



## **Cyclone Risk Mitigation Measures in India**

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### **India is vulnerable to a large number of disasters**

- Approx. 59% of the landmass is prone to Earthquakes
- Approx. 12% (About 40 million hectares of land) is prone to flood and river erosion.
- Approx. 68% of the cultivable area is vulnerable to drought/landslides/avalanches
- About 5770 km of coastline out of a total 7516 km is prone to Cyclone and Tsunami

## Vulnerability directly proportional to

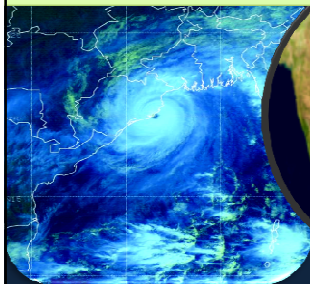


- Rising population
- Haphazard Urbanization
- Developments in High-Risk zones
- Environmental Degradation
- Climate Change.

## Cyclone Vulnerability and rationale for inclusive approach

- ▶ About 5700 Km. of the country's coast of 7516 Km exposed to severe cyclones.
- ▶ Area prone to cyclones is 8.5% of the total area of the country.
- ▶ Average no. of cyclones forming in the Bay of Bengal and Arabian Sea is 5-6 of which 2-3 cross the Indian Coast every year.
- ▶ East Coast is more prone than West Coast, the ratio being 4:1.
- ▶ Super Cyclone of Orissa Oct., 1999 was severe followed by several instances of cyclones including Cyclone Aila in 2009 and Cyclone Laila 2011

## Orissa Super Cyclone-29<sup>th</sup> Oct., 1999



Storm Path



Formed	October 25, 1999
Dissipated	November 3, 1999 (1999-11-04)
Highest winds	3-minute sustained: 260 km/h (160 mph)
Fatalities	~9209 direct
Damage	\$4.5 billion
Areas affected	India, Myanmar



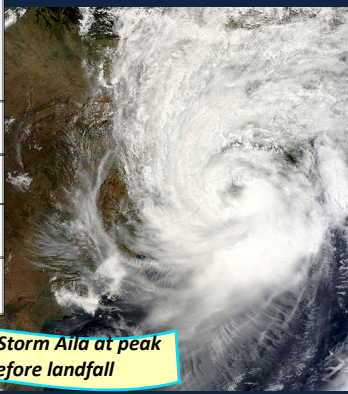
Source : Wikipedia

## Ailia Cyclone

Storm Path



Formed	23 May 2009
Dissipated	26 May 2009
Highest winds	3-minute sustained: 110 km/h (70 mph) 1-minute sustained: 120 km/h (75 mph)
Fatalities	325 total, ~8,000 missing
Damage	\$552.6 million
Areas affected	India, Bangladesh



Source - Wikipedia

Severe Cyclonic Storm Aila at peak intensity before landfall



## Mitigation Measures

### Structural Mitigation Measures

- Cyclone walls and Coral reefs
- Tsunami breakwaters (to provide cushion against Cyclone)
- Increasing the river dike height
- Cyclone Shelters (safe places to flee)
- Evacuation routes identification



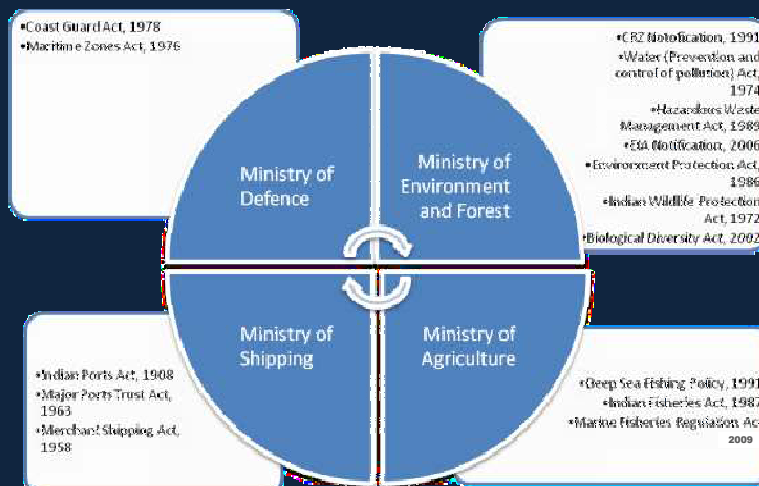


# Mitigation Measures Cont.

## Non-Structural Mitigation Measures

- Coastal Regulations Zone Act - Strict implementation (no development within 500 m of the high tide line with elevation of less than 10 m above m.s.l.)
- Land use Zoning in accordance with CRZ
- Natural Bio-shields (Mangroves) & shelter belt plantations (Casuarinas)
- Maintaining Natural Sand dunes
- Maintaining and promoting beach development

