Final class Report

Topic: Coastal Processes, Hazards, and Mitigation in District Thatta Sindh, Pakistan

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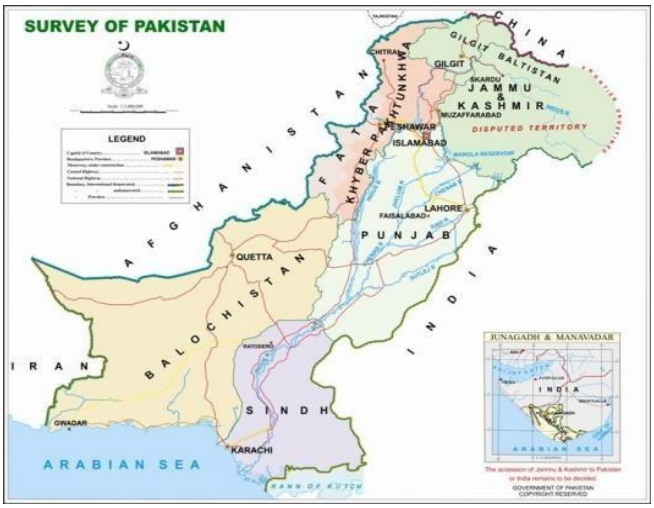
COASTAL AREA; THATTA DISTRICT, SINDH, PAKISTAN

Introduction

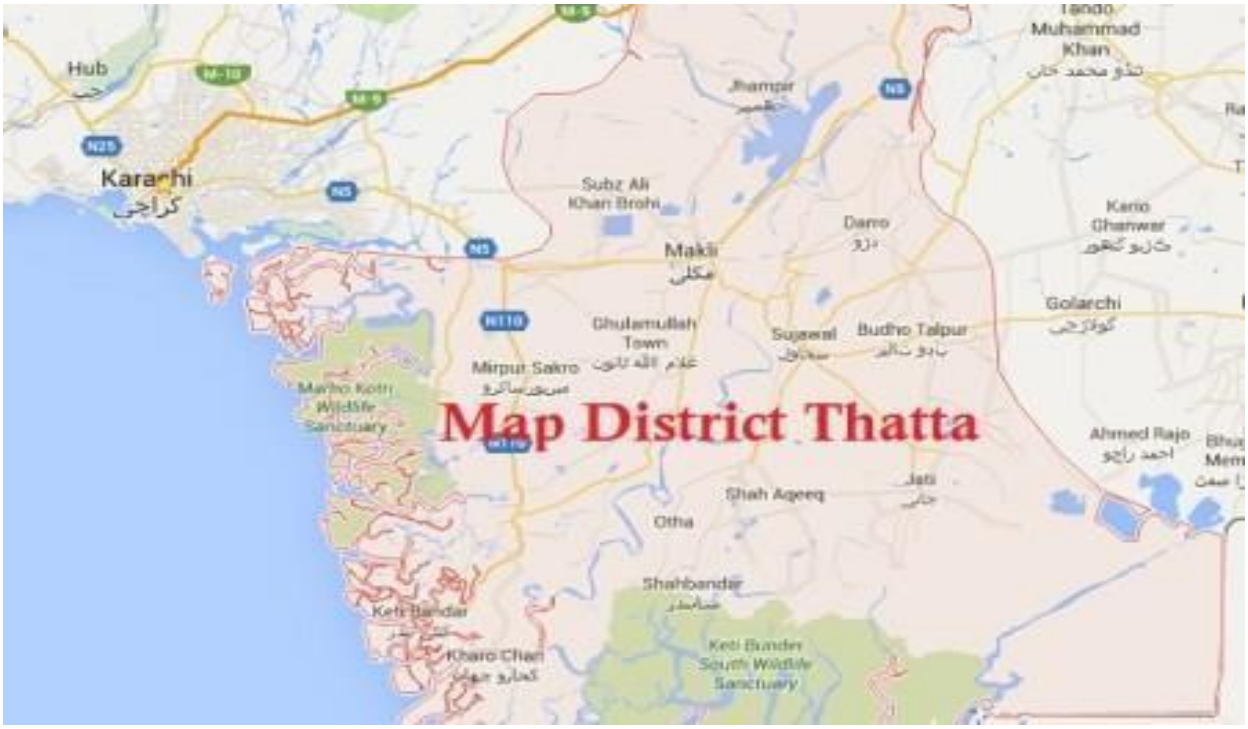
The coastline of Pakistan extends 1,050 kms along the Arabian Sea. Karachi, Ormarah, Pasni and Gwader are some of the important coastal areas. The coast of Pakistan can be divided into coasts of Sindh and Balochistan because they exhibit large variability in climatic and hydrological resources and physical limitations. Sindh coast is endowed in hydrological terms as Indus River falls to the Arabian Sea and contributes into large Indus River delta with micro-climate of deltaic region and wide variability of estuaries and mangroves



