Geoinformation for Disaster Risk Reduction

Concepts, Applications and International Programs

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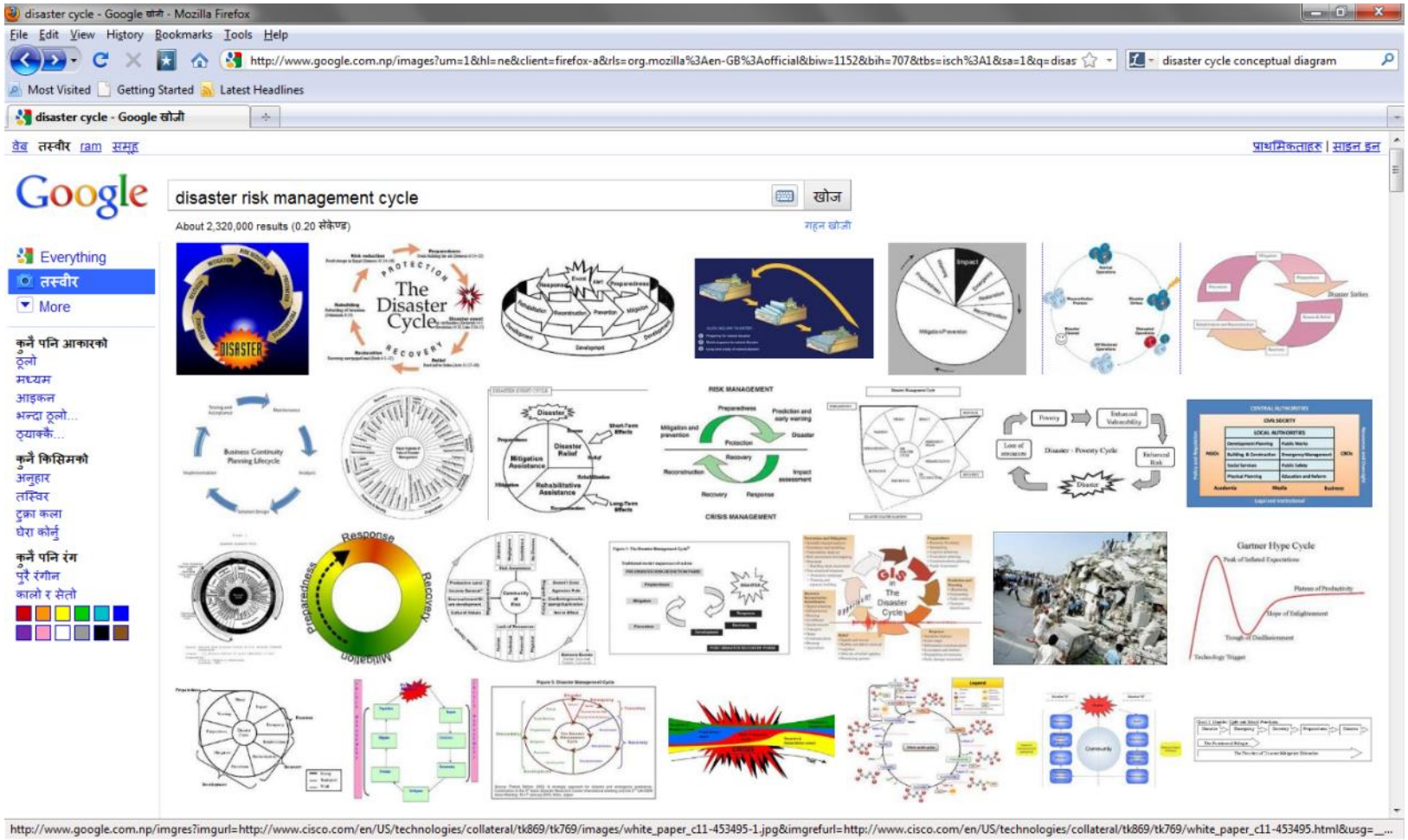
Centre for Geoinformatics – Salzburg University, Austria

Content

- **Disaster Risk Reduction – Definitions and conceptual framework**
- **Application of Geoinformation in DRR**

Disaster Management



FEMA disaster cycle

FEMA, 2005: The life cycle of disasters. www.fema.gov

FEMA disaster cycle

FEMA chart becomes brunt of joke.

[Jon Stewart, Comedy Central's Daily show, Oct 2005]

Commenting on FEMA's controversial response to Katrina, Jon Stewart said,
"What should FEMA have done?
Perhaps the answer can be found on their website…"

"This chart, clearly depicting the agencies responsibilities in the event of a disaster…

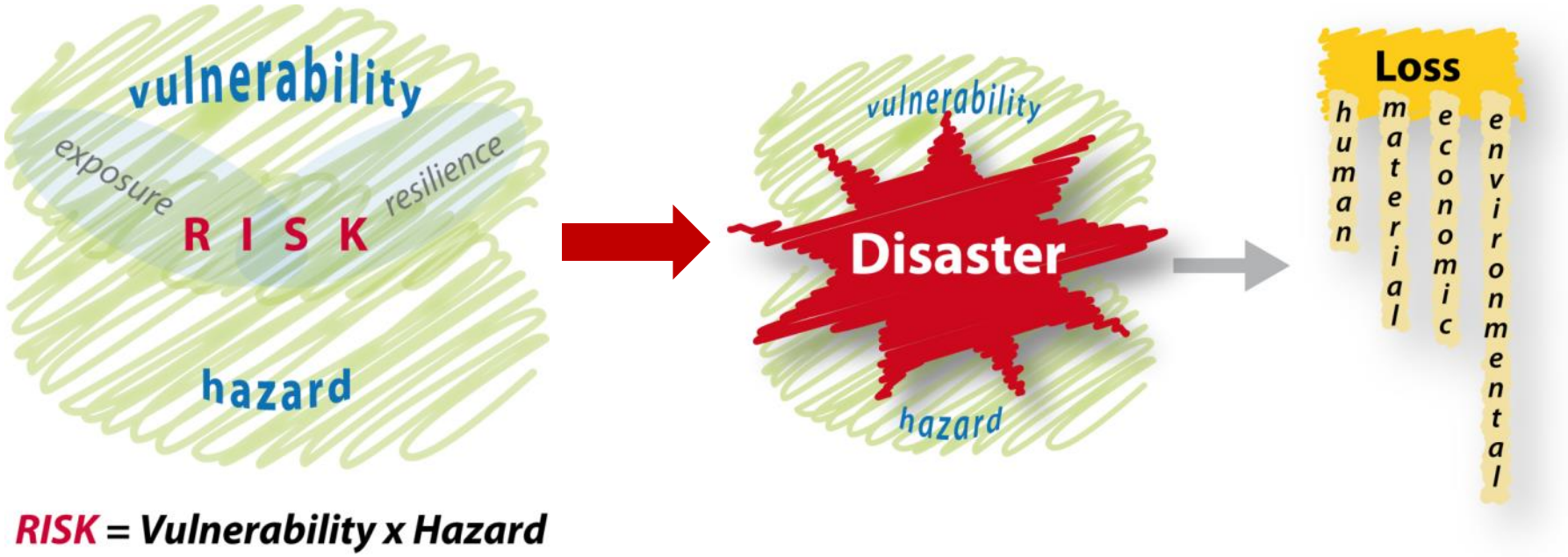
It begins with a response to a disaster, leads to recovery, mitigation, risk reduction, prevention, preparedness…
(dramatic pause)

