



Water and  
Environmental  
Conservation

# INTEGRATED COASTAL ZONE MANAGEMENT

## Theme 4: Sustainable development of coastal zones in Yemen

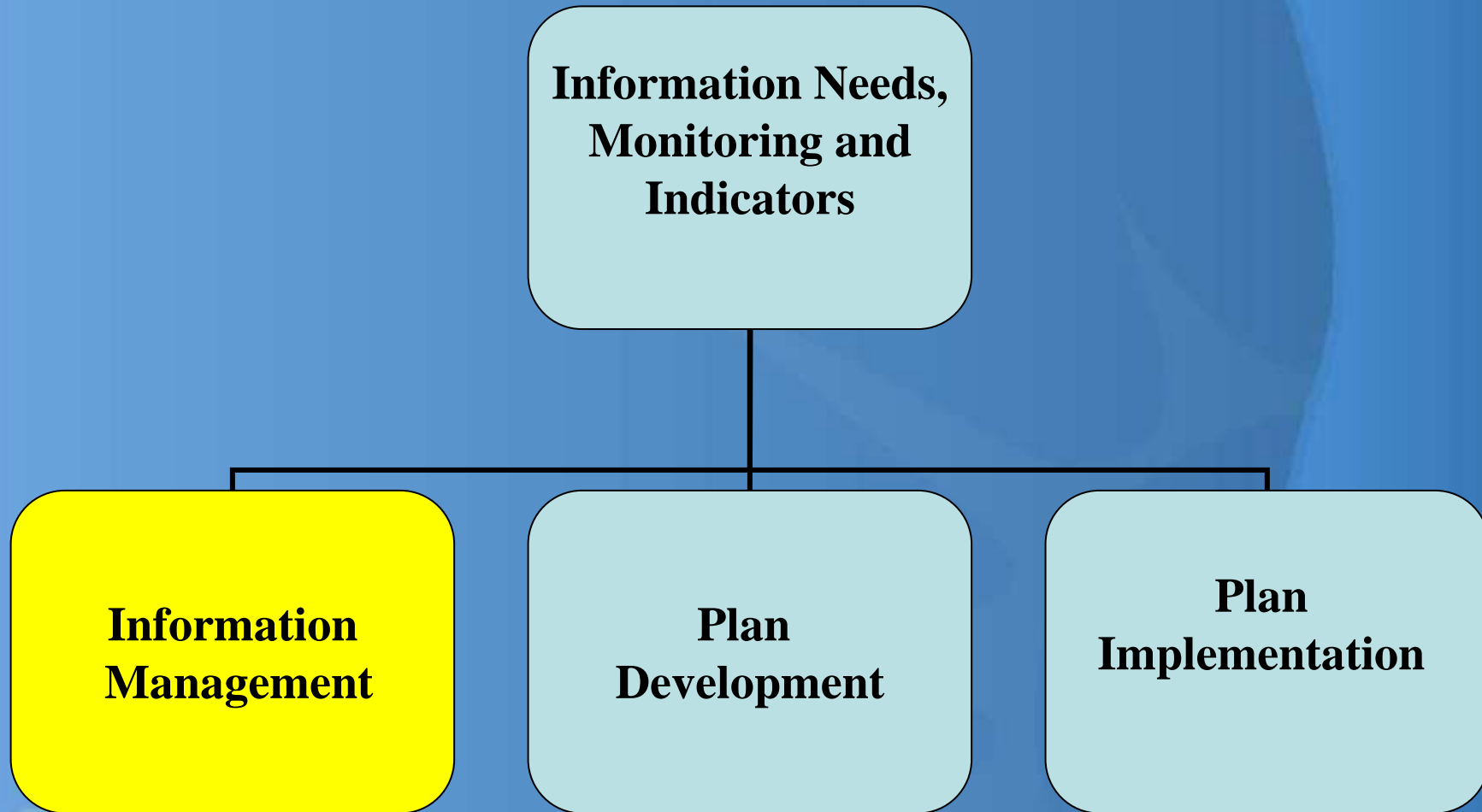




## Sustainable development of coastal zones in Yemen

**Management Strategies  
and Instruments**

**Information Needs,  
Monitoring  
and Indicators**





## Information Management

**1. Data Collection  
&  
Management**

**2. Data Utilization**

**3. Content  
&  
Structure  
of the Data Base**

**4. Decision Support  
System (DSS)**



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# 1. Data Collection & Management