Location of Thatta, lying between 23°43' to 25°26' north latitude and 67°05' to 68°45'east longitude, Thatta is one of the southern and border districts of Pakistan.it is bounded by Jamshoro in North, Karachi in North West, Hyderabad and Tando Muhammad Khan in North East, Badin in East, Arabian Sea in the South and Rann of Kutch in South East. District Thatta spreads over a vast area of 17,355 square kilometers and is the second largest district of the Sindh province following District Tharparkar. It covers 12.3% area of the province and 2.18% of Pakistan.

Thatta District has been declared as one of the poorest district of Pakistan; especially its coastal areas are extremely poverty stricken. According to latest Asian Development Bank (ADB) estimates, “The poverty figures in Badin and Thatta district are higher perhaps as high as 70 percent”. According to ADB Sindh Coastal and Inland Community Development Project Interim Report [December -2005] “54 percent of the population was found among the poorest category while another 79 percent were poor. According to the report poverty was highly correlated with household economic characteristics such as land ownership and employment opportunities. Land

owners are usually among the non-poor. The intrusion of sea on the agriculture land has badly affected the perception of wealth. According to the community perception of poverty, those having no capital or any kinds of resources of their own and usually depend on the land and fishing grounds of others for their livelihood and seek their livelihood usually on daily basis are the poorest



The River Indus

Indus river estuary, one of the estuaries has been least studied on physical and chemical processes, it is located (24.15 °, 67.66 ° - 23.98 °, 67.4 °) along North Arabian Sea. Indus delta is the sixth largest delta in the world, with a fan shaped structure built by huge amount of silt flowing down from the upland and mountains through Indus River, which covers a distance of about 2880 km to meet the North Arabian Sea (Abbasi, 2002). The current delta covers an area of about 600,000 hectares that is distributed in 17 major creeks and several minor creeks, mud flats and mangroves (Meynell and Qureshi, 1993).

River Indus is Pakistan's longest river and is considered as one of the longest rivers in Asia. River Indus flows on the Eastern side of the District Thatta. Taluka Thatta, Ghorabari and Keti Bunder are situated along the river Indus and that is why, some union councils of these three Talukas are very prone to flooding especially during the monsoon season. During 2010 flooding, District Thatta badly affected which cause heavy loss of life and property.

Weather and Climate

The climate of the district is moderate. The mean maximum and minimum temperature recorded about 40 ℃ and 25 ℃ respectively. The sea breeze blows for eight months of the year, from

March to October, making the hot weather comparatively cool. As a result there is an immediate fall in temperature. January is the coldest month. The annual average rainfall of the district is about 200 mm.

Average temperature and rainfall in District Thatta

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Maximum high temperature (°C)	25.5	28.3	32.9	36	37.8	36.8	34.8	33.3	33.8	35.2	32	27.2	29.6
Minimum low temperature (°C)	10.9	13.4	18.5	22.5	25.9	28	27.4	26.4	25.3	22	17	12.4	15.4

Disaster Risks in Thatta District

There are different types of disasters. Natural disasters include floods, droughts, famines, earthquakes, cyclones, hurricanes, tornadoes, typhoons, landslides, volcanic eruptions etc. Manmade disasters include chemical accidents, oil spills, radiological accidents, conflicts/wars, mass population displacement or refugee migration, forest fires, water cuts, diversions and mismanagement of rivers through construction of dams, barrages, link-canals, and oceanic pollution etc.