and ends up BACK IN DISASTER!"

"In truth, FEMA did exactly what they said they were going to do."

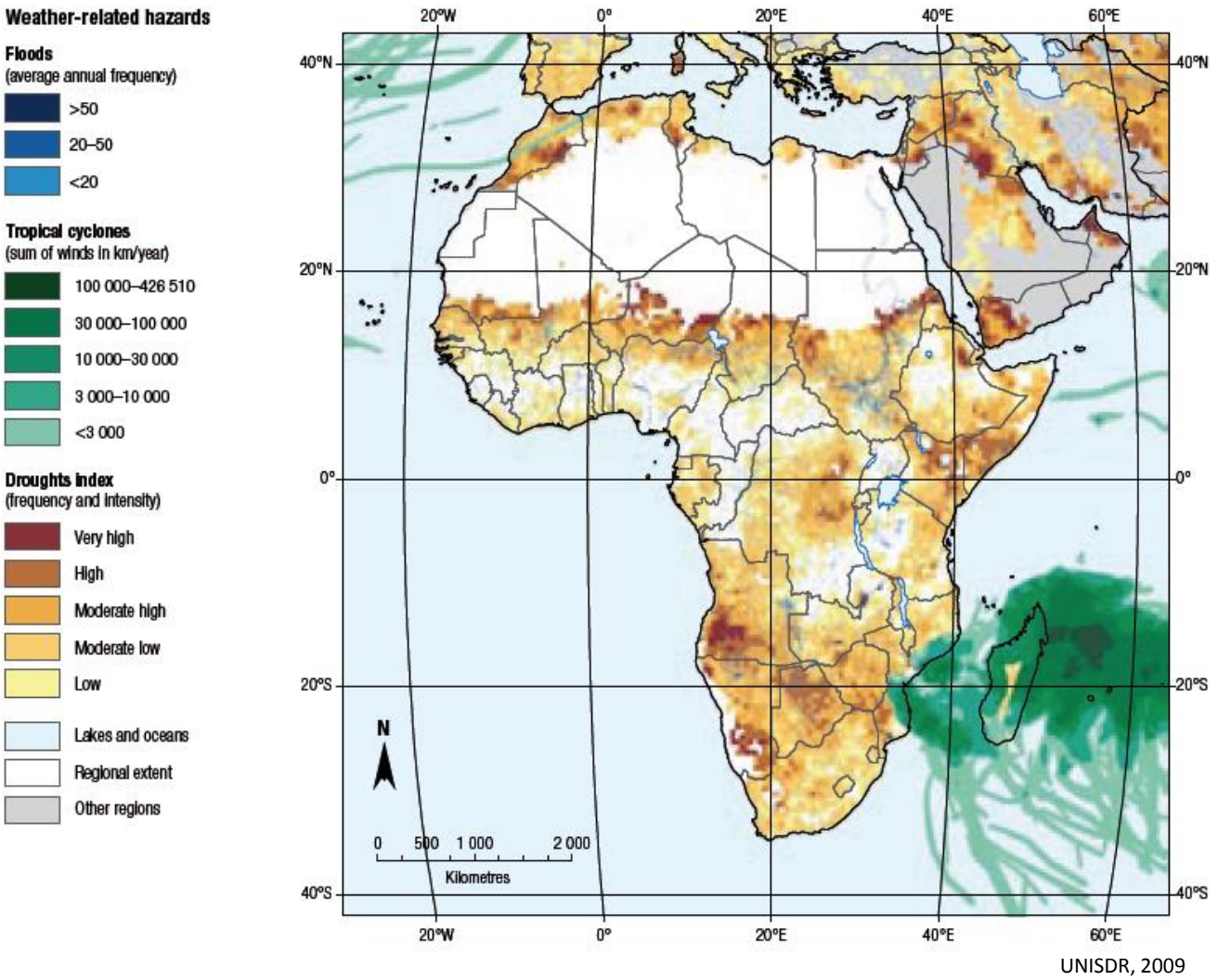

Risk
Reduction
Recovery
Emergency Response
Prepardeness
Mitigation

Risk - Vulnerability - Hazard



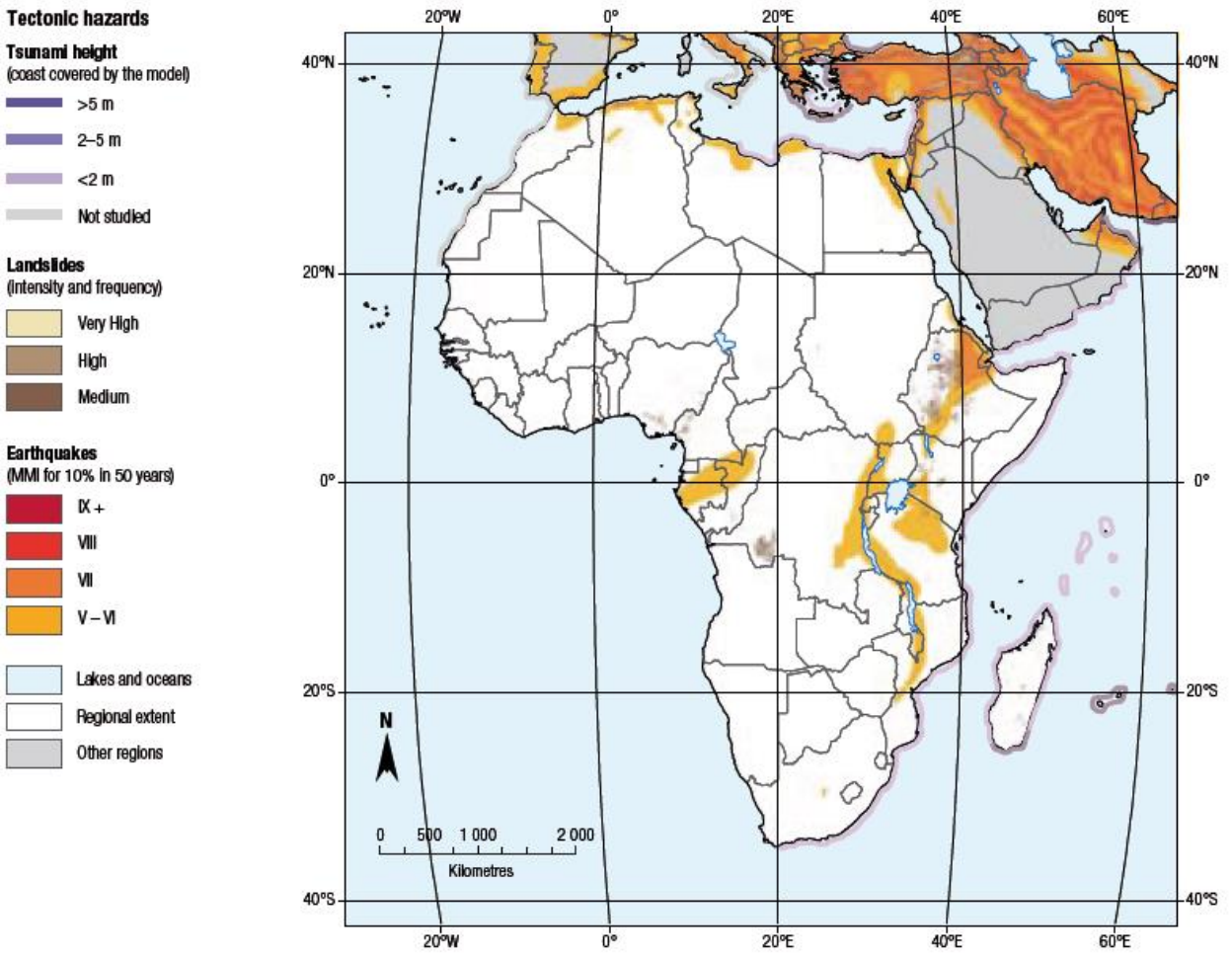
Kienberger, 2010

Hazard



UNISDR, 2009

Hazard



UNISDR, 2009

Hazard

- **Hazards can be the result of the physical impacts on natural environment of climate extremes –such as warming, deficit or heavy precipitation, heat waves– or hazards are the extreme events themselves –such as intense tropical storms.**
- **When the intensity or recurrence of hazard events is related to processes of environmental degradation and human intervention in natural ecosystems the origin of hazard can be considered as socio-natural**
- **A hazard is a threat not the actual event. Any hazard can manifest itself in an actual harmful event.**
- **If it can be measured in real damage or harm it is no longer a hazard but has become an event, disaster or catastrophe.**

Vulnerability

- **Specific interest and dynamic in the recent years**
- **Different concepts and perceptions**
