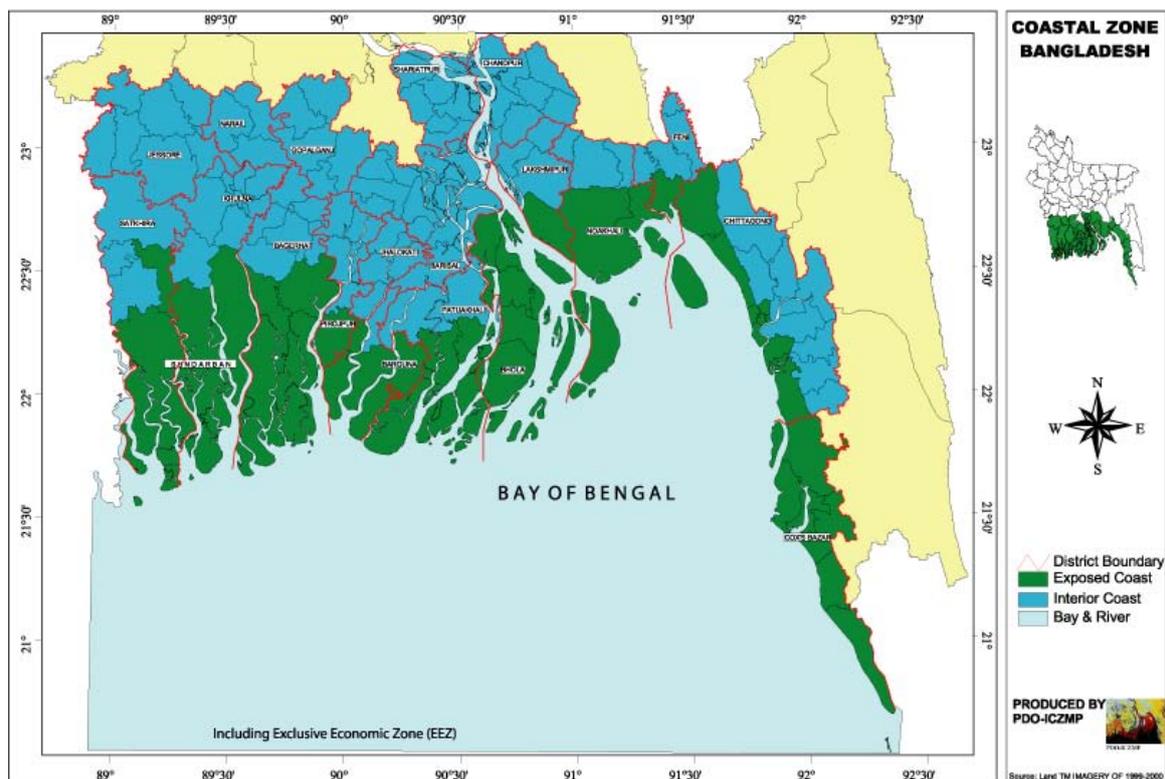


Figure 1. The coastal zone of Bangladesh

The coastal zone of Bangladesh forms the lowest landmass and is part of the delta of the extended Himalayan drainage ecosystem. The Ganges–Brahmaputra–Meghna Delta, covering most of Bangladesh, is also one of the largest and youngest deltas in the world, and is still very active. Sixty-two percent of the land of the coastal zone has an elevation of up to three metres and 86 percent up to five metres (Islam *et al.*, 2006).

The population of the coastal zone of Bangladesh was 36.8 million in 2001 (only 8.1 million a century earlier). Agricultural labourers, small farmers, fisherfolk and the urban poor make up 71 percent of the 6.85 million households (Ahmad, 2004). The coastal population is projected to grow to about 43.9 million in 2015 and 60.8 million by 2050 (Ahmad, 2005). Official poverty indicators show a slightly higher percentage of the population living below the absolute poverty line in the coastal zone compared to the country as a whole (52 percent vs. 49 percent), while the GDP per capita and the annual GDP growth rates in the coastal zone are more or less similar to the national averages.

The coastal zone of Bangladesh is prone to multiple threats such as cyclones, storm surges and floods, as well as earthquakes, tsunamis, and above all, climate change. The government has identified the zone as an “agro-ecologically disadvantaged region” (GoB, 2005). Scarcity of drinking water, land erosion, the high groundwater arsenic content, waterlogging, water and soil salinity and various forms of pollution have also slowed down social and economic developments (Islam and Ahmad, 2004).

Even though only two people were reported dead and no damage to properties was reported, the effects of the Asian tsunami in 2004 were felt all over Bangladesh, and in coastal districts in particular. Waves were formed in all rivers in the coastal area and also in waterbodies elsewhere in the country. Aftab Alam, a geologist and earthquake-specialist explained “this quake mainly shook the ocean waters which are interconnected with the sub-soil water

tables.” He further noted that “the hydrostatic pressure increased, and that resulted in water surges in different water bodies across the country.” Ioualalen *et al.* (2005) investigated, through a simulation study, the reasons for no impact on the Bangladesh coast. They noted that mitigation was attributable to the presence of the extended Bangladesh continental shelf, the non-radiative direction of propagation onto the Bangladesh coast that was reached mainly by edge waves, and possible defocalization by the Nicobar and Andaman islands.

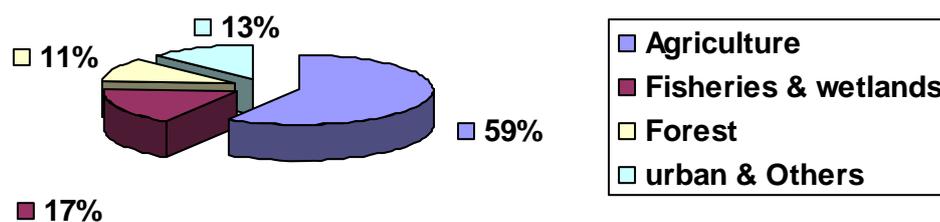
During the last 250 years, six tsunamis, at most, have been reported to have affected the coast of Bangladesh (Choudhury, 2006). Because of Bangladesh’s low elevation, Sadhuram (2005) predicted that a tsunami of one metre could severely damage coastal Bangladesh. It is estimated that at least 4.8 million people are at high risk from tsunamis (Islam *et al.*, 2006).

This paper attempts to describe major land uses and land-related issues. Recent initiatives, especially policy and strategic options in coastal and land management, are examined. The aim is to describe the different measures undertaken to address disaster management, including a possible tsunami strike.

1.2 Major land uses

Land use in Bangladesh is generally determined by physiography, climate and land levels (Brammer, 2002). Together they constitute a highly complex environment characterized by five main land types related to the depth of seasonal flooding. There are 30 or more agro-ecological zones with differences in soils, climate and hydrology and areas with varying degrees of risk apropos disastrous floods, drought and cyclones. About 60 percent of the land is seasonally inundated to a depth of 30 centimetres or more.

Land in coastal Bangladesh is used *inter alia* for agriculture, shrimp and fish farming, forestry, salt production, ship-breaking yards, ports, industries, human settlements and wetlands (Figure 2). Land use in the coastal zone is diverse, competitive and often conflicting (Alam *et al.*, 2002; Islam, 2006a).



