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Estuarine Landforms of Puri Coast in Orissa, India

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Abstract: ***An estuary is a body of water formed where freshwater from rivers and streams flows into the ocean, mixing with the seawater. The processes operating in an estuary are a function of the characteristics of the catchment and of the receiving basin into which the river discharges. Although the relative balance of wave, tide and river processes shows the exert considerable control over morphology, estuaries are the product of longer-term evolution in time and space over which boundary conditions change. Estuarine circulation is generally a function of the interaction of the marine processes, particularly tide, with fluvial discharge and water already in the system. Present study shows the estuarine processes and associated landforms of the study area.***

Keywords: Estuary, Catchment, Morphology, Estuarine Circulation, Marine Process

1. Introduction

In natural landscape estuary is a distinct part. Estuary is an arm of sea that extends inland to meet the mouth of river. According to Pritchard (1952) estuary is a semi enclosed coastal body of water which has a free connection with the open sea and with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage. Estuary is characterized by its distinct landforms. Various features that make up the surface character of the earth are called landform. Development of any landform depends on involved process and the topography character.

2. Study Area

Puri district is the southernmost district province of Orissa. The Puri coast is situating on the north western part of Bay of Bengal. The actual length of the Puri sea beach is 150.4 km. The study area consists of the estuarine coast. The estuarine coast is extended from 19°46'56.3"N to 19''47'20.4"N and 19°46'47.9"N to 19°47'11"N**.** latitude and the longitudinal extension is 85°46'52.4"E to 85°46'47.4"E and 85°46'55.6"E to 85°46'52.4"E. Concerned area is located at 5.6km west from core of the town Puri.

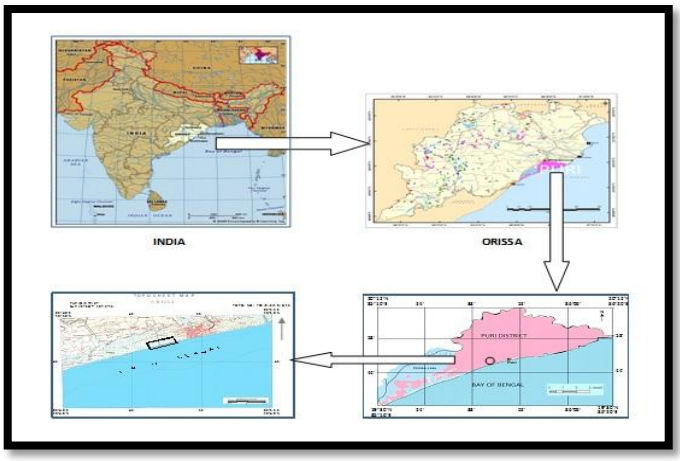

Figure 1: Location map

3. Objectives

1. To find out the active processes in an estuary.
2. To find out the relation between the process and the topography.
3. To identify the topographical character.

4. Methodology

a) Five cross profile is drawn in the selected study area by using dumpy level. After drawing those profile landform features are identified.
b) Visual techniques.

5. Estuarine Process

The fundamental processes by which estuarine landforms is developed is the deposition of fine grained sediment. There are two large scale flows with in estuaries, these will be examined separately but infect are superimposed one on another. The two flows are:

a) Tidal current set up by the movement of the tidal wave in the estuary.
b) Residual currents set up by the mixing of the fresh and saline water.

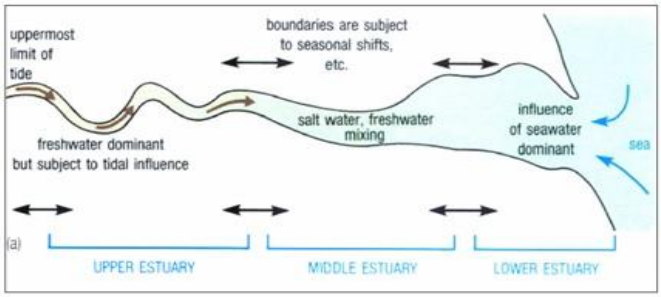

Figure 2: Estuarine process

6. Estuarine Landforms

Most estuaries are areas of predominant sedimentation in which tidal channels meander between mudflats and channel bars of mud and sand.