It has only recently dawned upon us to take care of our natural resources and manage them wisely so as to reduce risks that natural and man-made hazards pose to people living today and ensure that future generations are able to live in a care free manner. Emphasizing and reinforcing the environmental concerns of disaster management has become a critical priority, requiring the sound management of natural resources as a tool to prevent disasters or reduce their impacts on people, their homes and livelihoods.

The district is vulnerable to a number of natural disasters including frequent cyclones, floods, and droughts. A chronology of disasters over the last five decades reveals that the area has remained in the grip of an uninterrupted cycle of disasters in one form or the other. Cyclones, heavy rainfalls, droughts and floods follow each other with short-lived intervals. However, earthquake seems to be a rare phenomenon proving to be less disastrous in its effects in comparison to other hazards experienced by the communities at risk.

The coastal tehsils of District Thatta being in close proximity to the Arabian Sea are endangered with growing seawater intrusion owing to the reduced fresh water flows/ availability. Vast land has either simply merged in sea or has become saline with seawater visible on the surface of the land during high tides. A large number of Dehs (local units of land), which were considered as fertile in the past, have amalgamated in the sea. Dozens of villages situated in those Dehs were uprooted and the villagers had to migrate to different places. A large number of villages in the proximity of the sea still face threats of inundation.

District Thatta has been suffering from the following natural calamities

Cyclones

Six coastal districts including Karachi, Thatta and Badin from Sindh Province and Lasbela, Gwadar and Ketch from Baluchistan Province are highly vulnerable to cyclone hazard. Due to its geographical setting, District Thatta is among district badly affected by the surge of cyclone on several occasions. Tropical cyclones not only wipe out the human settlements and huge losses of human and animal lives, but it also destroys and badly damaging the fishing boats and fish harbors, thus resulting badly affect the livelihood of the majority of fisher communities of the district. Historically, the tropical cyclones formed over the Arabian Sea and making landfall at the coastal areas of Sindh and Baluchistan including District Thatta.

It has been observed that Tropical Cyclones now frequently developing in the Arabian Sea and their severity become frequent and abnormal mainly due to global warming and climate changes phenomenon. Some of the major tropical cyclones hit the coastal areas occurred during May 1902, June 1926, June 1964, November 1993, June 1998, May 1999, June 2007 and 2011 and June 2014. The Cyclone Yemen in 1999 hit three coastal districts of Sindh, where 244 loss of life, 40177 animals perished, villages affects population affected 0.5 million was reported.

Rain Flood

Like other part of the country, the monsoon season which brings major proportion of rainfall starts from June and lasts till September in the district. During the recent years, the behaviors and distribution of rainfall has been observed very abnormal mainly due to the impacts of climatic changes where the district receives heavy rainfall in the form of erratic and cloud burst especially during different time period of the monsoon season. These types of rainfall generate flash floods and witnesses of heavy loss of life and property in the district. The history shows that District Thatta was hit by various episodes of flooding during the recent past.

Earthquake

Although District Thatta falls away from the fault line and is unlikely to be affected by a massive earthquake. There is no recorded historical data available of the damages in the district due to previous earthquakes prior to 2005. However, October 2005 earthquake caused minor damages in the district. Some of prominent faults situated in the coastal zones are (a). Karachi-Jati, (b). Surjan-Jhimpir, (c). Pab Fault (d). Hub Fault and (e). Allah Bund-Rann of Kutch faults. Over the last sixty years, earthquakes of intensity lower than 5 on Richter Scale, including those in 1945 and 1985, have struck the region comprising the macroenvironment and thus far they have been of minor significance.

Tsunami

Due to its geographical location, District Thatta can be affected by the tsunami disaster also. A tsunami disaster hit the Makran coast in Balochistan Province during November 1945. The Tsunami resulted sea waves of 12-15 meters height that killed about 4,000 people in the Makran coast. Although Karachi and Thatta were away from the epicenter, but still 6 feet high sea waves were observed which affected harbor facilities. The effects of the Tsunami of December, 2004 were also felt along the coastline of Pakistan. The abnormal rise in water detected by tide gauge station in Keti Bunder area of District Thatta created panic in the coastal population including Karachi.

Sea Intrusion

1.22 million acres land either eroded or subsequently submerged under the sea, livelihood opons of thousands of people destroyed, mass displacement, structural damages, and vast area under deserficaon.