-Figure 2. Major land uses in Bangladesh

1.2.1 Agriculture

Like in other parts of Bangladesh, coastal livelihoods are largely dependent on agricultural crops, mainly rice; thus, agriculture predominates. Important factors affecting land use for agriculture are flooding, physiography, soil salinity, drainage congestion and irrigation

facilities. Agricultural land in the coastal area is limited to wet season cropping because soil salinity is high in the dry season. Medium-high land dominates the coastal area, followed by highland, medium-low land and lowland.

The net cultivable area is 1.95 million hectares. At present, coastal regions contribute approximately 16 percent of the total rice production of the country. In coastal districts rain-fed monsoon paddy is the dominant crop, covering about 70 percent of the total paddy-cropped area. About 60 percent of the paddy-cropped area is planted with local varieties adapted to poor water management that results in waterlogging and salinity. The cropping intensity is 170 percent.³ The coastal zone produces a relatively high proportion of pulses, oilseeds, betel nuts and leaves, winter vegetables and potatoes. The SRDI (Soil Resources Development Institute) routinely prepares maps identifying many different types of agricultural land uses.

Within the coastal zone, three coastal districts — Gopalganj, Pirojpur and Barisal — have a history of practicing an agricultural system called soil-less agriculture or floating agriculture. In this system, wetlands are used mainly for vegetable production (Huq *et al.*, 2004; 2005).

1.2.2 Fisheries

One of the main economic activities in the coastal zone is aquaculture (Islam, 2003). In 2002 and 2003, the fisheries subsector contributed 5.23 percent of the GDP. A vast network of river systems, *beels* (natural depressions), *baors* (dead river sections), floodlands and ponds provides opportunities for both capture and culture fisheries. The EEZ in the Bay of Bengal also supports marine fisheries. The main land uses in fisheries are pond aquaculture and shrimp farming.

Pond aquaculture is practiced over 116 000 hectares of the coastal area (Table 1) and represents 40 percent of the total pond area of Bangladesh. *Baors* occur in the southwestern districts of Jessore, Khulna, Narail, Satkhira and Gopalganj. They cover 32 percent of the total *baor* area of the country. The coastal zone has only 1 655 hectares (three percent of the country) of semiclosed seasonal waterbodies (floodland) and 5 488 hectares (five percent of the country) of *beel* areas.

Table 1. Water area (ha) in the coastal zone in 2002–2003

District	<i>Beels</i>	Semi-closed seasonal water bodies	<i>Baor</i>	Ponds
Total CZ	5 448	1 655	1 752	115 959
Bangladesh	114 161	50 711	5 488	290 500
%	5	3	32	40

Source: DoF (2003).

However, the significance of shrimp farming has grown rapidly over the last 30 years (Alam and Phillips, 2004). Shrimp exports are now the second biggest foreign exchange earner of the country. At present, Bangladesh produces around 2.5 percent of the global shrimp trade (DoF, 2004). Land devoted to shrimp farming has increased remarkably over the last decade and is still increasing (Figure 3). Shrimp areas have expanded from 51 812 hectares in 1983 to 137 996 hectares in 1994 and 218 649 hectares in 2004 (DoF, 1995, 2005).

³ Cropping intensity is the average number of crops grown on a unit of land over a period of one year.

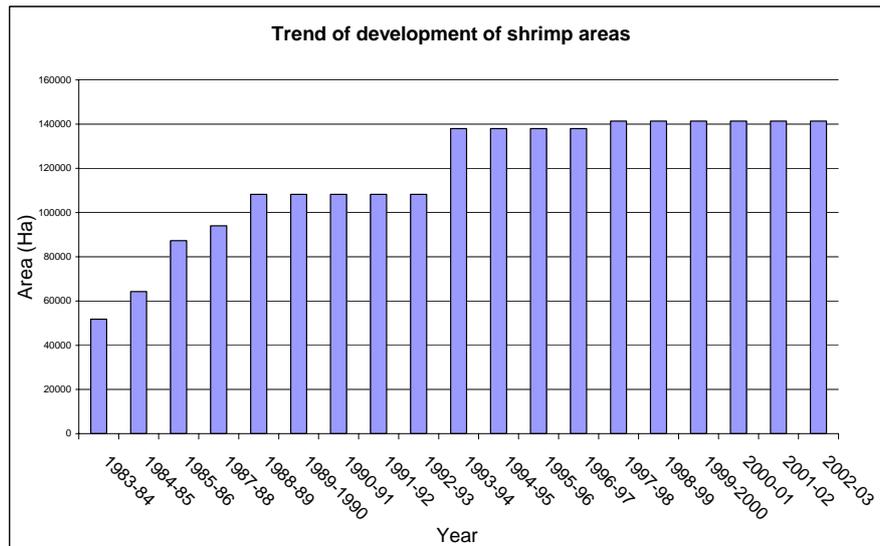


Figure 3. Trend in expansion of shrimp areas

Brackish water shrimp (*bagda*) farms are mostly concentrated in the southwestern districts of Khulna, Satkhira and Bagerhat and the southeastern district of Cox’s Bazar; they are mainly located within polders. In Khulna and Satkhira, farms largely alternate between shrimp and rice production, but in Cox’s Bazar, they alternate between shrimp and salt production. The average farm size of 93 percent of all shrimp farms inside polders is less than ten hectares. In the whole coastal zone, 52 906 brackish water shrimp farms, with a total area of 1 72 833 hectares, have been established (DoF, 2005). Most shrimp farms depend on tidal saline water from adjacent rivers and canals and are thus dependent on the tides for water supply.

Freshwater shrimp (*galda*) farming has been increasing rapidly in recent years by ten to 20 percent *per annum*. The shrimp is now being cultivated in almost all *thanas* of the coastal zone where sweet water is available; it is intensively concentrated in the *thanas* of Mollahat, Fakirhat, Chitalmari and Kochua of Bagerhat District; Dumuria, Phultala and Terokhada of Khulna District; and Monirampur and Abhoynagar of Jessore District. In 1995, the Department of Fisheries reported 10 700 *galda* farms in the Khulna region, covering an estimated area of 4 200 hectares. By 2003/2004, this had increased to 36 275 farms covering an estimated area of 14 292 hectares. In the whole coastal zone, there are 87 442 *galda* farms with a total area of 45 816 hectares (DoF, 2005).

1.2.3 Forestry

The forestry subsector accounted for 1.9 percent of the total GDP in 2002/2003 (MoF 2003). In addition to traditional forest products like timber, fuelwood, pulpwood, wax and honey, forests provide raw material for many wood-based industries. Nearly 50 percent (7 869 000 hectares) of Bangladesh’s forests are in the coastal zone; they comprise both natural forests, including the Sunderbans, and planted forest.

The natural forest area includes mangrove forest, mixed evergreen and deciduous forest and mixed thickets and forest in Teknaf, Ramu, Cox’s Bazar, Ukhiya and Fatikchhari *thanas* of Cox’s Bazar and Chittagong districts. Mangrove forests play an irreplaceable role in the life cycle (for example as breeding or nursery grounds) of economically important fish, shrimp and crab species.

The Sundarbans is the largest productive mangrove forest in the world. It is located in the southwest corner of Bangladesh and covers 6 017 square kilometres. The total growing stock of the forest is estimated to be 10.6 million cubic metres, of which 64 percent is *Heritiera fomes*. Pure *Heritiera* forest is decreasing at a rate of 0.17 percent per year. This indicates that the site is becoming adverse for the less salt-tolerant *Heritiera*. The other mangrove forest types are also diminishing, but at a very slow rate (Iftekhar and Islam, 2004 a,b). The principal cause of deforestation is expansion of agricultural land. Population growth and economic pressure are two prominent factors leading to the large-scale clearing of forests. Almost all of the mangrove forests in the vicinity of Chittagong and Cox's Bazar have already been cleared for other land uses.