  - Vulnerability, Resilience, Adaptive Capacity, Sensitivity, Susceptbility
- **Strong interdisciplinary focus**
  - Natural and Social Siences
- **Different disciplines involved**
  - From Ethnology to Engineers
  - „Climate Change vs Hazard Community“

Consolidated Risk Framework

- **Establishing a framework which links to**
  - Disaster Risk Reduction
  - Climate Change Adaptation

- **Outcome** [draft version] **of EC FP7 research project**

MOVE
Methods for the Improvement of Vulnerability Assessment in Europe

SEVENTH FRAMEWORK PROGRAMME

www.move-fp7.eu

Vulnerability

- Vulnerability reflects the **susceptibility** or the **intrinsic predisposition** to being affected or **the conditions that favour or facilitate damage**

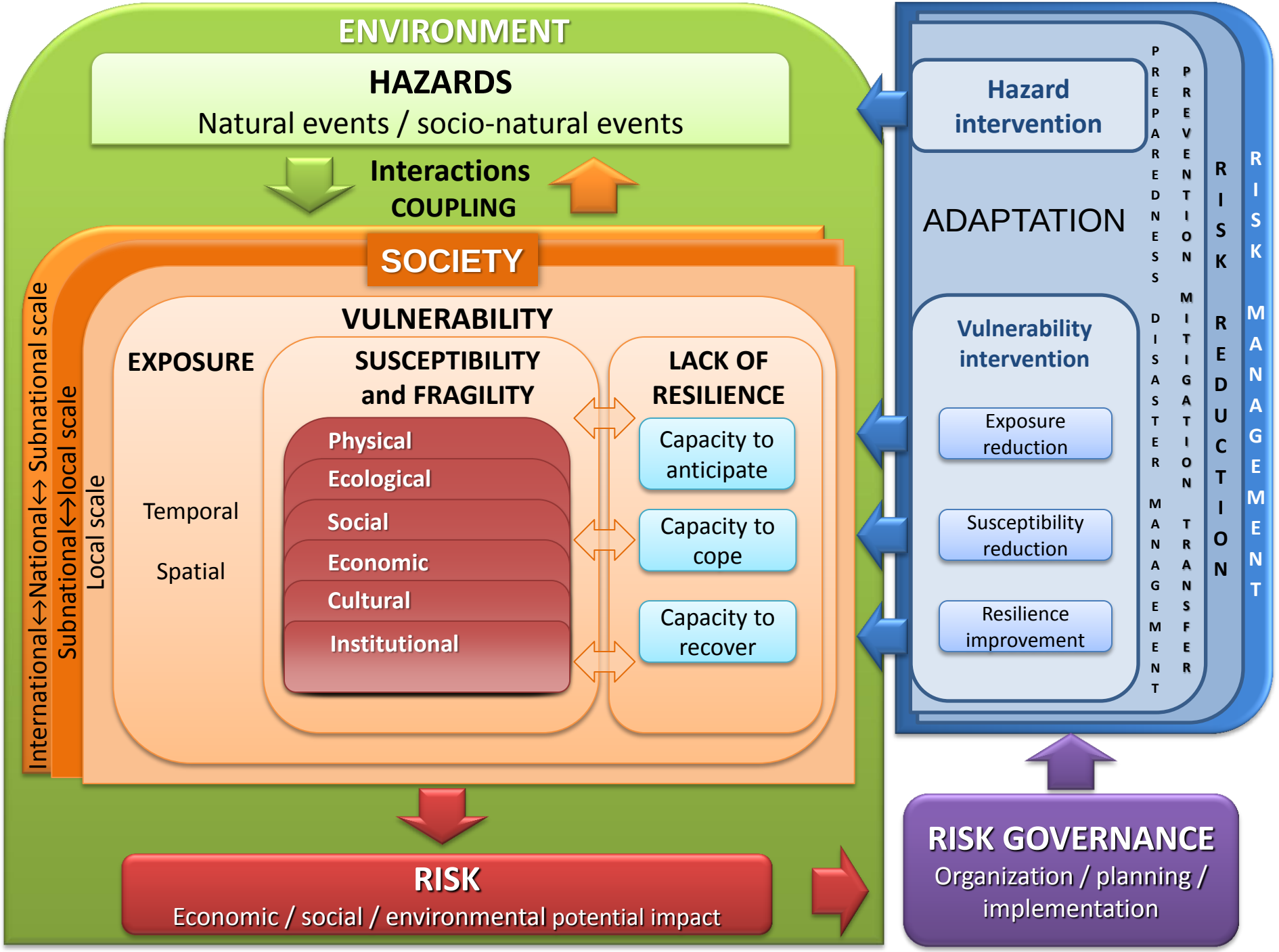
- Vulnerability is the **result of different social and environmental processes** and the characteristics and conditions they give rise to. It is a condition that exists with **reference to a concrete hazard** context and is, therefore "determined", delimited or contextualised with reference to defined and delimited physical events.