## Enabling environment for Coastal Zone Management in India

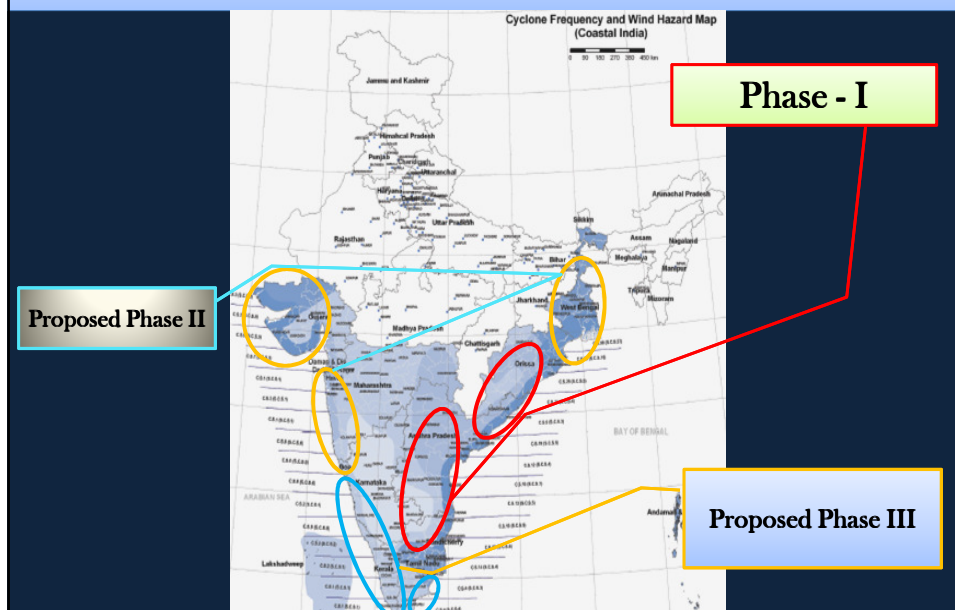


Encompasses almost all measures –

## The National Cyclone Risk Mitigation Project launched

Contemplated to reduce the vulnerability of coastal communities to cyclone and other hydro - meteorological hazards.

### Cyclone Mitigation Approach



## PROJECT PHASES

- ▶ Phase I – Andhra Pradesh and Orissa (US \$ 308.60 million)
- ▶ Phase II and III – Remaining States/UT's

## Project Components

Component A  
Rs 72.75 cr

- Early Warning Dissemination Systems and capacity building of coastal communities ★

Component B  
Rs 1164 cr

- Investments in physical infrastructure like cyclone shelters, roads, embankments etc in AP and Orissa ★

Component C  
Rs 29.1 cr

- Technical assistance for National and State level capacity building and knowledge creation ★

Component D  
Rs 95.06 cr

- Project management and implementation support ★

## Project Outputs

Sl. No.	Investment	Orissa	AP
1.	Cyclone Shelters	130	148
2.	Cyclone Shelters for Fishing Communities	19	-
3.	Shelter-cum-Go downs	6	-
4.	Approach Roads to proposed Cyclone Shelters	130 (150.35 k.m.)	206 (280 k.m.)
5.	Approach Roads to existing Cyclone Shelters	61 (112.8 k.m.)	-
6.	Roads connecting habitations less than 500 or unconnected habitation	-	271 (479 k.m.)
7.	No. of Bridges	-	22
8.	No. of Roads	-	3 (23 k.m.)
9.	Saline Embankment	23 (157 k.m.)	2 (33.6 km.)

# Project Outcomes/Benefits

NCRMP is expected to benefit coastal communities in terms of better infrastructure for protection and evacuation, greater accessibility, improved warning dissemination and quicker response.

		Lives Protected	Land Area Protected (in Ha)
<b>A</b>	<b>Orissa</b>		
	By Cyclone Shelters	169150	N/A
	By Embankments	221804	38296
	By Access Roads	169150	N/A
<b>B</b>	<b>Andhra Pradesh</b>		
	By Cyclone Shelters	95439	N/A
	By Roads/Bridges	419522	N/A
	By restoration of Tidal Banks	37000	12640

## Integrated Coastal Zone Management Project (ICZMP): (US\$ 256.81 millions) (Gujarat, Orissa and West Bengal)

### COMPONENTS

#### Capacity Building

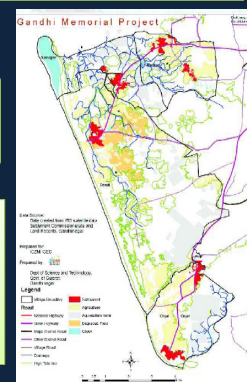
- Mapping, delineation and demarcation of the hazard lines, and delineation of coastal sediment cells and coastal Ecologically sensitive Areas (ESAs).
- Capacity Building of administrative departments, coastal Zone Management Authorities, R&D institutes involved.
- Nation-wide training program on integrated coastal zone management.
- Establishing National Centre for Sustainable Coastal Management (NCSCM)