In 1964, the Forest Department started afforestation in coastal areas. At first, planting was carried out to increase the mangrove shelterbelt. In later years, plantation forestry mainly proceeded on stretches of government land along roads under the social forestry programme. A total of 112 972 hectares had been planted by 2000.

1.2.4 Salt production

In 1960, the Bangladesh Small and Cottage Industries Corporation started to produce salt on 2 742 hectares in Chittagong and Cox's Bazar districts in southeast of Bangladesh, where salt production continues to be concentrated. Since then, land use under salt production has been gradually increasing (Figure 4) to meet the ever-growing demand. There are 41 000 listed salt producers. In 2003/2004, 0.9 million tonnes of salt were produced on 24 900 hectares of land.

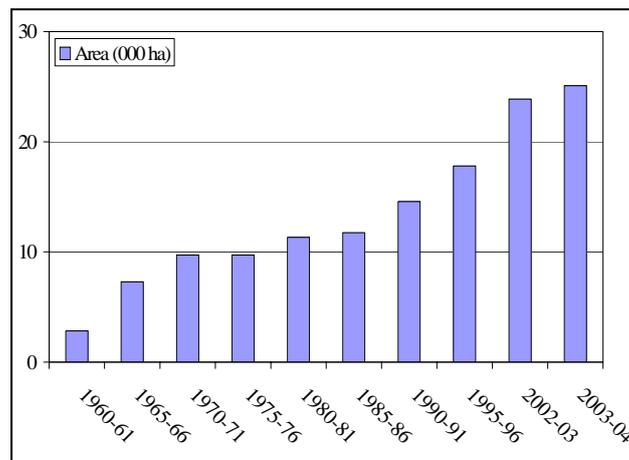


Figure 4. Area under salt production in Bangladesh

1.2.5 Other land uses

Urban, commercial/industrial areas: Three metropolitan areas and city corporations (Barisal, Chittagong and Khulna), 74 municipalities and a host of other urban areas are located along the coast. Chittagong is the second largest city in Bangladesh and is the commercial capital of the country. Chittagong is the country's main seaport. Commercial/industrial land includes areas under the Export Processing Zone (EPZ), the industrial belt in Chittagong and Khulna, and ship-breaking yards on the Faujdarhat coast of Sitakunda *thana* in Chittagong.

Tourism: Many tourist attractions are located in the coastal zone. Land use for tourism is still negligible, but is gradually increasing. Cox's Bazar is the only well-developed beach town and is the most visited, as it has both natural and cultural diversity. Kuakata beach, St Martin's Island and the Sundarbans are other important tourist destinations.

Environmentally important areas: The coastal zone possesses several ecosystems that have important conservation value. The world's largest uninterrupted stretch of mangrove ecosystem, the Sundarbans, is a World Heritage Site; coral ecosystems are found around St Martin's Island. These ecosystems are biodiversity hot spots, but planned management is yet to be initiated. Recognizing the gradual depletion of ecosystems and the ecological importance of the flora and fauna, Bangladesh has identified protected areas in the form of national parks, game reserves, wildlife and fish sanctuaries, World Heritage sites, Ramsar sites, marine reserves and ecologically critical areas (PDO-ICZMP, 2004; Islam *et al.*, 2006).

1.3 Changes in land uses — causes and impacts

Over time, land use in Bangladesh has changed dramatically (Islam, 2006a). At different stages of economic development, new land uses have emerged. Most of the coastal lands are suitable for more than one use. This has resulted in the following issues:

- Demand for expansion of all land uses (urban, settlement, shrimp etc.);
- Increasing demands for new uses (*inter alia*, tourism, export processing zones);
- Encroachment and conversion of land from one use to another; and
- Conflicting land uses and demands.

Traditionally, land use in coastal Bangladesh was predominantly for paddy cultivation, especially low-yielding locally adapted varieties. In very limited areas of the southwest, traditional shrimp culture was practiced. However, salt intrusion and tidal surges routinely caused crop damage. Crop failure due to saltwater intrusion or monsoon flooding has been reported in most areas once every three years (Nishat, 1988).

The green revolution in the 1960s called for more intensive rice cultivation. The government recognized the need for protection of the coastal areas and construction of embankments was started. The Coastal Embankment Project (CEP) was taken up, with assistance from the World Bank, in 1967. The embankments included regulators and other structures to control water intake and drainage of the empoldered area. The primary purpose was to increase agricultural production. During the first phase, 92 polders⁴ were constructed with 4 022 kilometres of embankments and 780 drainage sluices. It became immediately apparent that empoldering increased the scale of production: The yields in certain places increased by 200 to 300 percent (Nishat, 1988). The dominant land use, during the period, was still paddy cultivation, primarily of traditional local varieties, but modern paddy varieties and technological packages were also introduced. Other land uses and land cover remained the same, i.e. salt production, mangrove forest and traditional shrimp farming.

In the 1970s and 1980s, the government continued large-scale polderization of coastal Bangladesh. Polders became part of the natural coastal setting. A total of 123 coastal polders were constructed in this hydrodynamically active delta. It was soon realized that internal water management had to be established within these polders in order to enhance further agricultural production. Changes in land use occurred due to intensification of paddy cultivation with attempted expansion of modern varieties and conversion of agricultural land to non-agricultural use. During this time, coastal afforestation was started with the objective of protecting the coast from cyclones and foreshore erosion; areas for industrial belts also started to expand.

⁴ The Dutch term “polder” is 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.

Achievements due to polderization evaporated within a decade. The polders of the southwestern coast experienced severe internal drainage congestion and heavy external siltation. Areas became unsuitable not only for agriculture, but in extreme cases, even for human habitation. It was termed as a “man-made disaster” (Rahman, 1995) resulting in increased poverty and outmigration from the area. At the same time, polders provided new opportunities for expanded shrimp farming using the control structures of the embankments. Subsequently, the land devoted to shrimp farming expanded and encroached on agriculture and forest lands.

A number of pressing reasons for land-use changes are described hereunder:

Population pressure: Bangladesh has a population of 130 million living on a land area of 147 000 square kilometres with an annual growth rate of 1.48 percent. In the coastal zone alone, the population is expected to increase from 36.8 million in 2001 to 43.9 million in 2015 to 60.8 million by 2050 (Ahmad, 2005). The present per capita agricultural land area of 0.056 hectares will be decreased to 0.025 hectares by 2050 (Islam *et al.*, 2006). With the increasing population, land is being converted from productive purposes, such as crop cultivation, to other uses. Bangladesh is losing good quality agricultural land by approximately 80 000 hectares annually to urbanization, building of new infrastructure (such as roads) and implementation of other development projects (World Bank, 2005).

Degradation of land: Land is being continuously degraded or lost owing to erosion, salinity, inundation and other anomalies. Statistics provide an alarming picture:

- At least 86 000 hectares of land were lost to river/estuarine erosion from 1973 to 2000 (MES, 2001) although this was somewhat compensated for by land formed through accretion.
- Seventy percent of the land of Barisal and Khulna divisions is affected by different degrees of salinity, which reduces agricultural productivity (Rahman and Ahsan, 2001).
- Fifty percent of coastal lands are subject to inundation of varying degrees and frequency that limits their effective use. This situation is expected to worsen due to climate change impacts.