- Vulnerability is the "**state of reality**" that **underlies the concept of *risk***

Why to conduct a vulnerability assessment?

- **As decison and planning support**
  - *"Vulnerability assessments **are action (policy) oriented** with the **overall objective** to **mitigate/avoid** the **negative impacts of hazards**"*
  - Reduction of **RISK**

- **Complex, integrated analyses & monitoring**
  - *"Vulnerability is currently **measured indirectly** and is described through **specific indicators** which allow to represent and **monitor the different dimensions of vulnerability**"*


ENVIRONMENT
HAZARDS
Natural events / socio-natural events
Interactions
COUPLING
SOCIETY
International↔National↔ Subnational scale
Subnational↔local scale
Local scale
VULNERABILITY
EXPOSURE
Temporal
Spatial
SUSCEPTIBILITY and FRAGILITY
Physical
Ecological
Social
Economic
Cultural
Institutional
LACK OF RESILIENCE
Capacity to anticipate
Capacity to cope
Capacity to recover
RISK
Economic / social / environmental potential impact
Hazard intervention
ADAPTATION
Vulnerability intervention
Exposure reduction
Susceptibility reduction
Resilience improvement
PREPAREDNESS
DISASTER MANAGEMENT
PREVENTION
MITIGATION
TRANSFER
RISK REDUCTION
RISK MANAGEMENT
RISK GOVERNANCE
Organization / planning / implementation

ENVIRONMENT

HAZARDS

Hazard intervention

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Vulnerability intervention

Exposure reduction

PREPAREDNESS DISASTER

PREVENTION MITIGATION

RISK REDUCTION

RISK MANAGEMENT

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International↔National↔Subnational scale