#### Green Action for Gandhi Dandi Heritage Initiative (G.A.N.D.H.I.)



*Important step in recognizing Gandhiji's vision for environment & biodiversity on the occasion of 80 years of Dandi March*

- Conservation of the coast & coastal resources
- Adopting nature-based development of resources
- Promoting integrated village & community development
- Promoting eco-tourism & "environment-positive" branding of destination Dandi.



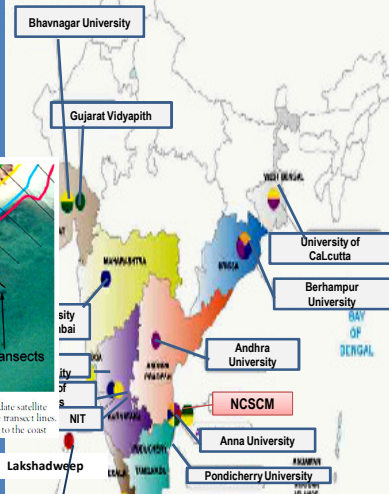
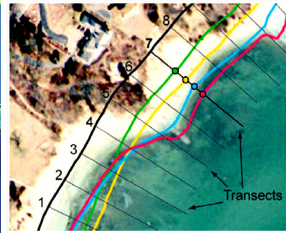
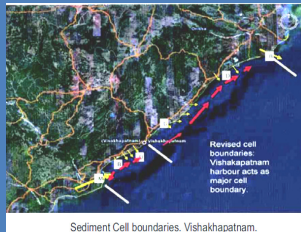


NCSM established within Anna University, Chennai and undertakes activities in collaboration with 15 identified research orgs. in India

- Analyze ICZM practice & develop suitable application in India.
- Evaluate & monitor implementation of the ICZM approaches
- Serve as an interface amongst community, experts & government
- Promote applied research , education & awareness including ecological literacy.

### Establishment of National Centre for Sustainable Coastal Management

### Sediment Cell Demarcation



The shoreline changes due to man-made and Natural processes will be studied all along the coastline. Based on this study the coastline will be classified as High, Medium and Stable erosion zone

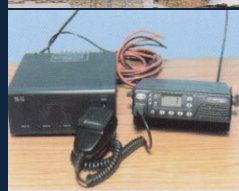
Thank you

## Component A - Early Warning Dissemination System (EWDS) - Total cost – Rs 72.75 cr

**Objective:** Improve the Last Mile Connectivity of early warning dissemination at the level of the community

**The component will support:**

- The installation of an EWDS allowing the state and/or district/sub district level control centre to send communication directly to the village level
- Strengthening of community capacity in maintaining and operating the EWDS as well as community mobilization during an emergency



## Component B - Cyclone Risk Mitigation Infrastructure – Total cost – Rs 1164 cr

- ▶ **Objective** Supports investments in the States to create cyclone risk mitigation infrastructure

**The component will provide for**

- **Cyclone shelters**
- **Missing road links and bridges**
- **Saline Embankments/tidal banks**



## Component C - Technical Assistance for

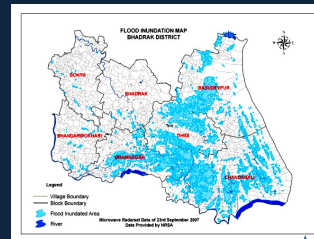
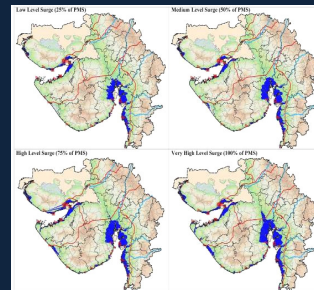
National and State Level Capacity Building and Knowledge Creation - Rs 29.10 cr

### Objective:

Help undertake risk and damage/loss assessment studies, and strategy for building up institutional capacities of the various stakeholders involved

### The component will support studies:

- Risk Assessment
- Preparation of long term training and capacity building strategy and capacity building for Damage and Loss Assessments



## Component D - Project Management and Implementation Support

### Objective Implementation support

The component will support project management by financing incremental operating costs for:

- Project Management Unit (PMU),
- Project Implementation Units (PIUs),
- Nodal units in line departments
- National Institute of Disaster Management (NIDM),
- Office equipment, training and exposure visits
- Consulting services for specialist activities.