Emergence of commercial shrimp farming: Increased demand and the high price for shrimp in international markets has led to increased commercial shrimp farming. The southwest had a history of traditional shrimp farming, but polders provided a further opportunity to intensify this activity. Many coastal polders, constructed to protect agricultural land from saltwater inundation, were turned into large shrimp farms. Saltwater was allowed into the polders in order to raise shrimps. Driven by commercial interests, land used for agriculture and mangroves was converted, often forcibly, to shrimp farming (Haque, 2004). This resulted in wide-scale land-use conflicts (Karim and Stellwagen, 1998; Deb, 1998), environmental pollution (Islam, 2003) and social unrest (Firoze, 2003).

Several studies reported a reduction in land for cattle grazing (Maniruzzaman, 1998), the death of trees and other vegetation (Alauddin and Tisdell, 1998), increased salinity of soil and water, and a reduction of the drinking water supply.

Firoze (2003) and Majid and Gupta (1997) reported the social and environmental impacts of industrial shrimp culture. As agricultural lands were converted into shrimp farms, sharecroppers and landless wage labourers lost their livelihoods. They began movements to resist the introduction of shrimp into 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 also initiated thousands of court cases. Many of these cases are still pending.

Brackish water shrimp cultivation on an industrial scale has introduced large-scale environmental degradation (Islam, 2003). Shrimp polders retain saline water for months and the salinity seeps into adjacent paddy farms and salinizes the soil. The loss of mangrove areas to aquaculture is a common feature, with Chakoria Sundarbans being the classic example (Chowdhury *et al.*, 1994; Brown, 1997). Between 1967 and 1988, Chakoria Sundarbans mangrove areas was reduced from 7 500 to only 973 hectares (Chowdhury *et al.*, 1994).

2 Issues

Natural disasters have made coastal land-use management an important aspect in national development. Hence, coastal land-use management is one of the key features in national coastal development policy and strategy.

Land accretion and land erosion on the coast generate socio-economic anomalies and issues. While erosion leads to the displacement of people, land capture and illegal settlement are prevalent in areas where the coast is accreting. Bangladesh regularly faces cyclones and storm surges which cause widespread damage to life and property. The shallow continental shelf and flat coastal land exacerbate the cyclonic storm surges. Surges usually exceed normal tide levels by three metres but in extreme cases, can be as high as six to nine metres. Recurring storm surges are of greater societal concern than an occasional tsunami (Mascarenhas, 2006). Protection from recurring storm surges is an important issue in land management.

2.1 Erosion, shifting coastline and displaced people

The coastal area along the Meghna Estuary is morphologically one of the most dynamic areas in the world (MES, 2001). The enormous sediment loads brought to the estuary by the Brahmaputra and Ganges rivers and very strong flows in the estuary drive the continuous reshaping of the estuary, migration of channels and banks, and accretion and erosion. Land erosion and accretion are common natural phenomena in the coastal zone. Erosion and accretion rates in the Meghna Estuary were calculated by comparing the positions of bank lines digitized from several Landsat satellite images taken during the period 1973 to 2000 (MES, 2001). Erosion/accretion of intertidal areas, i.e. mudflats, is not included in this analysis. The net change for 1973 to 2000 shows an overall land gain for the Meghna Estuary system of about 50 800 hectares (Table 2). The average annual gain for the entire study period was 1 880 hectares/year.

Table 2. Summary of erosion and accretion in the Meghna Estuary, 1973–2000

	Erosion and accretion in ha and ha/yr					
	1973–1979	1979–1984	1984–1990	1990–1996	1996–2000	1973–2000
Accretion for the period	50 175	45 550	33 505	56 520	23 850	137 168
Erosion for the period	32 873	31 112	42 410	29 182	32 260	86 366
Net change for the period	17 302	14 438	-8 905	27 338	-8 410	50 802
Annual rate of accretion	8 363	9 110	5 584	9 420	5 963	5 080
Annual rate of erosion	5 479	6 222	7 068	4 864	8 065	3 199
Annual rate of net change	2 884	2 888	-1 484	4 556	-2 103	1 882

Source: MES (2001).

Coastline stabilization, hence, is an enormous and costly task. Bangladesh has adopted certain engineering and non-engineering measures as follows:

- Strengthening of the coastline at economically and commercially important sites.
- Land reclamation through construction of cross dams. In order to reduce land losses through erosion, the government constructed a few cross dams to facilitate enhanced land accretion. More than 50 000 hectares of new land have been reclaimed.
- Afforestation: establishment of a coastal green belt along the coastline.
- Establishment of set-back distances along the coastline. This is still a proposal and will restrict certain uses, such as the construction of residential blocks or hotels, within a specified distance inland from the shore.

Because of the continual shifting of the coastline and erosion, displaced people are common in the community fabric of coastal Bangladesh. They are numbered not in hundreds, but in hundreds of thousands. People who have been displaced up to 14 times are not uncommon.

There is a government plan for the rehabilitation of displaced people, but it is being implemented slowly. In fact, this is a huge task for Bangladesh. Hence, displaced people, on their own, find places elsewhere through the land capture mechanisms described hereunder, especially on government land. Nearby embankments and newly accreted lands are common destinations for displaced people.

Suggestions for further action:

- Via modelling, identify and declare present and future highly erosion-prone areas.
- Prevent and discourage human settlement in these highly erosion-prone areas.
- Make a database of people displaced by erosion. These people should be prioritized in the allocation of government land.

2.2 *Khas* (state) land

In a highly populated country such as Bangladesh, *khas* (state) land is scarce. Through the process of accretion, *char* (accreted) lands emerge mainly in coastal areas which are eventually declared as *khas* land. An annual rate of accretion of 5 080 hectares of land has been estimated from 1973 to 2000. These newly accreted lands, according to government policy, are supposed to be afforested. However, at this early stage of land development, government administration mechanisms rarely exist. People start to occupy accreted lands long before the most vital living conditions are met. Several, often competing, factions led by powerful people — locally known as *jotdars* — determine life in these new areas. Land allocation by *jotdars* is described in the next section.

2.3 Land capture

Alam (2004) described the incidence and mechanisms of land capture by powerful players, especially in coastal *char* lands.

Traditionally, the newly accreted *char* lands were cultivated for at least three to four years before habitation and good crops persuaded the landless families to migrate to the new *char*. From the mid-1990s, with increasing population pressure, mangrove forests were destroyed to make new areas for habitation and migration. *Jotdars* and criminals promoted this type of land capture.

Capturing large quantities of *khas* land usually brought *jotdars* into the public eye, via press and media. Therefore, instead of grabbing land openly, *jotdars* adopted a new *modus operandi* by selling the possession of government *khas* land to poor landless families.

In the absence of formal institutions in the new *char*, *jotdars* developed their own system of selling government *khas* land. *Jotdar* mediators invited landless families from nearby eroded areas to take shelter and to settle on newly accreted *char* lands. Initially migration in a new *char* takes time, but once it begins it starts a chain reaction, i.e. when migration starts, it automatically attracts others. The first group of migrants invites relatives and other members of society for support and security; consequently, the new *chars* are being captured by landless families on a daily basis by purchasing *char* land from the *jotdar*.

Socio-economics of land capture and autonomous settlement: A story (Alam, 2004)

Nobagram appeared before 1970 and people started living there after its formation. Sultan Ahmed is from Nobagram. “We were settled by the rich absentee land grabbers who claimed land of this *char* as their ancestral land.