In our study area identified landforms are:

A. Bar
B. Tidal flat surface
C. Steep concave slope of meander

7. Profile Wise Landforms and Active Processes

Table 1: Profile wise landforms and active processes

Profile	*Location*	*Length(m)*	*Identified feature*	*Involved process*
A	19˚46'56.5"N to 19˚46'56.5"N & 85˚46'52"E to 85˚86'53.2"E(A0 to A30)	155	Bar	Tide and turbulence of water
B	194701.8"N-854651.5"E to 194701.8"N-854652.5'E(B0 to B25)	175	Tidal flat	Tide and turbulence of water
C	19˚47'0.53"N-85˚46'51.1"E to 19˚47'0.53"N-85˚46'51.9'E (Co-C44)	220	Tidal Flat, Bar	Tide
D	19°47'13.5"N-85°46'49.3"E to 19°47'13.5"N-85°46'50.1'E(D0-D41)	205	Tidal flat surface	Tide and turbulence of water
E	19˚47'17.2"N-85˚46'56.1E to 19˚47'17.2N-85˚46'57.4"E(E0-E25)	125	Steep concave slope of meandering bars	Tide

A. Bar

Bar is a distinct feature of estuary. It is a ridge of sand in a river of or sea, built up by the action of tides, currents etc and often exposed at low tide. A common beach feature is the sand bar, sometimes known as spit. It is composed of mud, sand and shingle, deposited in water across the mouth of river. The shape size and position of the sand bar is consistent with the observations. Short term simulations of hydrodynamic and sediment transport processes at the initial stage indicate that the response to the interaction between river discharge and tidal currents which are strongly influenced by the funnel shape.

Figure 3: Tidal bar

The transition zone between the river dominated part in the upper estuary and the flood tide dominated lower estuary is located where sediment transport pathway coverage and the sand bar develops.

In the study area bars are composed mainly of sand particle and it develops in very small size and volume. In our study area bar is located at 19°46'56.3"N, 85°46'52.4"E; 19°46'47.9"N; 85°46'55.5"E

B. Tidal Flat

Tidal flat is another feature. A broad flat area very closed to sea level that is flooded and drained with each rise and fall of tide. The feature is characterized with very gentle slope and flat surface. The formation and evolution of deposition system for tidal flat composed of mud and sand is controlled mainly by tidal hydraulics. The increases in deposition rates on the higher flat caused by low velocities and setting lag here, will caused these areas to rise in height faster than those below mid tide. Since the upper limit of the flat is held at, or just below, high water mark, this means that deposition occurs in leans like layer which prograded offshore.

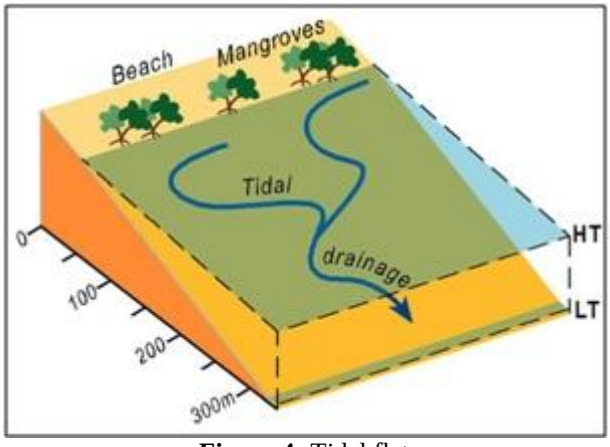

Figure 4: Tidal flat

In the study area this is composed of finer sands and eroded sediments through tide in stream channel. The flat surface is found submerged under water in high tide. Tidal flat is found in almost part of this selected area.

C. Steep Concave Slope of Meander

Most river channels display a degree of sinuosity in another word they are meander. Meander occurs where vertical erosion has virtually ceased and the available energy is used in lateral erosion (and deposition) producing meander. The origin of steep concave slope of meander is related to meander formation. In low flowing conditions straight channels are seen to have alternating bars of sediment in the river bed so that the flow is forced to wave around them. These form shallow, faster flowing riffles and deeper, slower flowing pools. The swing of the flow induced by the riffles, tend to direct the zone of maximum velocity or thalwag to one side of the channel, leading to erosion. The resulting concave bank is eroded by under cutting of the alluvial material of the rivers floodplain.

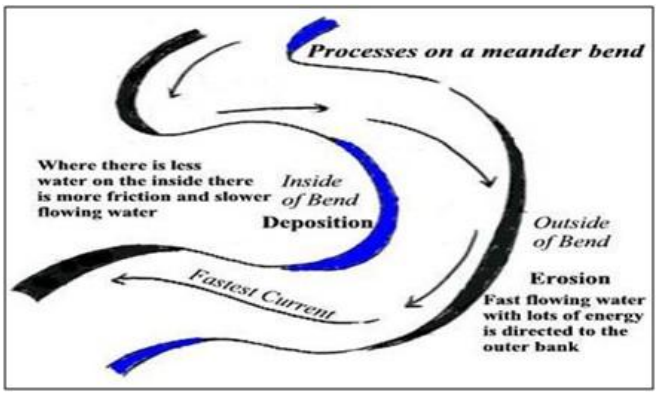

Figure 5: Steep Concave Slope of Meander

In the study area this slope consists with above 3° of slope. In this selected area it is located at 19°47'05.5"N, 85°46'53.4"E; 19°47'03.4"N, 85°46'53.6"E

8. Conclusion

Landforms are developed by mainly deposition of transported sediment. The dominant process of this estuary is mixing of salt and fresh water by which different deposited landforms may be develops in future.

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