

Natural Hazards in Coastal Regions and Systems

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Research issues:

- climate change – sea level rise – extreme events: impacts
- GIS-based Assessment of potential risks and vulnerability
- Development of risk assessment methods at different spatial scales: macro- , meso- and micro scale
- Perception of Risks in affected areas, Warning mechanisms
- Risk Management: Coastal Defence, Regional & urban planning, risk information; Integrated Coastal Zone Management: ICZM
- IPCC-Study on Germany's coasts, Island of Sylt case study, research projects *MERK*, *COMRISK* and *FLOODSITE*

B5: Coasts at Risk

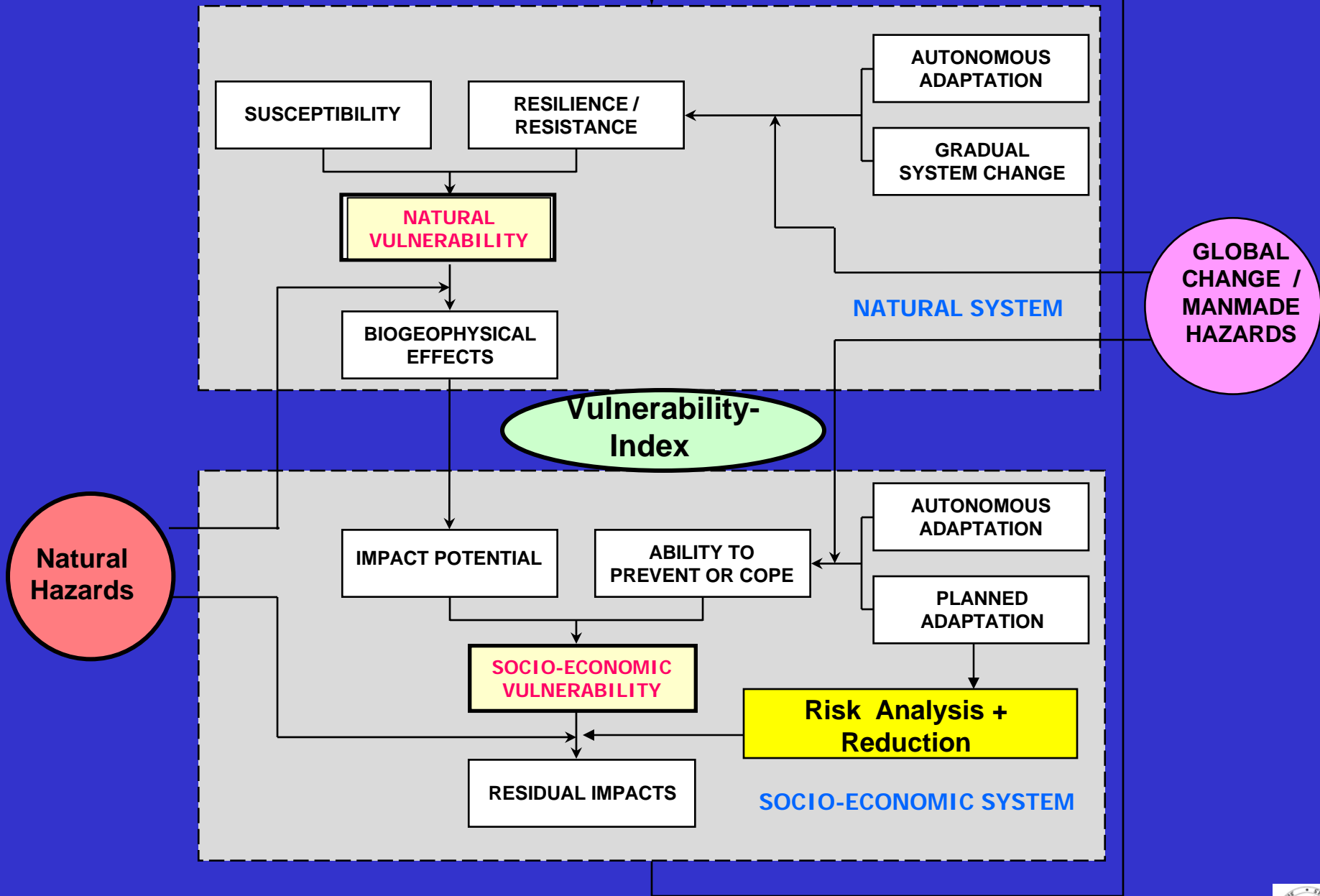
Geo-hazards: Causes of Risks:

- Accelerated Sea Level Rise
- Increase in Storm Floods
- Shoreline Erosion
- Tsunamis
- River Floods
- Soil and Groundwater Pollution a.o.