We cultivated their land as sharecroppers and got a small piece of land each for housing and farming. We were poor and landless and the victims of river erosion. So, we accepted them as our mentors. My mentor was from Kabir haat on the mainland. He had 3.5 hectares of land and gave me 0.5 hectare for housing and farming. I had draught power and cultivated his land as a sharecropper. He was always ruthless towards me. If I could not produce enough rice due to natural calamities or shortage of inputs, he misbehaved with me as if I were almost his slave.”

In fact we were *lathial* (henchmen) to protect their land, which we cultivated as sharecroppers, from other opposing parties. They also forced us to pay extraction money on different pretexts such as annual revenue, permanent settlement. We could say nothing against them.

Suggestions for further action:

- Enforce laws preventing illegal claiming and subsequent sale of new *char* land.
- Strengthen field-level government institutions to address land before it is illegally claimed.
- Create a GIS-based database on *khas* land existing in different districts.
- Designate and preserve *khas* lands for immediate and long-term development activities.
- Allocate a portion of *khas* lands to be distributed among victims displaced by erosion.
- The Ministry of Land to coordinate with the Ministry of Environment and Forests for early transfer of accreted *char* lands for afforestation.

2.4 Structures of land allocation

According to government policy, usually the coastal *char* land is initially handed over to the Forestry Department for 20 years. During this period, mangrove forests are planted as part of the coastal protection system. As accretion progresses, the land behind the mangrove belt is converted into agricultural land for settlement. Hence, the government also has a land settlement programme, although limited in scale. Landless families who are victims of river erosion have priority in the allocation of land. Implementation, however, appears to be cumbersome with lengthy procedures. The Char Development & Settlement Project, financed by the Government of the Netherlands, is assisting the Government of Bangladesh (specifically the Ministry of Lands) to implement its land settlement policy. During Phase 1 of the project (1994–1999), 2 225 hectares of land were distributed to 4 450 families; each family received a maximum of 0.8 hectares. Furthermore, 990 families were settled in 30 clustered villages. During Phase 2, *khas* land amounted to 3 890 hectares *in toto* and a target was set for 6 848 families. By the end of August 2005, a total of 5 890 families had a

Jamabandi (record of rights) approved, 2 454 families had received a *Khatian* (genuine land title), while 674 families were settled in clustered villages (CDSP 2005).

Land allocation is the most complicated job. The process is a long story of foreseeable and unforeseeable obstacles, ranging from manipulation by powerful local people, land-use conflicts between agriculture and shrimp or fish farming, to political influence and bureaucratic inefficiency.

2.5 Stabilization and protection of new lands

Over the last two decades, Bangladesh has used coastal afforestation and polderization to stabilize and protect newly accreted lands from tidal and storm surges.

Coastal green belt: Dense forests can attenuate wave velocity (Mascarenhas, 2006). In order to better protect life in coastal areas from cyclones and tidal surges, in 1966, the Forest Department began a mangrove plantation programme outside the protective coastal embankments. The programme was based on evidence that the Sundarbans' natural mangrove forests provided effective protection from wind and waves for the western coastal areas and, thus, it was expected that the planting of belts of mangrove would give a worthwhile degree of protection to other coastal areas of the country open to the sea. The Coastal Afforestation Scheme operated from 1966 to 1974, during which time 4 745 hectares of plantations were established. Encouraged by its initial success, the project was extended to 1980. Under this project another 29 700 hectares of plantations were raised. All these plantations were concentrated on the offshore islands and new accretions. The afforestation species raised were keora (*Sonneretia apetala*), baen (*Avicennia officinalis*), kankra (*Bruguiera gymnorrhiza*), golpata (*Nypa fruticans*) and gewa (*Excoecaria agallocha*).

Of late, the coastal green belt has been undergoing indiscriminate destruction and encroachment. Power-brokers with links to local politicians have taken the lead in clearing the forests. The administrative machinery is powerless to stop the clearing. A programme of participatory mangrove plantation involving nearby coastal communities, which has proved successful in other countries, could be a sustainable mechanism to protect mangrove forests. This mechanism is being actively considered within the Forest Department.

Polders: Polders are mainly designed to provide protection against tidal intrusion with the main objective of increasing agricultural production; however, they also provide protection against floods and storm surges. Polders are now part of the natural setting of coastal Bangladesh. A sudden increase in the construction of embankments took place after 1960. The initiative, called the Coastal Embankment Project (CEP), involved the construction of some 5 107 kilometres of embankments to form 123 polders and protect an area of 1.5 million hectares. It has been estimated that 957 kilometres are sea dykes.

The 123 polders that have been built protect coastal land from floods. Sea dykes are perceived to provide protection against storm surges and anticipated sea-level rises due to climate change. Drainage in these polders is provided at low tide by means of flap gates mounted in sluice structures, usually located where natural drainage channels (*khals*) cross the embankment alignments. The objective to increase agricultural productivity was achieved with great success for the first ten to 15 years, until drainage congestion became serious in some areas, thus necessitating an integrated approach (Ali, 2002). As a result, the Coastal Embankment Rehabilitation Project started to incorporate elements of internal water management, land use inside the polder, and social use of the embankment and foreshore. Despite criticisms over drainage problems, the polders have resulted in higher agricultural returns by excluding saline tidal flooding. Communications have also improved. Polderization has contributed considerably to altered and new land use in coastal Bangladesh.

3 Policies and institutions

3.1 Governance and institutional structures for coastal land management

The ministries involved in the administration and management of land are:

- Land;
- Agriculture;
- Environment and Forest;
- Water Resources;
- Local Government and Rural Development;
- Fisheries and Livestock; and
- Communications and Shipping.

The Ministry of Land (MoL) is the custodian of government-owned land and has the overall responsibility for the allocation of land for use by others. Maintaining land records, surveying for revenue collection and recording of rights and settlement are its major functions. The ministry works through the Department of Land Record and Surveys (DLRS), headed by a director-general, which is responsible for survey and settlement operations. It has three directors to look after administration, land records and surveys. The field establishment is under the Director of Land Records. The management of land and ancillary items is conducted through local (district and *thana*) administration.

Land, particularly agricultural and homestead land, has mostly been possessed by individual owners through a historical process of transformation from the Permanent Settlement Regulation of 1793, to the Bengal Tenancy Act of 1885. The government has the right to acquire any land for the common good after providing adequate compensation. Forest land, other than the recently introduced social forest, is owned by the Forest Department.

Apart from privately and publicly owned land, Bangladesh has a total of 1.27 to 1.92 million hectares of *khas* land (Kader and Hossain, 2006). There is a government programme for the gradual distribution of parcels of such land to landless people.

The agricultural *khas* land distribution process passes through several stages and ends with a *Khatian*. A number of MoL officials and three committees play a vital role in the land settlement process. The land settlement process starts with the identification of *khas* land according to a ruling by the Union Assistant Land Officer (UALO) and surveyor (*Amin*) and subsequently passes through several more stages, ending with the registration of the lease deed (*Kabuliyat*) by the subregistrar, an officer under the Ministry of Law, Justice and Parliamentary Affairs. The Assistant Commissioner (Land), MoL, based at the *thana*, plays the central role in the land settlement procedure. Timely completion of the settlement process depends on prompt action by the Assistant Commissioner (Land).