## A. Data Collection:

- Data are the essential element of any information system





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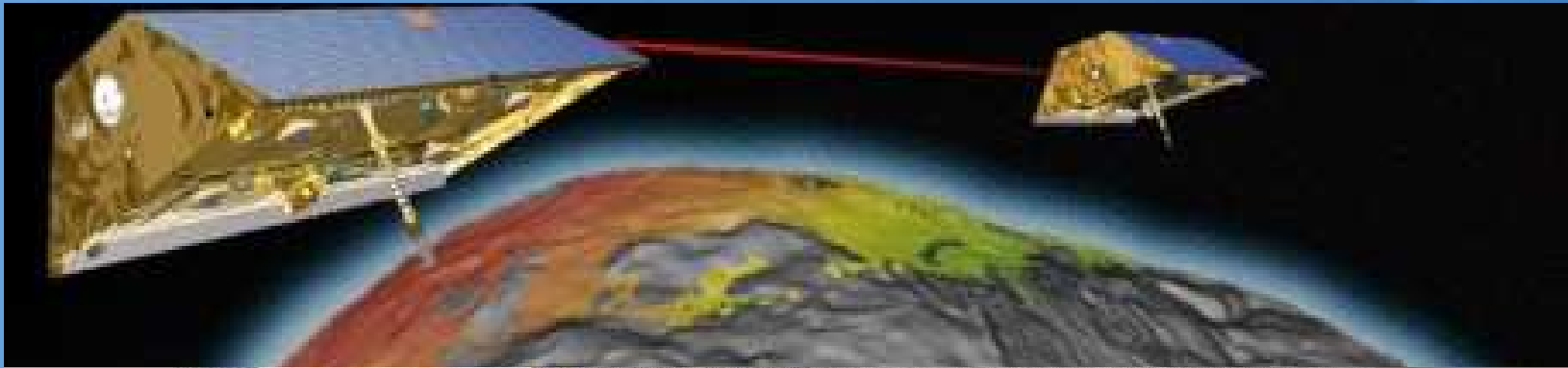
- Their Reliability, accuracy and accessibility are essential to decision making





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- Remote sensing (satellite Images) is a major source especially for inaccessible locations





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- Field truth is required for verification of data







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## B. Data Management include:

- Identification of the areas or variables likely to be under pressure from future development
- Selection of appropriate sites for essential public services which do not cause environmental degradation
- Identification of resources of high sensitivity for protection policies
- Identification of priorities for nature conservation where sensitive ecological resources are in areas subject to pollution
- Planning Tourism development in relation to the carrying capacity of natural resources
- Selection of alternative development scenarios or projects
- Identification of appropriate policy instruments and
- Definition of appropriate financial mechanisms

## 2. Data Utilization:

### Data Utilization Include:

- Identification of key indicators of the existing state of the coastal environment
- Identification of coastal resources under stress or at risk, and their level of vulnerability or risk of degradation
- Forecasting the possible impacts of alternative development trends on sensitive resources
- Identification of areas for development using site suitability and exclusion criteria
- Simulation and testing alternative options
- Monitoring and feedback
- Exploration of available information and alternative scenarios



### 3. Contents and structures of Database:

The types of information needed include:

- **Basic environmental conditions (geology, hydrology, climate, biology and topography)**



- Natural resources (Water supply, agricultural land, forest and pasture land, fishery and aquatic resources, recreation and tourist resources, Natural heritage resources, mineral resources)



Qalansiah Lagoon, Socotra Island



Dragon tree in Socotra island





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- Environmental hazards (Hurricane, floods,.... etc)





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- Land use (agriculture, extractive, industrial, residential and services)





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- **Network and infrastructure (water supply and drainage, waste disposal, transport etc.)**





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## A SUGGESTED DATABASE FOR ICZM

- **Resource Management (quantity and quality)**
  - **Land Area:**
    - **Built-up area**
    - **Agricultural land**
    - **Land set a side for construction**
    - **Land set a side for special purposes**
    - **Forests**







• ***Water Resources:***

- **Surface Water**
- **Ground Water**
- **Coastal Water**

• ***Marine Resources:***

• ***Wildlife Resources:***





## • **Economic Activities:**

- **Industry**
- **Mineral and construction, material extraction**
- **Agriculture**
- **Tourism**
- **Fishing and aquaculture**
- **Forestry**
- **Transport**
- **Energy**



- **Infrastructure:**

- Roads
- Railways
- Airports
- Water Supply
- Sewage treatment
- Irrigation

- **Pollution discharge:**

- Air
- Water
- Waste
- Hazards and Risks

- **Existing policies, plans and programmes:**



## 4. Decision Support System (DSS)

The GIS system allows data to be stored in a computerized format and visualized, analyzed and managed in an integrated manner.

These data will allow the decision makers to take their actions based on a comprehensive information and reliable data





## A SAMPLE SET OF COASTAL SUSTAINABILITY INDICATORS:

### Land Development:

- Percentage of Coast Line urbanized
- Amount of green field land developed per year
- Amount or percentage of development occurring on coast
- Extent of farmland or rural land lost each year and overtime

### Water:

- Extent of fishable and swimable waters, change of water quality over time
- Extent of pervious and impervious surfaces, changes in pervious and impervious cover

### Forest and Habitat:

- Change in forest cover
- Acreage in forest
- Extent and status of endangered species
- Extent and status of biodiversity hotspots in coastal zone



## **Hazard Exposure:**

- Number of structures within 10-year erosion zone
- Number of unelevated structures in floodplain
- Number of older structures built to lower (older) building standards
- Number of hurricane shelters in relation to population

## **Air:**

- Number of days in violation of the federal Clean Air Act

## **Wetlands:**

- Acreage of coastal wetlands converted, each year and over time
- Acreage of existing and protected wetlands

## **Fisheries and Marine Resources:**

- Health of coral reefs, Sea grasses, and other marine habitats
- Status and condition of local and regional fisheries
- Number of oil spills



## **Recreation and coastal access:**

- Number of beach access points
- acreage of public beach

## • **Energy and Resource Use:**

- Water consumption (per capita)
- Energy consumption (per capita)
- Recycling rate
- Solid waste generated per year
- Number of treatment plants

## • **Energy and Resource Use:**

- Modal share for walking, bicycling and transit
- Percentage of built environment bicycle – or pedestrian-friendly