Coastal Hazards – Risk & Vulnerability Assessment

WHAT IS VULNERABILITY?

- IPCC CZMS, 1992: The degree of *incapability to cope* with the consequences of climate change and sea-level rise.
- IPCC SAR, 1996: The extent to which climate change may damage or harm a system; it depends not only on a system's sensitivity, but also on its *ability to adapt* to new climatic conditions.
- IPCC TAR, 2001: The degree to which a system is susceptible to, or *unable to cope* with, adverse effects of climate change [...]. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its *adaptive capacity*.



Impacts of coastal hazards:

Socio-Economic Damages caused by natural disasters:

- Loss of property and coastal habitats
- Loss of life; physical & mental health risks
- Loss of jobs, of subsistence resources
- Loss of tourism, recreation and transportation functions
- Loss in food production (agriculture/aquaculture)
- Loss of non-monetary / cultural resources

Vulnerability

B 5 (2): Coasts at Risk:

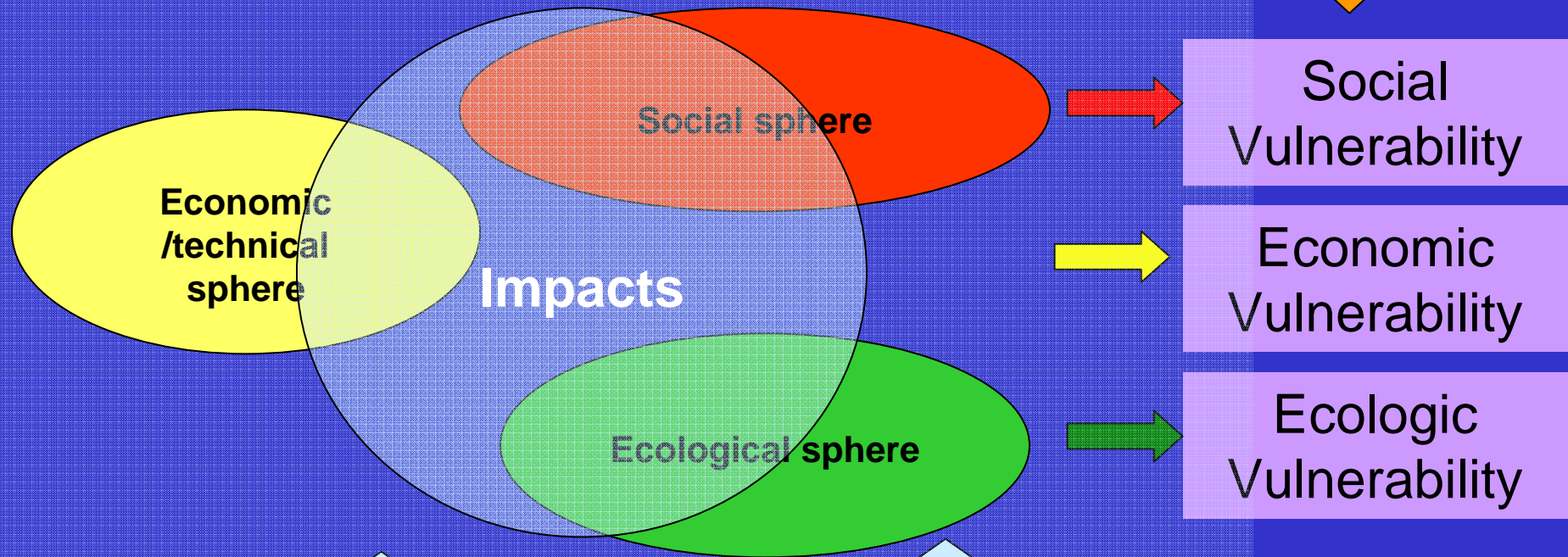
Risk assessment

Risk Modelling

Risk Management

geogene hazards (sea level rise, floods, tsunamis)
→ **physiographic + hydrologic Impacts**