Among the three committees, the *Upazila* Agricultural *Khas* Land Management and Settlement Committee (UAKLMSC) is vital and responsible for the identification of *khas* land, selection of landless families and approval of the *khas* land allotted in favor of selected landless families. The District Agricultural *Khas* Land Management and Settlement Committee (DAKLMSC) supervises the *thana* committees and approves settlement cases. The national committee is the regulatory and appeal committee of the district committees.

The government, on a pilot scale, has tried digitization of land records with the introduction of modern land management, which has showed positive results. This modern system has not been introduced on a wider scale due to financial limitations.

There are no community-based organizations or traditional governance structures responsible for coastal land and resource use. However, there are a number of NGOs who work with the landless community to establish their rights and access to *khas* land. *Samata* is one of the leading NGOs working on this issue.

3.2 Policies and regulations governing coastal land/resource management and use: Conflicts and gaps

The Government of Bangladesh has policies for the different sectors.⁵ Land management is promoted through the land-use policy, the agricultural policy, the forest policy, the water policy, the coastal zone policy, the environment policy and the fisheries policy.

The Land Use Policy of 2001 has provided guidelines for the protection of agricultural land, waterbodies and the optimal use of other land, as well as for restriction or minimization of the acquisition of land for non-productive use. There are 28 policy directives that should be followed by all concerned in land management and administration.

The National Land Use Policy (NLUPo) observes in its introduction that per capita land availability is gradually decreasing due to the increase in population. The maximum utilization of land and water resources depends on an effective land-use plan and would contribute to the GDP of the country. The objectives of the policy are therefore to:

- Arrest the continued decrease of agricultural land to ensure food production for the increasing population.
- Prevent indiscriminate and misuse of land.
- Determine which land should be used for which purposes and develop guidelines for the most appropriate use of land.
- Exercise utmost economy in the acquisition of land for the implementation of development projects and for urbanization and other land uses.
- Determine land needed in future for development purposes and earmark and protect this land (especially *khas* land).
- Ensure that the use of land is environmentally friendly.
- Ensure the best possible use of land to support poverty alleviation and enhanced employment opportunities, thus contributing to arresting the growth of landless households.

The NLUPo states that for a balanced ecoenvironment and human health, 25 percent of the total land should be under forest cover. This can be achieved largely by afforestation on *char* and other suitable land.

The NLUPo recognizes that it is almost impossible to increase the land area of the country.

⁵ These policies are: the Environment Policy and Implementation Plan (1992); the National Tourism Policy (1992); the Livestock Development Policy (1992); the National Forestry Policy (1994); the National Energy Policy (1996); the National Education Policy (1997); the National Policy for the Advancement of Women (1998); the National Fish Policy (1998); the National Policy for Safe Water Supply and Sanitation (1998); the National Water Policy (1999); the National Agricultural Policy (1999); the Industrial Policy (1999); the National Shipping Policy (2000); the National Health Policy (2000); the National Rural Development Policy (2001); the National Land Use Policy (2001); the National Policy on Information and Communication Technology (2002); the National Energy Policy (2004), the National Policy for Arsenic Mitigation (2004) and the Coastal Zone Policy 2005.

The amount of land obtained through natural accretion is not that significant. Land reclamation by artificial means is expensive and effective only in the long term. Consequently, planning at least for the short term should be limited to existing and available land resources.

Land issues have been mentioned in other policy documents:

- The Environment Policy (1992) encourages land use depending on the ecosystem prevailing in different parts of the country. It emphasizes that efforts should be strengthened for land reclamation, erosion protection, soil fertility and reduction of soil salinity and alkalinity. This policy also mentions transferring newly accreted land to the Forestry Department on a priority basis to stabilize and protect the land from erosion.
- The Forestry Policy (1994) mentions that “effective measures will be taken for afforestation in the newly accreted char in the coastal areas, as it protects soil and reduces the velocity and intensity of cyclones, tornados and tidal bores” (*sic*). Afforestation also helps to stabilize newly accreted land.
- The National Water Policy (1999) suggests undertaking surveys and investigations of the problem of riverbank erosion; developing and implementing master plans for river training and erosion control; and planning and implementing schemes for reclamation of land from the sea and rivers.

The NLUPo has a provision to establish a National Land Use Committee, to be headed by the prime minister, for its review and implementation. The MoL has, however, established a high-level interministerial committee to monitor the implementation of the NLUPo. The first meeting of this committee was held in February 2005.

Islam and Koudstaal (2003) analyzed several government policy documents and regarded the NLUPo to be an important policy document affecting future developments in the coastal zone. The policy document is strong on the conservation of *khas* land for use by future generations, but is not clear on a governmental *khas* land distribution programme. This document refers to land-use conflicts in the coastal zone and introduces zoning as an instrument for managing scarce land resources. The policy does not favor artificial reclamation of land as it is prohibitively expensive. However, the institutional structure to implement this policy and the necessary arrangements for cooperation are not functional as yet. The policy calls for raising awareness on the issues of conservation of land, and for active participation of the ministries, departments and agencies, but does not have any action plan to follow up on the policy. Capacity development for sustainable land management is needed.

3.3 Integrated Coastal Zone Management (ICZM)

Area-specific management in the coastal zone was previously pursued in Bangladesh through the following initiatives (Islam, 2004):

- Off-Shore Islands Development Board (1977–1982);
- Bangladesh National Conservation Strategy (1987);
- UN/ESCAP-GoB Coastal Environment Management Plan for Bangladesh (1987);
- Coastal Area Resources Development Plan (1988);
- Special Parliamentary Committee on Coastal Area Development (1988–1990); and
- national capacity building apropos the ICZM initiative (1997).

All these initiatives gradually prepared the ground for the government's initiative in 1999 to embark on a process of Integrated Coastal Zone Management (ICZM). In that year, the government expressed its commitment through a policy note entitled "Integrated Coastal Zone Management: concept and issues" to prepare for a plan for the operational and effective introduction of ICZM (MoWR, 1999). The conceptual approach, as formulated in the policy note, was elaborated through a joint mission of the Bangladesh Government, the World Bank and the Netherlands Development Assistance. The preparatory phase for formally introducing ICZM in Bangladesh was carried out from February 2002 to June 2006.

3.3.1 Coastal zone policy and strategy

The government approved and adopted the Coastal Zone Policy in 2005 and the Coastal Development Strategy in 2006. The Coastal Zone Policy (CZPo) provides a policy framework for long-term ICZM (MoWR, 2005). The Coastal Development Strategy (CDS) establishes strategic priorities and activities (MoWR, 2006). The government has also approved the Priority Investment Program (PIP) to be implemented during 2006–2010. Although all these initiatives have created a high expectation among coastal communities, NGOs and government agencies working in the coastal zone, they have yet to be implemented.

The CZPo establishes the goal of ICZM as "to create conditions, in which the reduction of poverty, development of sustainable livelihoods and the integration of the CZ into national processes can take place."

More specifically, the following development objectives have been determined:

- economic growth;
- basic needs and opportunities for livelihoods;
- reduction of vulnerabilities;
- sustainable management of natural resources;
- equitable distribution;
- empowerment of communities;
- women's development and gender equity; and
- conservation and enhancement of critical ecosystems.

The CDS (Coastal Development Strategy) is the linchpin in the ICZM process, linking the CZPo with concrete development programmes and intervention. The CDS is also built on existing national sectoral strategies and plans and on the document on National Strategy for Accelerated Poverty Reduction (PRSP) (GoB, 2005).

