



**Coastal vulnerability  
assessment: Assessing  
vulnerability to climate  
change and sea level  
rise**

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**Coastal Vulnerability Assessment: *Assessing  
Vulnerability to Climate Change and Sea Level  
Rise***

**R. A. van Dam**

**Workshop presentation**

***“Workshop on the Vulnerability of Olango Island to Climate  
Change and Sea Level Rise”***

**Costabella Tropical Beach Resort, Mactan Is., Philippines  
9-10 December 1998**

**&**

***“Workshop on the Vulnerability of Yellow River Delta, China”***

**Beijing Grand Hotel, Beijing, China  
22 January 1999**

Overhead sheets used for the two presentations are attached.

The information presented represents a modified vulnerability assessment approach based on the IPCC “Common Methodology” and more recent approaches developed in Australia. Some of the information and data presented have been published previously, in Supervising Scientist Reports 101 and 123.

# *Coastal Vulnerability Assessment*

*Assessing vulnerability to  
climate change and sea  
level rise*

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# *Presentation Outline*

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- Climate change and sea level rise
- Coastal vulnerability assessment
- Objectives of VA
- VA framework
- The process of VA
- Outcomes of VA
- Example: The Alligator Rivers Region (ARR)
- Summary

*Asia-Pacific Wetlands VA Workshops:  
Olango Is., Philippines, December 1998  
Yellow River Delta, China, January 1999*

# *Climate change & sea level rise*

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*Global climate change due to human activities and associated production of greenhouse gases:*

- $\text{CO}_2$  - risen 30% since mid 1700s  
combustion of fossil fuels  
changes in land use
- $\text{CH}_4$  - risen over 100%  
agriculture
- $\text{N}_2\text{O}$  - risen by 15%  
agriculture

*& aerosols*



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*Climate change & sea level rise*

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• ***Potential consequences of sea level rise include:***

- habitat loss and change
- changes in species composition
- infrastructure damage and loss
- increase in incidence of mosquito-borne diseases
- economic losses -tourism, fishing, etc.

• ***Due to:***

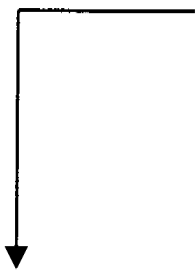
- inundation/flooding
  - increased storm surge
  - coastal erosion
  - changes in light penetration
  - saline intrusion
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# *Coastal Vulnerability Assessment*

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*Three important terms:*

- Sensitivity
- Adaptability
- Vulnerability



*Vulnerability:*

- The extent to which climate change, or other factors, may damage or harm a system.
- Depends on the system's sensitivity and adaptability



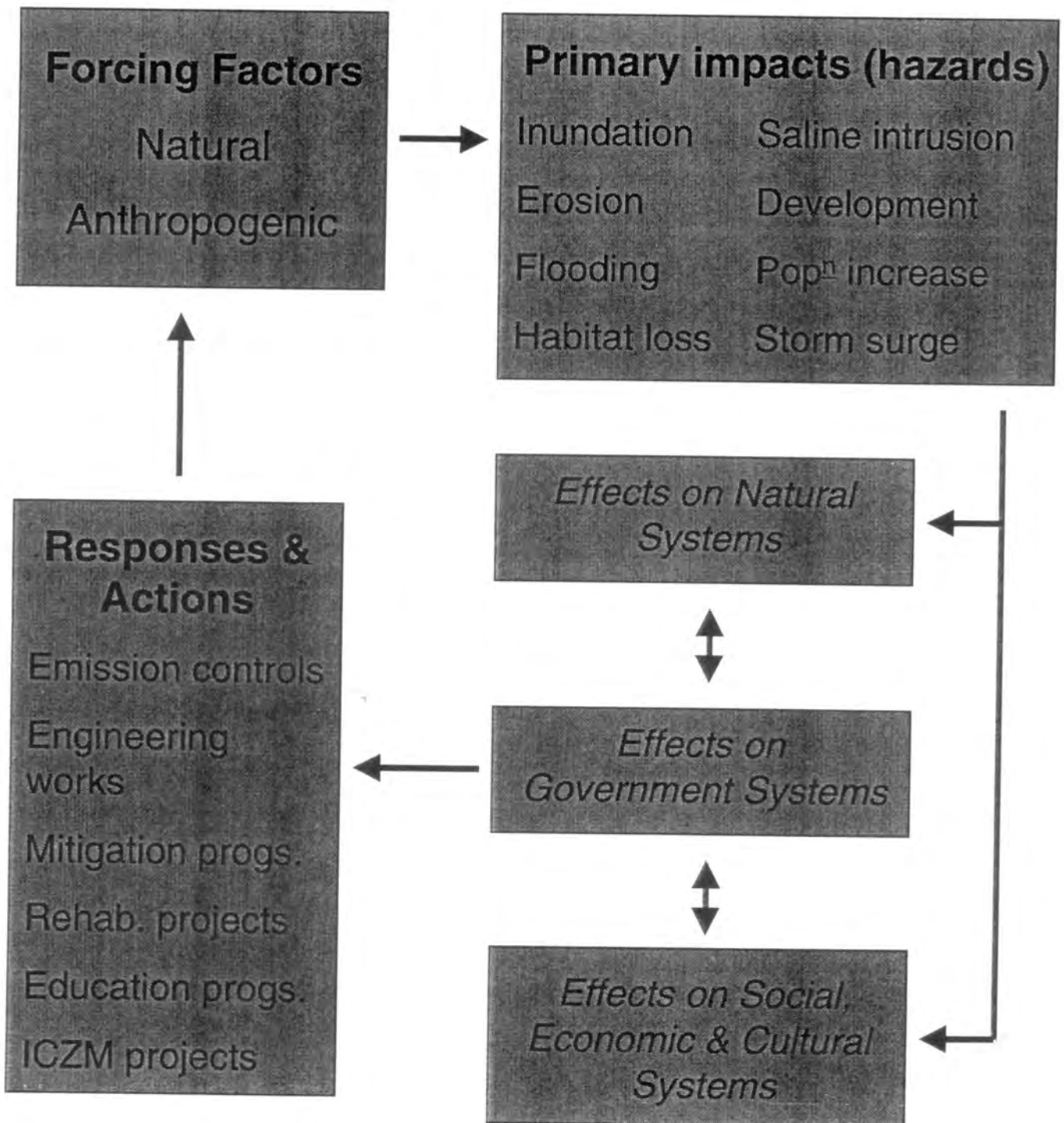
# *Objectives of Vulnerability Assessment*