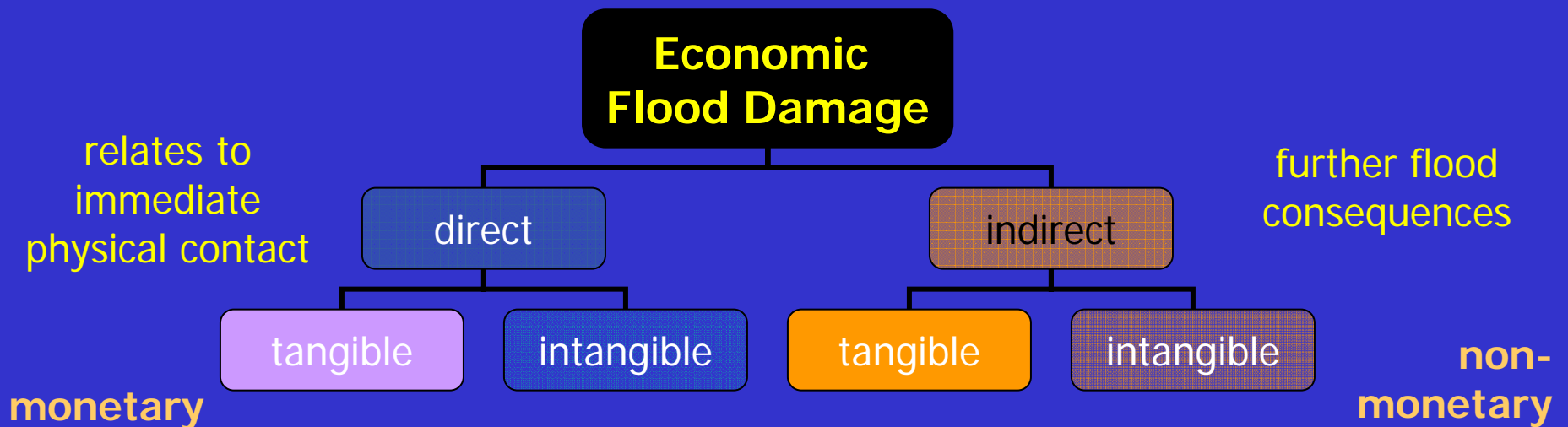
coastal system



Resilience:

- Assessment of risk mitigating factors
- ability of adaptation in coastal communities

Vulnerability and economic flood hazards



- e.g.:
- | | | | |
|--------------------|----------------|-----------------------|----------------------------|
| - buildings | - life | - production losses | - reduced competitiveness |
| - infrastructure | - health | - market disturbances | - migration |
| - crops, livestock | - environment | - loss of time | - increased susceptibility |
| - capital goods | - unique goods | - ... | - ... |
| - consumer goods | - art | | |
| - ... | - ... | | |

Indicators for Vulnerability and Resilience

Social vulnerability variables	Economic vulnerability variables	Ecological vulnerability variables	Resilience variables
<ul style="list-style-type: none"> - Age - Gender - Families with young children - Ethnicity - Disability - Pre-existing health problems - Education - Type of property - Population at risk - ... 	<ul style="list-style-type: none"> - Economic exposure index, based on trade openness - Export concentration index - diversification index - Peripherality - ... 	<ul style="list-style-type: none"> - Touristic pressure - Percentage of nature conservation areas - Human population density - ecological diversity (entities at the landscape) - populations and communities of organisms (endemic species) - ... 	