Nine strategic priorities and three routes of implementation have been adopted in the CDS document. One of the nine priorities is "Optimizing the use of coastal land." It is elaborated in the CDS document (MoWR, 2006) that the "Land use in the coast is diverse, competitive and often conflicting. Erosion of land is a common feature, especially in the Meghna estuary and on islands. Land is also degrading due to increased salinity and water logging. Moreover, new lands are accreting and being gradually developed. Acceleration of the land accretion process and optimum use of these coastal lands would significantly contribute to the regional economy and well-being of the local people. Land zoning is one instrument that optimizes the use of coastal lands."

3.3.2 Consultation of stakeholders in coastal planning

Both the CZPo and the CDS documents were formulated through a process of multilevel consultation over a long period (Islam, 2005).

The CZPo was formulated over a period of two years, as described hereunder:

- An outline was prepared and presented during the Dialogue in September/October 2002.
- An annotated outline was discussed with a group of selected experts in March 2003.
- Based on the discussion, the outline was elaborated in a preliminary draft of the policy.
- This preliminary draft was presented at a national workshop held 12 May 2003.
- Based on discussions and comments, the first draft was prepared in August 2003. A Bangla version of the draft was prepared in September 2003.
- During September-October 2003, the draft CZPo was presented and discussed at the local level in 19 coastal district towns, facilitated by the district administration.
- The draft was discussed at the Task Force on Policy & Strategy, at the Inter-Ministerial Technical Committee and at the Inter-Ministerial Steering Committee during 2004.
- The Coastal Zone Policy 2005 was approved at the cabinet meeting on 17 January 2005.

Like the CZPo, the CDS was also formulated through the following multilevel consultations and reviews:

- An annotated and extended outline was prepared in August–September 2004. In preparing this outline, all relevant documents were reviewed.
- The outline was presented at one national and four regional consultative workshops held in October 2004.
- Based on the workshop recommendations, the first draft was prepared in February 2005 and sent to relevant agencies and members of the task forces.
- “CDS highlights” were disseminated through *Coast News* and posted on the Web site.
- Comments and suggestions were solicited from the general public through a public announcement in four national dailies (February 2005).
- The draft was presented during March–April 2005 at 28 local level consultation meetings: three remote *chars*/islands, three selected unions, three selected *thanas* and 19 coastal district headquarters. These consultations contributed to further revision of the draft CDS, including strategic priorities and prioritization of concept notes.
- A peer review of the draft by selected experts was organized in June 2005.
- The draft was presented to the members of parliament in July 2005.
- The draft was presented at the Eighth Inter-Ministerial Technical Committee meeting and finally endorsed at the Ninth Inter-Ministerial Technical Committee meeting held 16 October 2005.
- The draft was approved at the Second Inter-Ministerial Steering Committee meeting held 13 February 2006.

3.3.3 Proposed institutional mechanisms to facilitate integrated planning between agriculture, fisheries and forestry in coastal areas

The institutional structure is based on the assumption that line agencies are the best implementers within an agreed planning and implementation framework at the national level, while coordination is to be ensured at the local level (Huda, 2004). This institutional set up of integrated management at the project or programme level will work more effectively if parties realize that working together in this manner is mutually beneficial to achieving common goals. Each of the parties should have sufficient institutional capacity to enter into such an arrangement for integrated management. There must be commitment to the common goals, while the respective responsibilities are clearly and precisely spelled out.

The proposed national level ICZM structure consists of the Inter-Ministerial Steering Committee (SC), Inter-Ministerial Technical Committee (TC), Focal Points, Task Forces and a Program Co-ordination Unit (PCU). The PCU for ICZM is an arrangement proposed in the CZPo to discharge its function for institutionalization of ICZM in Bangladesh. It is a multidisciplinary and multi-agency arrangement. The PCU's role is to coordinate, monitor and harmonize operation of the ICZM process and to serve as a service for relevant government and non-government agencies, local government institutions and private sector entities active in the coastal zone.

The *Inter-Ministerial Steering Committee (SC)* provides policy guidelines on issues related to the coastal zone. This high level committee is chaired by the minister of the lead ministry and includes representatives (at the Secretary level) of concerned ministries including land, agriculture, forestry and fisheries. The Ministry of Water Resources (MoWR) will act as the secretariat for this committee. The SC preferably meets at least half yearly.

The *Inter-Ministerial Technical Committee (TC)* resolves interorganizational conflicts and removes planning and implementation bottlenecks. It is headed by the Secretary, MoWR, and comprises representatives of all the concerned agencies who are members, including the director-generals of the Department of Agricultural Extension, Department of Fisheries, the Forestry Department and the Directorate of Land Records & Surveys. The TC also comprises representatives from universities, NGOs, the private sector and civil society. The TC convenes at least once every quarter.

Focal Points are established in all relevant agencies to act as operational contact points in relation to ICZM activities and to maintain contact with the lead agency.

Task Forces are established on specific issues for an agreed time period. They consist of members of the TC, PCU, Focal Points and/or topic experts.

This institutional structure was operational during 2002–2006 and contributed to the preparatory operationalization of ICZM in Bangladesh (Islam, 2006b).

4. New measures being implemented or considered

Bangladesh has implemented a number of measures to support planning and management in disaster-prone coastal areas that have implications for long-term disaster management and tsunami mitigation. For decades, Bangladesh has had a safe haven system combining polderization, forest belts and a disaster preparedness scheme and has gained substantial experience. After the 2004 tsunami event, the government made a tsunami vulnerability assessment of the country. It has already adopted indicative land zoning with steps to carry out detailed land zoning. Land zoning will take into consideration the risks from tsunami and climate change. The government is actively considering the use of the existing cyclone

warning system to disseminate tsunami warnings to local populations and the establishment of set-back distances, briefly described hereunder:

Tsunami Vulnerability Assessment: The 2004 tsunami compelled Bangladesh to assess its vulnerability to tsunamis. Taking into consideration tectonic factors, basin configuration, geological boundary conditions and ground characteristics, the Geological Survey of Bangladesh has proposed a Tsunami Vulnerability Map of Bangladesh (Figure 5). In this map, the coastal belt of Bangladesh is divided into three Tsunami Vulnerability Belts.