Drought

Being part of the dry region, District Thatta always faces the risk of droughts. The Kohistan and desert zone of the district are especially vulnerable to drought hazard as the areas face extreme shortage of potable water. Geography, District Thatta can be divided into four zones, namely eastern desert, western hilly / mountainous area, a coastal area in the south and irrigated agriculture area in the middle. Its 60% area is arid receiving rainfall on average of 5 inches during monsoon and very little during the month of December and January. The arid area people depend upon the scanty rainfall raising livestock and millet crops. The failure of rainfall and impacts of climate changes, reduce the water supplies in the Indus River System (IRS). Sindh is at the end of the system usually takes the brink. Besides, two-third of ground water is brackish and 80% agricultural land is affected by water logging and salinity.

Drought spell occurred during 2012 also which was becoming more severe, but fortunately the late monsoon rains saved the area from devastation, even than about 15% population of Thar moved to barrage command area with their livestock in search of livelihood. The uncertain situation during monsoon 2013 due to untimely rains affected the crop sowing in Thar and Kohistan, which results sufferings of human and animal population.

Coastal belt of Thatta District

The coastal belt of Thatta District is 107 KM in which, Tehsils Jati, Kharochhan, Keti bander, Shahbander, Ghorabari and Sakro were affected, during the Cyclone of 1999. The cyclone which was traveling at about 120 miles per hour was very severe and caused huge losses to life and property. The worst affected tehsils of district Thatta were Tehsil Jati, Shah Bunder, Keti Bunder and Kharochan.

Due to its geographical position, the district Thatta Indus has been subjected to sea intrusion, cyclones, worst rain flood and river floods. Being in the tail and having large (Kohistan) areas, it has also gone through painful sufferings of drought due to meager rainfalls and shortage of water. The coastal tehsils of District Thatta being in close proximity to the Arabian Sea are endangered with growing seawater intrusion owing to the reduced fresh water flows/ availability. Vast land has either simply merged in sea or has become saline with seawater visible on the surface of the land during high tides. A large number of Dehs (local units of land), which were considered as fertile in the past, have amalgamated in the sea. Dozens of villages situated in those Dehs were uprooted and the villagers had to migrate to different places. A large number of villages in the proximity of the sea still face threats of inundation.

Keti Bunder and Kharo Chhan Tehsils of the district are the worst affected of the land degradation as a result of sea water intrusion. According to the Sindh Government figures, out of 43 Dehs of Keti Bunder Tehsil, 33 Dehs have been completely eroded and encroached by the sea. Similarly, the government figures show that out of 42 Dehs of Kharo Chhan tehsil 37 Dehs have been completely degraded which means more than 50% of the land of tehsil has gone to the sea (IUCN, 2001)

Following six Tehsils are situated along costal area:

i) *Mirpur Sakro*
ii) *Ghorabari*
iii) *Keti Bunder*
iv) *Kharochan*
v) *Jati*
vi) *Shah Bunder*

The cyclone shocked the locale organization as it was of unusual force and did not allow the District Administration to hint the occupants of Coastal Area in time for clearing. The populace in the beach front belt particularly the anglers were left stranded and resultantly endured overwhelming causalities.
Keeping in see the above repeating circumstance of violent winds, it is important to draw/chalk out far reaching system to adapt up to such common disasters. The force of tornado can be characterized into two classes.

a) *Low Cyclone*: The low category cyclone is one where intensity of winds is up till 60 Km/ Hours. Here, the services of the entire District Administration would be mobilized and NGOs would be actively involved to provide safety and security to people, through evacuation and provision of sustenance at the relief camps, wherever they are necessary at the nearest town, away from the coastal belt. The Army is requested to be on the high alert
b) *Severe Stage of Cyclone*: The sever stage of Cyclone ranges between 120 Km/Hours and above. The situation shall be declared as severe and in such situation Armed Forces shall be requested to come forward for the assistance of Civil Administration, apart from mobilization of NGOs in District Administration itself.

c) *Flood monsoon (Rainy season):* In Pakistan, rainy season (monsoon) starts from June and lasts till September. The average rainfall in the district is 100 mm per year. In 2003 the rain started in the first week of June and lasted till August 2003. The total rainfall was more than 250mm and it created an emergency situation in the district, resulting in massive life loss and damage to crops, livestock and infrastructure. The rainfall below 100 mm is not alarming and is found to be manageable, but the rainfall exceeding the limit of 100mm will require immediate action.