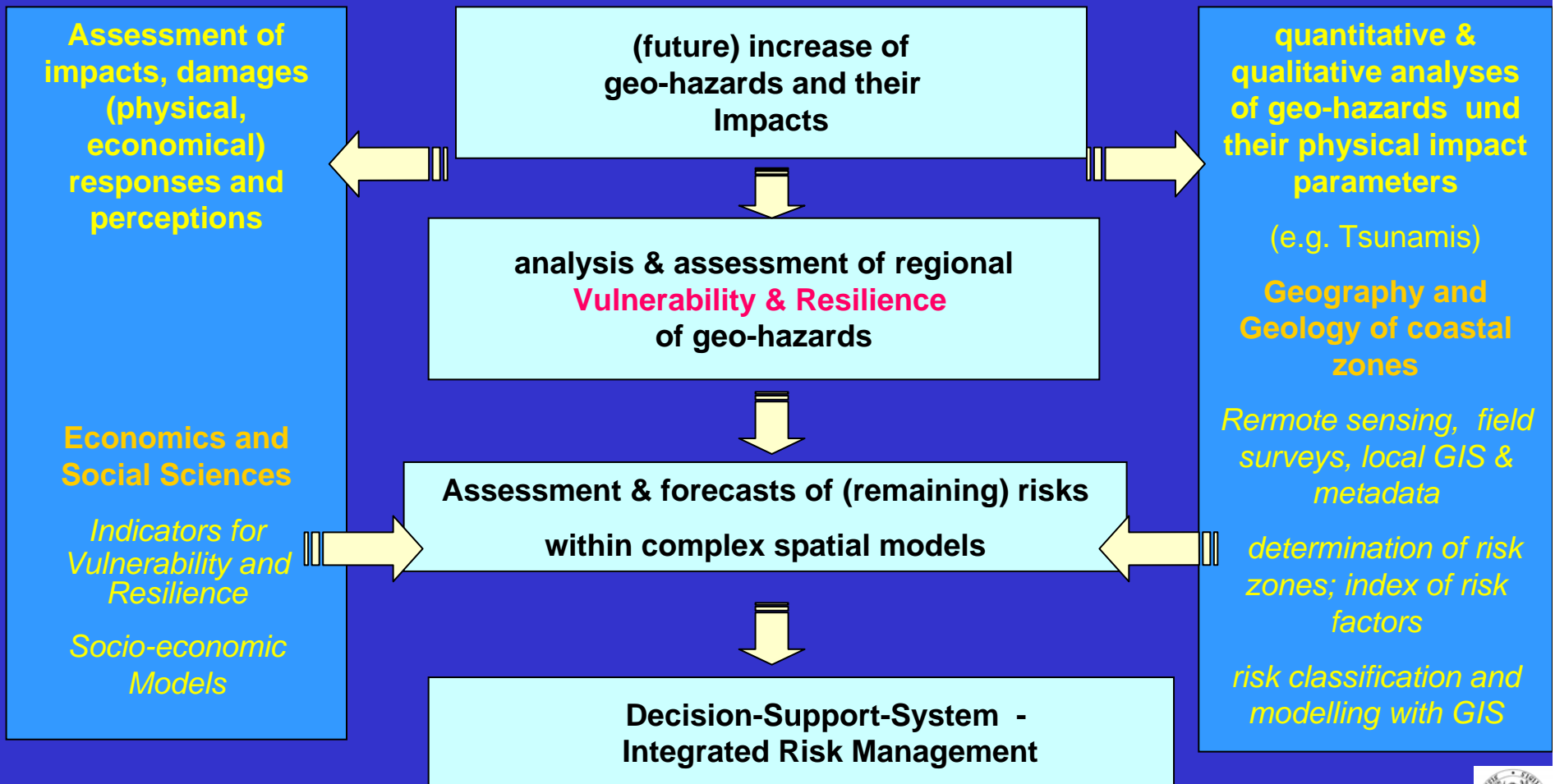
Resilience –

Ability to avoid risks or cope with negative impacts

Social vulnerability variables	Economic vulnerability variables	Ecological vulnerability variables	Resilience variables
			<ul style="list-style-type: none"> ▪ percentage of ecologically intact area ▪ degree of individual social integration ▪ HDI = Human Development Index ▪ Renewable natural capacity (% land unmanaged) ▪ Awareness of flood risk/risk perception ▪ Membership of social networks ▪ Presence of Flood Action Groups ▪ Insurance...