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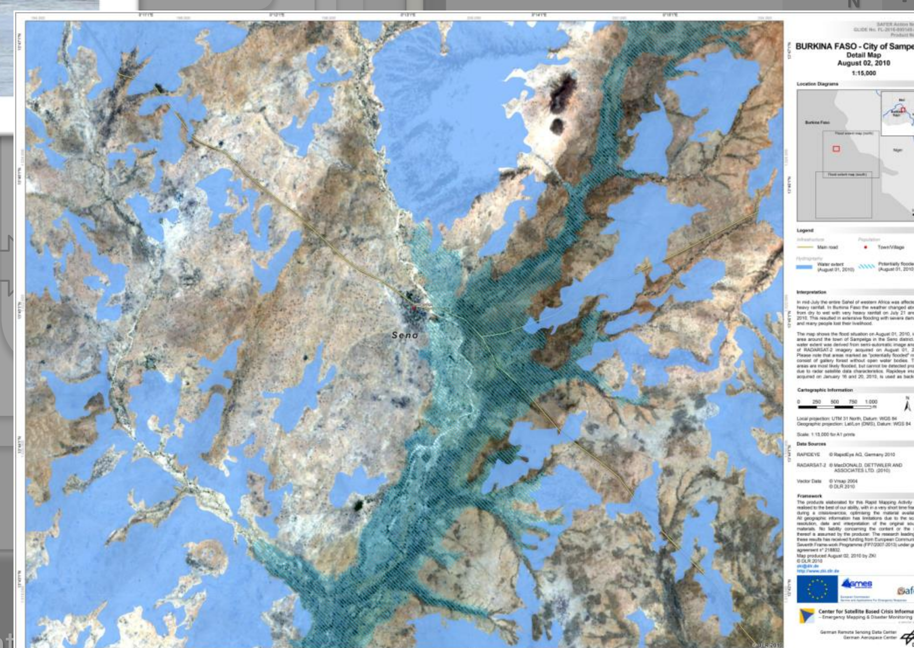
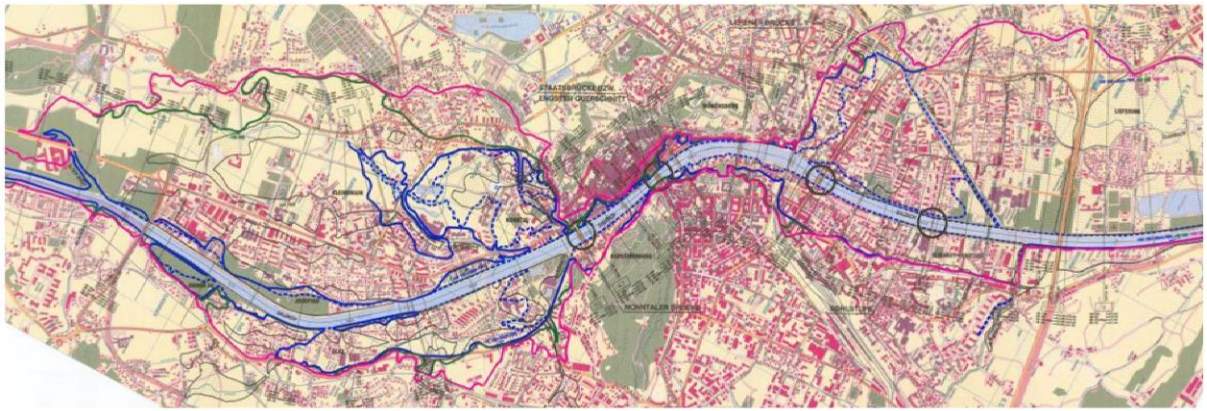
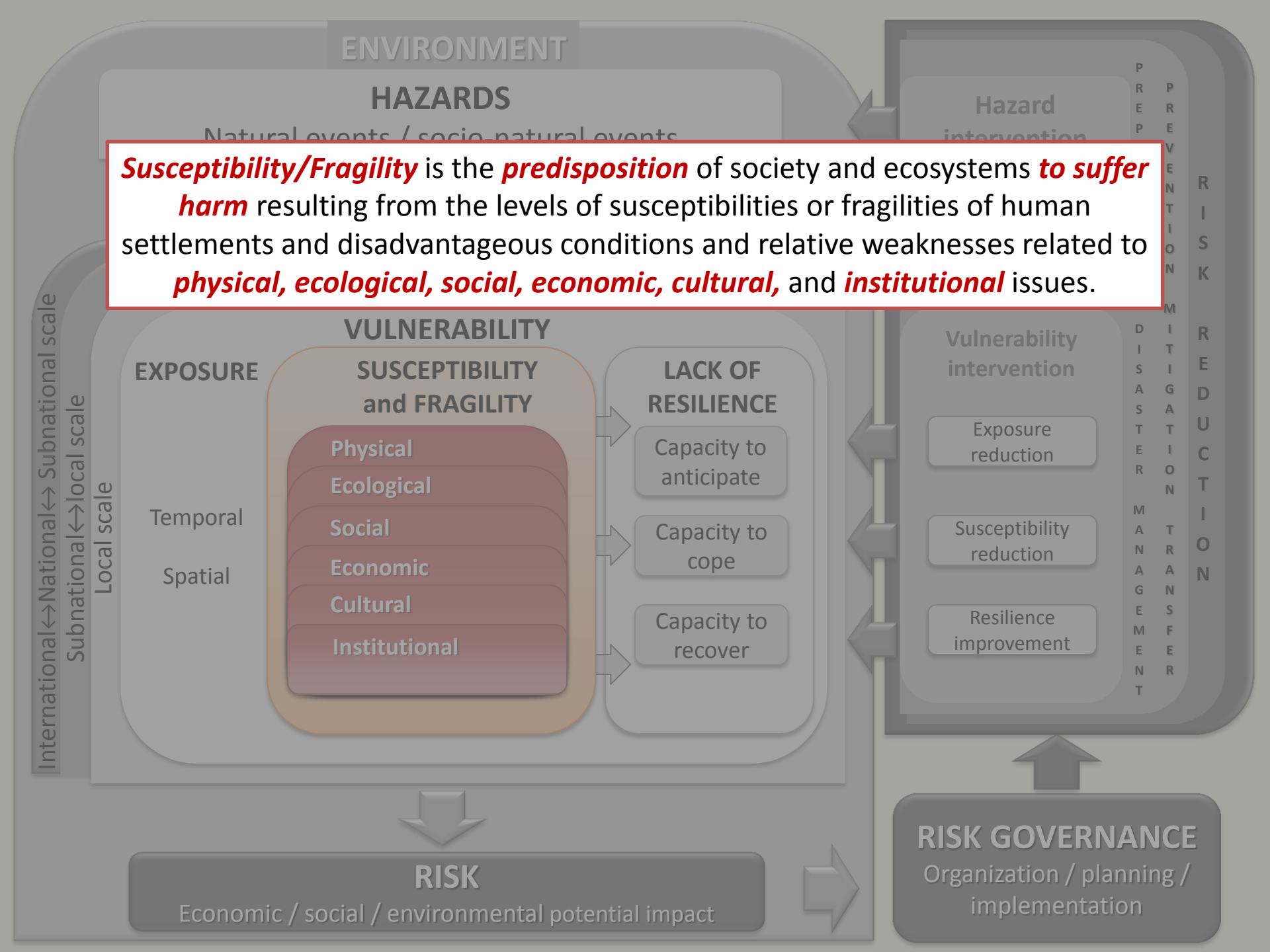


RISK

Economic / social / environmental potent...



The ***exposure*** is the social and material context represented by **persons, resources, infrastructure, production, goods, services and ecosystems** that may be **affected** by a **hazard event**. It is the inventory of components of *society* and *environment* that are exposed to the hazard from **spatial and temporal point of view**.


ENVIRONMENT
HAZARDS
Natural events / socio-natural events
Susceptibility/Fragility is the predisposition of society and ecosystems to suffer harm resulting from the levels of susceptibilities or fragilities of human settlements and disadvantageous conditions and relative weaknesses related to physical, ecological, social, economic, cultural, and institutional issues.
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MITIGATION
TRANSFER
RISK REDUCTION
RISK
Economic / social / environmental potential impact
RISK GOVERNANCE
Organization / planning / implementation