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- To identify current status of coastal areas, and vulnerability due to existing coastal hazards
- To identify future vulnerability of coastal areas due to climate change
- To develop processes to monitor, adapt to, prevent and/or mitigate impacts arising from climate change
- Needs to be a flexible approach and take account of:
  - variability in physical and biological conditions
  - differences in social, economic, and cultural factors

# Vulnerability Assessment Framework

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# *The Process of VA*

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## *1. Defining the scope of the assessment and the study area*

- What is to be assessed?
- How is it to be assessed?
- What is the site of interest?

## *2. Establishing the present situation*

- Documenting the site's environmental resources
  - *physical, biological, social, economic, cultural*
- Identifying forcing factors & processes of change in the existing environment
  - *developing an understanding of natural variability and effects of human interference in the absence of climate change*

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### *3. Determining predicted climate change scenario*

- Usually based on broad regional climate change scenarios (eg IPCC predictions)
- Inclusion of local & site-specific information if available
- estimated temp. changes, sea level rise, rainfall, cloud cover, extreme events, ENSO

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### *4. Assessing vulnerability to climate change*

- Vulnerability to current forcing factors
  - Predicted vulnerability to climate change
- vulnerability with respect to natural, socio-economic and cultural resources/attributes*
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• *5. Assessing the significance of changes*

- Due to current forcing factors
- Due to climate change

• *6. Documenting existing responses to current changes*

- Governmental/management responses - *technical, engineering, educational, policy-based*

• *7. Identifying information gaps*

- Recognises uncertainty
  - Includes identifying/prioritising future research needs
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*8. Determining requirements for monitoring hazards and their changes*

- Simple yet meaningful monitoring tools
- Results easily applied to coastal management processes

*9. Determining future responses to anticipated changes*

- Due to current forcing factors
- Due to climate change
- Strategies to minimise risks and costs
- Should be cost effective, technically & environmentally sound
- Incorporated in coastal management policy & actioned in management plans

# Major Outcomes of VA

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- Understanding of natural, socio-economic and cultural resources that are vulnerable to coastal hazards (*including climate change*)
- Development of appropriate methods to monitor coastal hazards (*including climate change*) and their impacts on the coastal environment
- Development of appropriate strategies to prevent, adapt to, or mitigate changes caused by coastal hazards (*including climate change*)
  - ie minimise risks

# *Example: Alligator Rivers Region*

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## *Natural attributes:*

- Coastal region encompassing mangrove communities, estuaries, salt flats, tidal rivers, estuarine & freshwater floodplains, freshwater wetlands, monsoon rainforests
- Exotic plants & animals (*forcing factor*)

## *Social, economic & cultural attributes:*

- Kakadu National Park -World Heritage
- Uranium mining (*forcing factor*)
- Tourism (*forcing factor*)
- Pastoralism (*forcing factor*)
- Aboriginal & Commonwealth land
- Aboriginal & non-aboriginal cultural values (*forcing factor*)





## Example: The ARR

*Vulnerability to climate change & sea level rise:*

### *Aboriginal cultural attributes*

- high
- -ve effects on traditional food sources & other essential resources
- Demonstrated ability to adapt to change
- Major effect of other forcing factors

### *Social & economic attributes*

- medium - high
- -ve effect on tourism due to loss of freshwater wetlands and damage to infrastructure
- -ve effect on mining industry due to water management problems & damage to infrastructure
- human health issues

## Example: The ARR

### *Outcomes:*

#### *Monitoring requirements*

- *Physical characteristics* - climate, tides, hydrology, hydrography, physico-chemistry, coastal morphology
- *Wetland communities* - mangrove vegetation structure & production, macro-fauna diversity/density, microtopography, sedimentation, habitat extent
- incorporated in a spatial and temporal database

#### *Strategies*

- *Coastal and catchment management plan*
  - community participation
  - integrated solutions
  - increased ability to manage tasks
  - links with regional neighbours

# Summary

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- Climate change is occurring, but its eventual extent & impacts are highly uncertain
- An understanding of potential impacts & their consequences is required
- Appropriate programs need to be put in place to monitor changes due to climate change & other important coastal hazards
- Strategies need to be developed that result in appropriate responses to the dangers imposed by climate change & other coastal hazards
- *Vulnerability Assessment* integrates these processes and assists in achieving appropriate outcomes