Risk Analysis & Management Model: **RESPONSE**

Reactions of social, political und natural Systems
to extreme events



GIS-based assessment of risk zones & vulnerabilities: Consideration of different spatial scales





III. Risk management

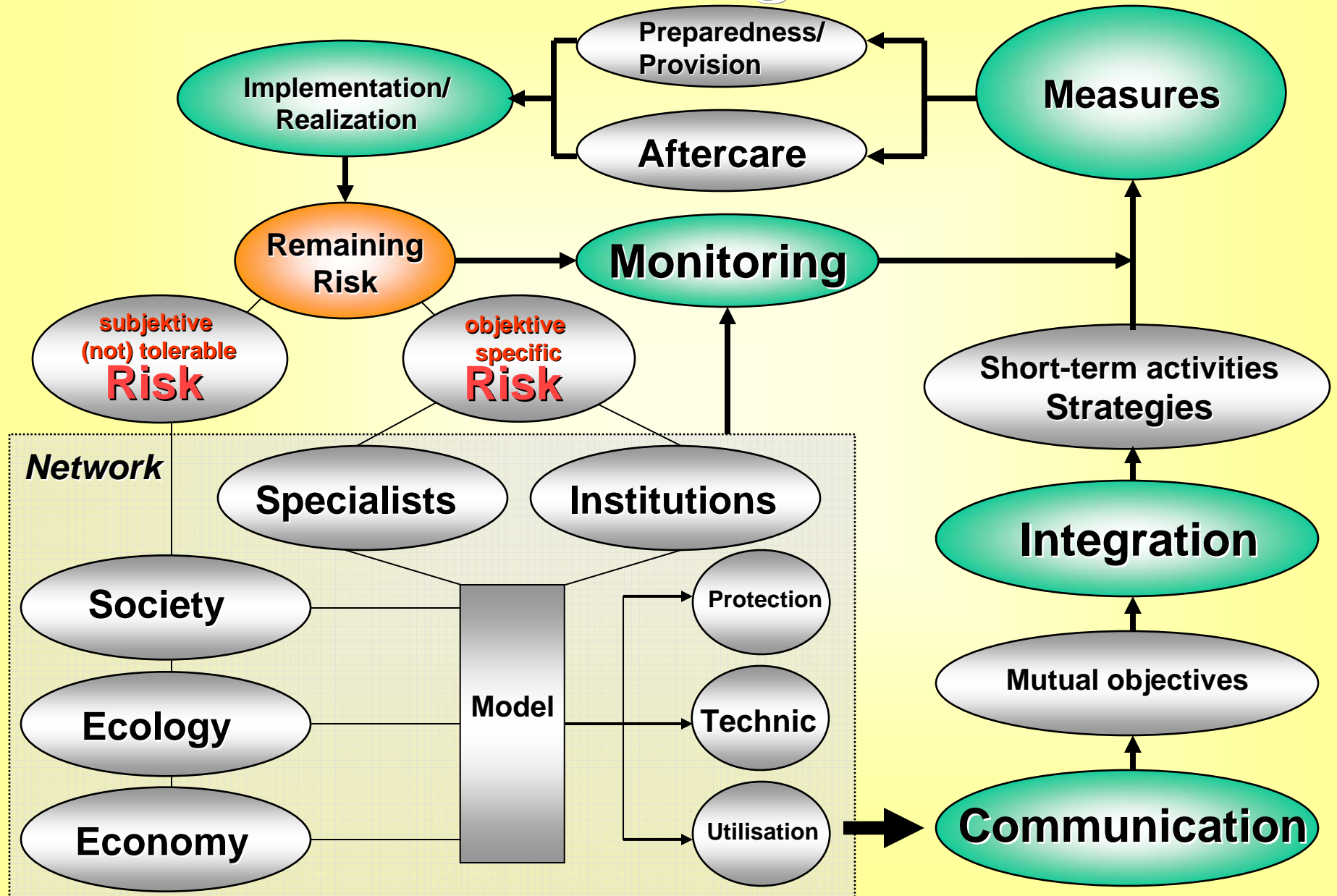


Fig. B5: Sea-Level Rise and Hazards at the Land-Sea Interface