Most effective factors for the coastal area of Thatta district
According to the assessment, Badin is currently bearing the brunt of “severe” sea intrusion and erosion while over Thatta and Sujawal face “moderate” erosion.
“According to independent surveys, more than 3.1 million acres of agricultural land has been submerged in Badin, Thatta and Sujawal districts,” said Nasir Panhwar, an environmental expert.

Kharo Chann and Keti Bunder - two old fishing creeks situated side-by-side on the delta in Thatta and Sujawal districts that are categorised in the climate division's report to be facing "severe" erosion - are almost completely destroyed.

Though no official records exist, but 34 of Keti Bunder's 48 settlements have been submerged by the Arabian Sea, displacing around 60,000 people, according to the Forever Indus study. Moreover, the current location of the town itself has changed three times during the past five or six decades.

The president of the Pakistan Fisherfolk Forum, Mohammad Ali Shah, claims that the damage goes as far as Kotri, 200 kilometres up the Indus River. "Since the Kotri Barrage was built in 1955, the water flow in the Indus Delta has been too low to push the seawater back and sustain the local ecosystems," he said. "As a result, the sea water creeps up the river channels, destroying and eating up land and damaging the local ecosystems. For example, the original residents of Keti Bunder were not fishermen but farmers and the Indus Delta used to be famous around the world for the production of red rice."

Shah explained that as water reserves had been destroyed by salinity and the land was too barren to grow anything, more than 90 percent of the population relied on fishing as their main source of income. However, he added, because of the harsher weather patterns now, even the fish catch had reduced to an extent that it was not enough to sustain the families.

Shah's experience is corroborated by the national assessment which confirms that a reduction in the flow of freshwater downstream Kotri has resulted in "surge" of seawater inland, causing destruction of agricultural land and "amplification" of erosion in Thatta and Sujawal districts.

According to the research, the Defence Housing Authority's Waterfront Development Project, while conducting dredging to reclaim land, intruded 300 metres into the deep sea and seven kilometres along the Clifton beach, eroding the intertidal zone of the Arabian Sea.

Sea water intrusion to the coastal line of Thatta district

Sea intrusion results as consequences of the scarcity of fresh water in downstream Kotri. It was the river Indus and its delta that was considered as sources of prosperity for the local residents and there was a time that District Thatta was considered as one of the most prosperous areas of the subcontinent. With the start of efforts to contain river Indus and manage its waters upstream through the construction of engineering marvels like dams, barrages and link canals, flow of Indus water started receding downstream Kotri barrage. This reduced inflow of fresh water in River Indus resulted sea intrusion that have resulted in the degradation of Indus delta and it is estimated that the delta has shrunk to 10% of the size it used to have. Most of the Thatta's lands along the costal belt have been encroached by the sea. The sea intrusion has also severely affected the aquifers and at many places in the district, the underground water and lands have become saline.

Intrusion of seawater from the Arabian Sea into the Indus River has been attributed to the diversion of river's flow. The quantity of outflow to sea has been progressively reducing, particularly after the construction of barrages, dams and link canals after the signing of the Indus

Water Treaty, 1960. The actual outflow to sea at the time of independence was about 80 MAF, which has now reduced to 36 MAF.

Mangroves plantation works as blanket cover to prevent the sea intrusion. But unfortunately, the destruction of mangroves owing to deforestation and reduce the flow of water in River Indus has resulted in affecting the reproduction of fish and thus causing reduction in the availability of fish especially to the poor fishermen. The Federal Flood Commission (FFC) has conducted a study of sea intrusion spread over 150 kilometers of the District Thatta and Badin. The study reveals of rising in sea level caused flooding in the coastal areas of Thatta. In other study conducted by the Pakistan Meteorological Office indicates sea water flooding in the coastal areas of Sindh. As a result of which panic have been created among the residents of Thatta and Keti Bunder, and in the villages located in the coastal belt of District Thatta.

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