Physical Dimension

ENVIRONMENT

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interactions

Hazard intervention

ADAPTATION

PREPAREDNESS DISASTER MA

PREVENTION MITIGATION T

RISK REDUCTION

Vulnerability intervention

Exposure reduction

LACK OF RESILIENCE

Capacity to anticipate

International↔National↔ Subnational scale

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Ecological Dimension

Social Dimension

ENVIRONMENT

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Hazard intervention

ADAPTATION

Vulnerability intervention

LACK OF RESILIENCE

PREPAREDNESS DISASTER MANAGEMENT

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RISK REDUCTION

International↔National↔ Subnational scale

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Economic Dimension

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Hazard intervention

COUPLING

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improvement

RISK

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RISK GOVERNANCE

Organization / planning / implementation

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Interactions

Hazard intervention

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RISK

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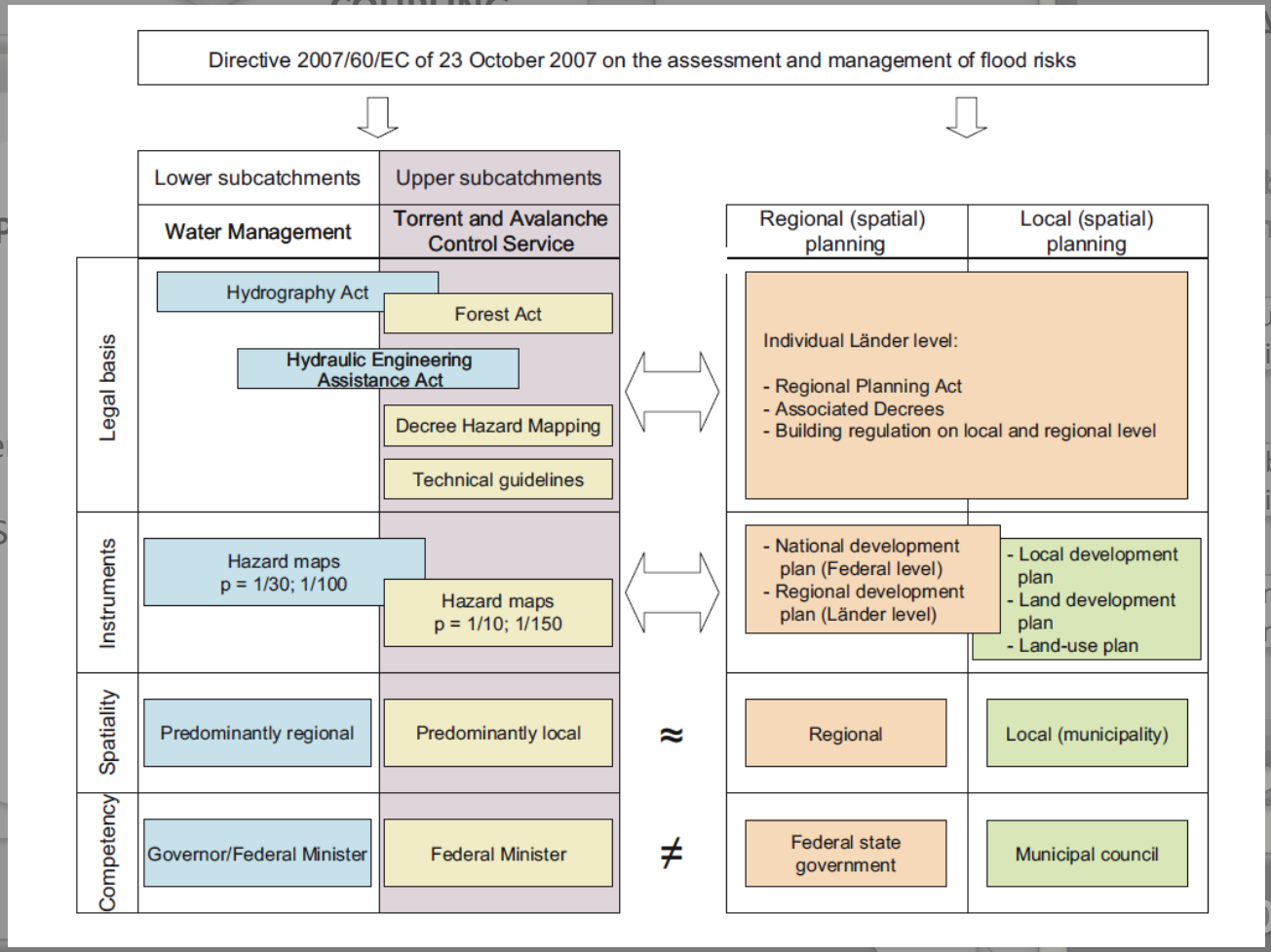
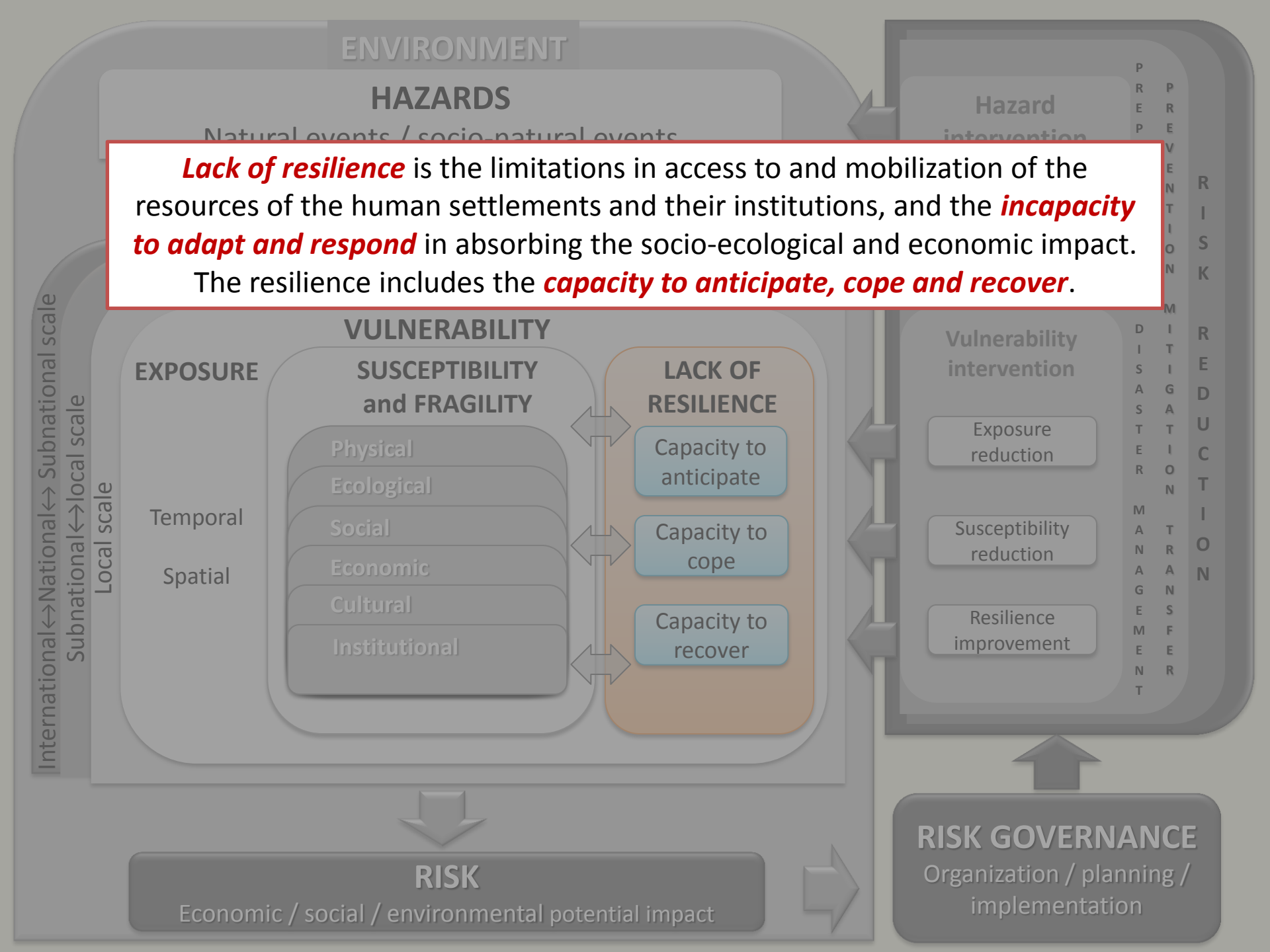
Institutional Dimension