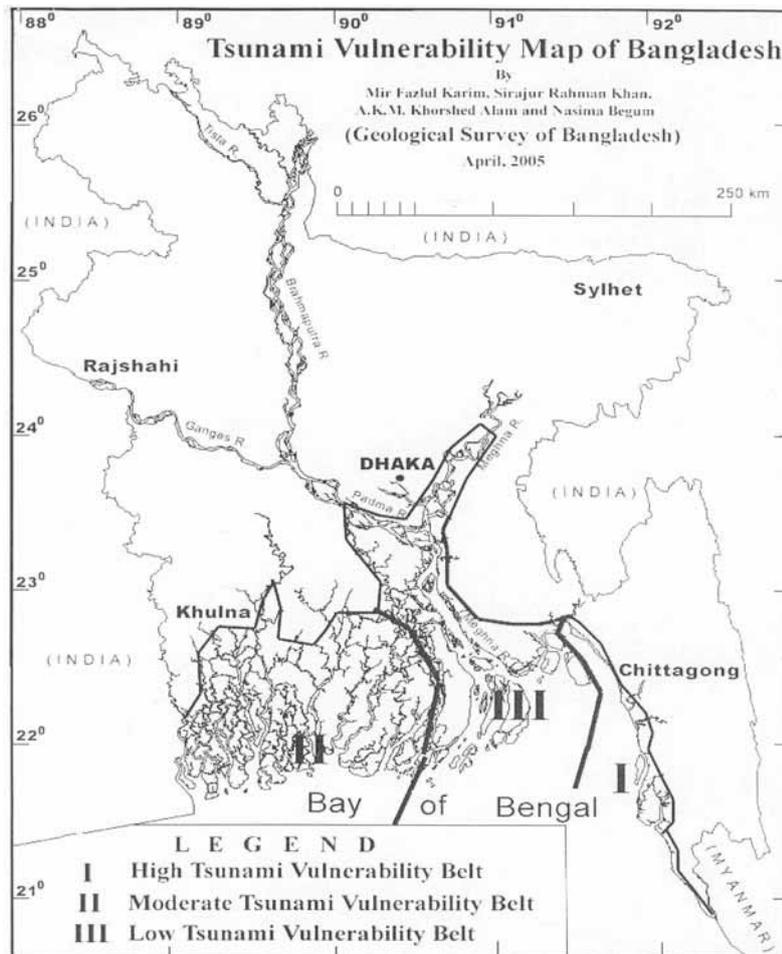


Figure 5. Tsunami vulnerability map of Bangladesh

1. **Tsunami Vulnerability Coastal Belt I** of the Chittagong–Teknaf coastline — *Most vulnerable*. The intradeltaic coastline is very close to the tectonic interface of the Indian and Burmese plates. The active Andaman–Nicobar fault system is often capable of generating tsunami waves.

2. **Tsunami Vulnerability Coastal Belt II** of the Sundarban–Barisal coastline — *Moderately vulnerable*. This old deltaic belt is extremely vulnerable to local tsunamis due to the presence of Swatch of No Ground⁶ nearby.

⁶ The Swatch of No Ground is a submarine canyon, about 25 metrekilometrekilometres south of the western coastline, which deeply incises the Bengal shelf near the Ganges–Brahmaputra river mouth, cuts the foreset beds of the subaqueous river delta and acts as temporary depocentre between the river mouth and the Bengal fan.

3. ***Tsunami Vulnerability Coastal Belt III*** of the Barisal–Sandwip estuarine coastline — *Low vulnerability*. The estuarine coastal belt is considered to be less vulnerable due to the presence of numerous islands and shallow mudflats in the upper regime of the continental shelf.

It has been estimated that at least 4.7 million people live in the most tsunami-vulnerable area of Coastal Belt I and 12.9 million people in Coastal Belt II.

Coastal land zoning: Land zoning has been advocated since the 1980s. A number of 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. However, zoning along sectoral lines does not provide a basis for choices between often conflicting sectoral objectives. Karim and Stellwagen (1998) emphasized “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 to arrive at the best choices for economic land use in an area, on the basis of its needs and potentials. Mutsaers and Mia (2004) outlined the conceptual basis for the first stage in the process to delineate an indicative coastal land zoning. To facilitate delineation, a ten-member technical support group was formed, notably with representatives from government and non-government agencies including the Forest Department, Department of Fisheries and the Soil Resources Development Institute, with the MoL coordinating the group. The group met several times during the process to contribute information and data and review ongoing work. Finally, an indicative land zoning has emerged (Miah and Islam, 2005; Islam, 2006a) identifying the following eight zones:

- Shrimp (brackish water) zone;
- Shrimp (sweet water) zone;
- Salt–shrimp zone;
- Forest zone;
- Mangrove (including Sundarbans) zone;
- Urban and commercial zone (industrial, port, EPZs and ship-breaking yards) zone;
- Tourism zone; and
- Agriculture zone.

Indicative land zoning was presented at the first meeting of the committee for monitoring the implementation of the National Land Use Policy, 2001 held 13 February 2005, at the MoL. The meeting was attended by senior Ministers, Secretaries and high-ranking officials of several ministries. The meeting endorsed the indicative land zoning for the coastal area. The MoL, at present, is pursuing detailed land zoning of the coast.

Tsunami preparedness — linking to the cyclone preparedness programme: Disaster preparedness, among other activities, includes construction of cyclone shelters and effective warning mechanisms for remote local coastal communities. The first purpose-built cyclone structures were constructed in the 1960s. There were 449 cyclone shelters in 1990, 1 921 in 1997 and 2 133 in 2004. Each of these cyclone shelters can accommodate between 700 and 1 000 people during cyclone storm surge emergencies (MoF&DM, 2005). Most of the cyclone shelters are used as schools during normal periods of the year.

The warning system under the Cyclone Preparedness Program (CPP) covers 11 districts in the coastal zone comprising 30 *thanas*, consisting of 259 unions. A total number of 34 000 trained volunteers train communities to respond to early warning signals. This programme

reaches at least 11 million people residing in the low-lying coastal area and offshore islands in the Bay of Bengal (MoF&DM, 2005). The CPP (CPP, 2000) operates an extensive network of radio communication facilities in the coastal area, linked to its communications centre at its headquarters at Dhaka. The purpose of this network is exclusively for disaster management tasks. The network consists of a combination of HF and VHF radios which cover part of the high risk cyclone zone areas. The CPP is now operating a total of 143 radio stations, out of which 64 are located in cyclone shelters in high-risk cyclone-prone areas. Almost all these radio stations are equipped with solar panels with storage batteries.

Set-back distance along the coast: The benefits of establishing set-back zones along the coast are well-recognized and practiced around the world. There are different ranges of set-back zones in different countries (8–3 000 metres), and even within one country there are various set-back zones (20–1 000 metres) for various purposes. India has adopted a 500-metre set-back zone. Bangladesh is also considering the establishment of set-back distances along the coastline. This will restrict certain uses, such as the construction of residential blocks and hotels within a specified distance. In the absence of set-back distances, hotels and other infrastructures are being indiscriminately built on the beaches of Cox’s Bazar, St Martin’s Island and other locations. For the Bangladesh coast, a set-back distance of 50 metres in general, 100 metres for non-polluting industries and 200 metres for polluting industries can be considered.

5. Concluding remarks

In recent years, coastal planning and land-use management have received serious attention by the Government of Bangladesh. Adoption of the Land Use Policy (2001), Coastal Zone Policy (2005), Tsunami Vulnerability Map (2005) and Coastal Development Strategy (2006) are some of the milestone achievements. However, implementation of policy and strategy directives remains a key issue. Some of the key concerns that need to be addressed are as follows:

- immediate establishment of the ICZM coordinating arrangement, as approved under the Coastal Zone Policy 2005, to coordinate and harmonize different agencies active in the coastal zone;
- demarcation of land zoning, as approved under the Land Use Policy, 2001 and enforcing laws to prevent encroachment;
- prevention of deforestation of the coastal green belt by involving coastal communities in its maintenance; and
- establishment of tsunami preparedness measures (including community-based awareness and preparedness) in the most vulnerable area where at least 4.7 million people remain at risk.

Countries in the region can share their experiences in coastal and land management supportive of disaster management, including tsunami strikes. At the regional level, the following activities and action programmes are proposed:

- Establish a network of expert groups on coastal and land-use planning and management.
- Arrange technical support for countries in the region to establish a modern GIS-based land record system.
- Commission a study on “planning and practices of land zoning” in selected countries. Though land zoning has been identified as an important instrument for sustainable land management for decades, its implementation still remains a concern.

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