ENVIRONMENT
HAZARDS
Natural events / socio-natural events
Lack of resilience is the limitations in access to and mobilization of the resources of the human settlements and their institutions, and the incapacity to adapt and respond in absorbing the socio-ecological and economic impact. The resilience includes the capacity to anticipate, cope and recover.
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Economic / social / environmental potential impact

implementation

Capacity to recover

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Spatial

Local scale

Subnational↔local scale

International↔National↔ Subnational scale

RISK

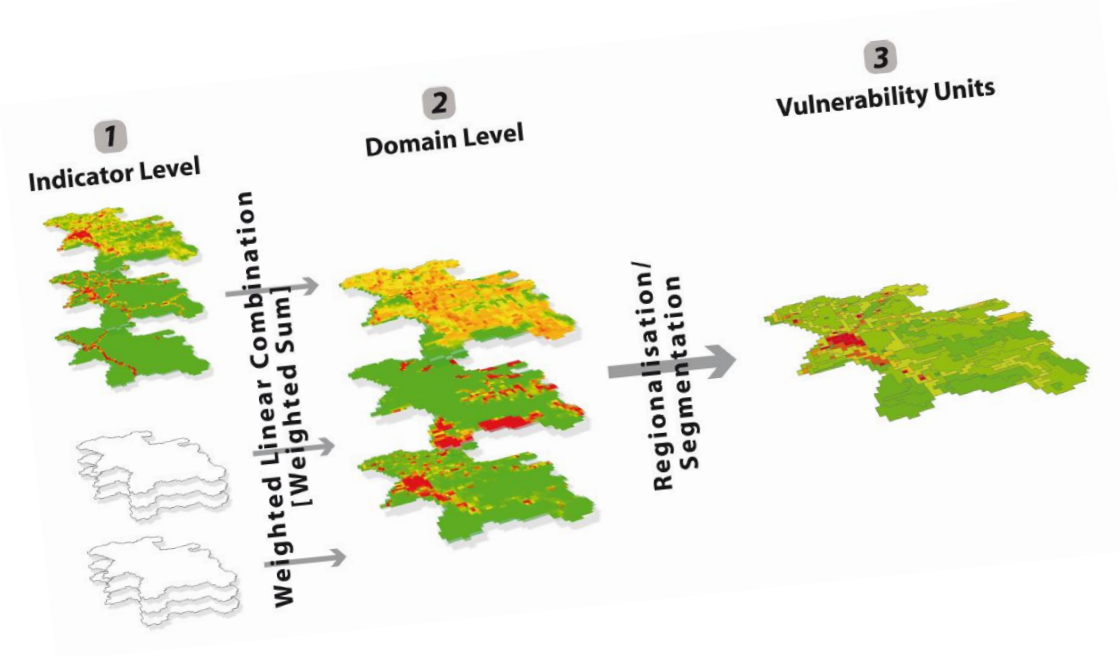
Economic / social / environmental potential impact

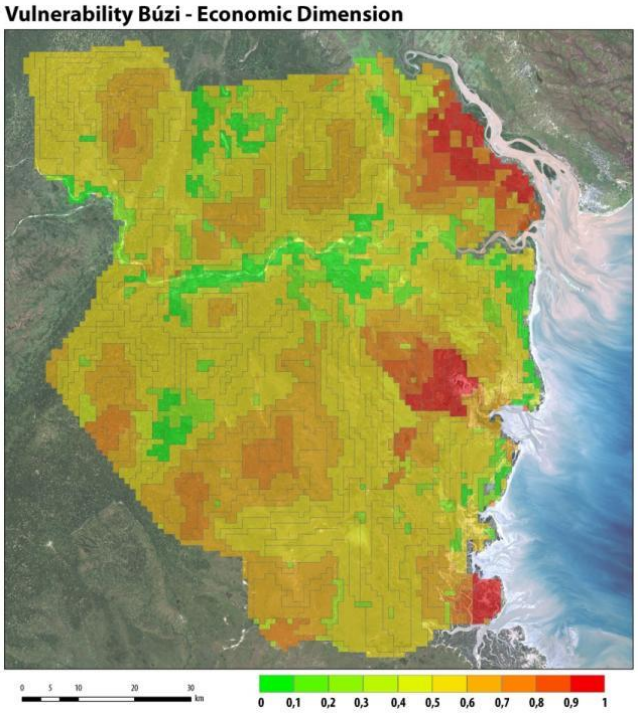
ERNANCE

/ planning /
implementation

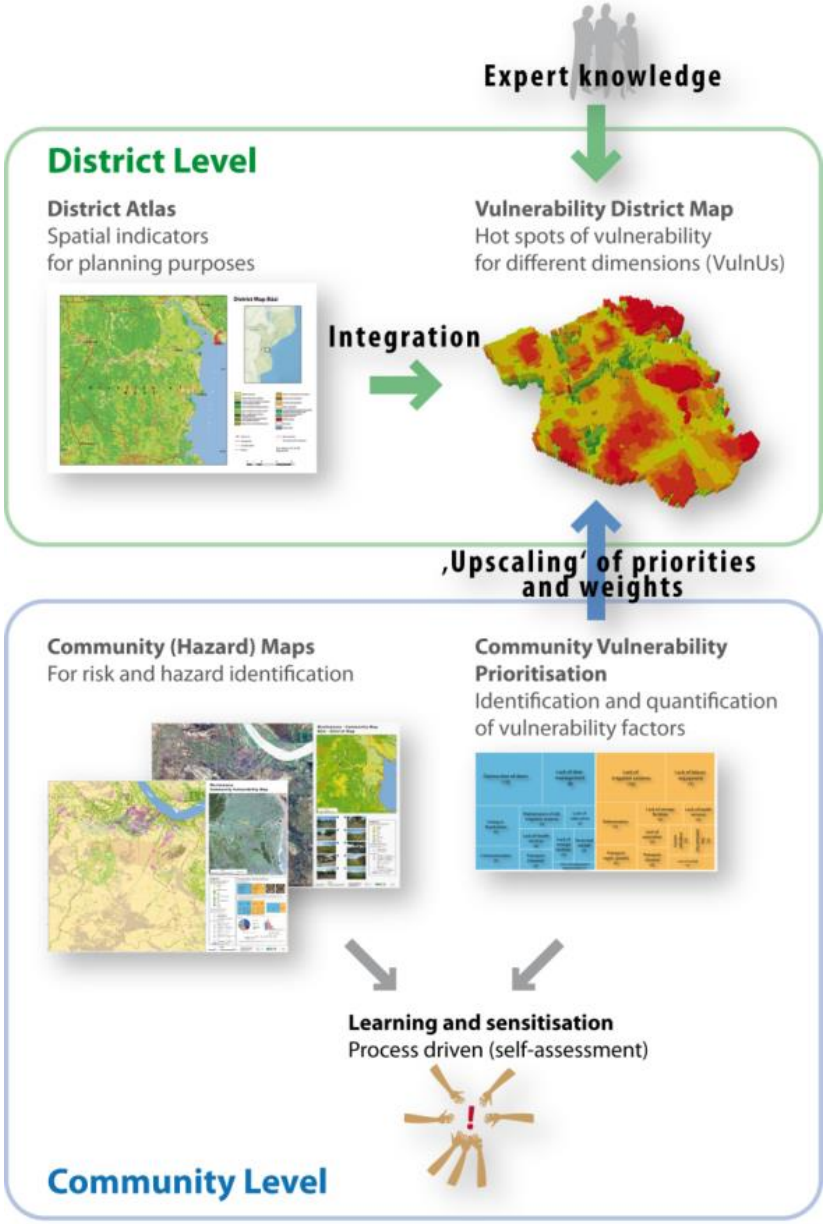
GI in Vulnerability Reduction

- **e.g. modelling of indicators**
  - Integration of data from Earth Observation, census data, and spatial databases



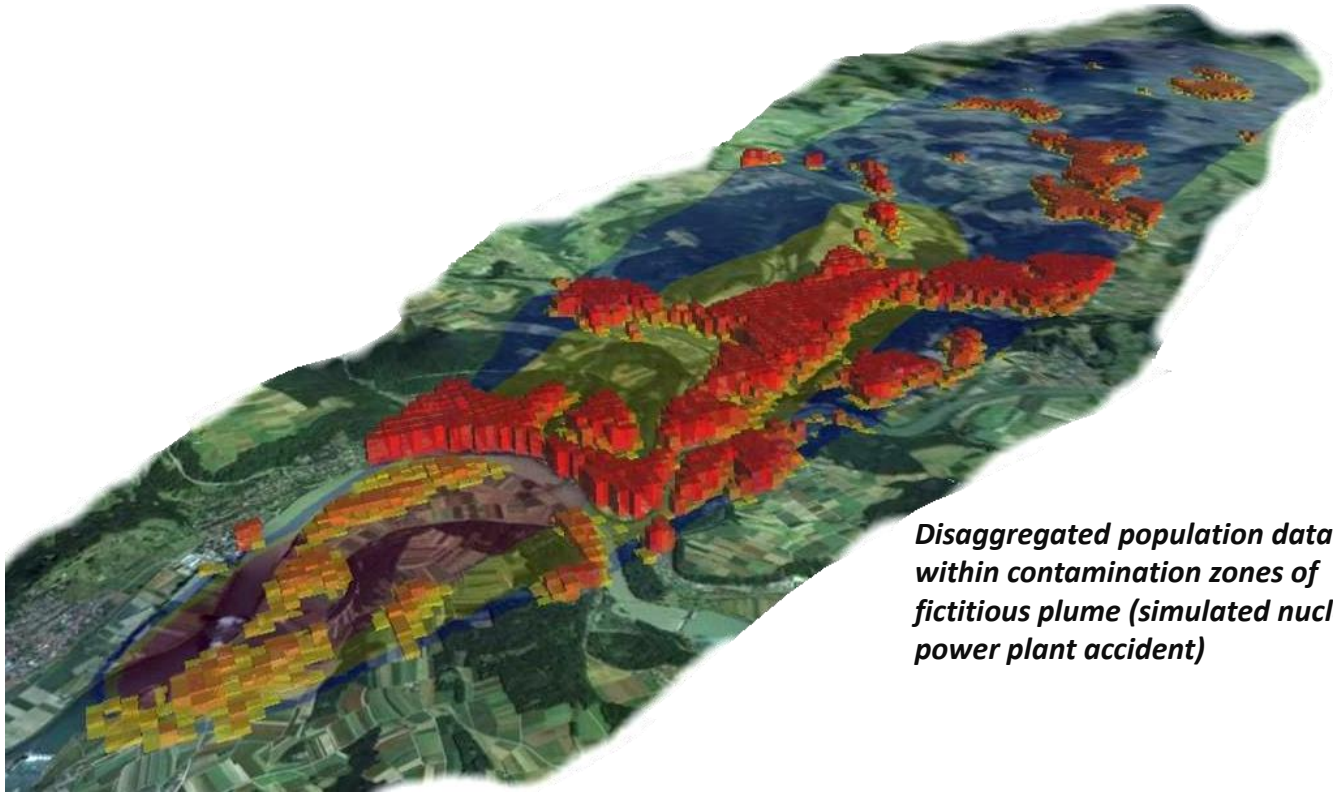


Integrate different perceptions



Kienberger, 2010

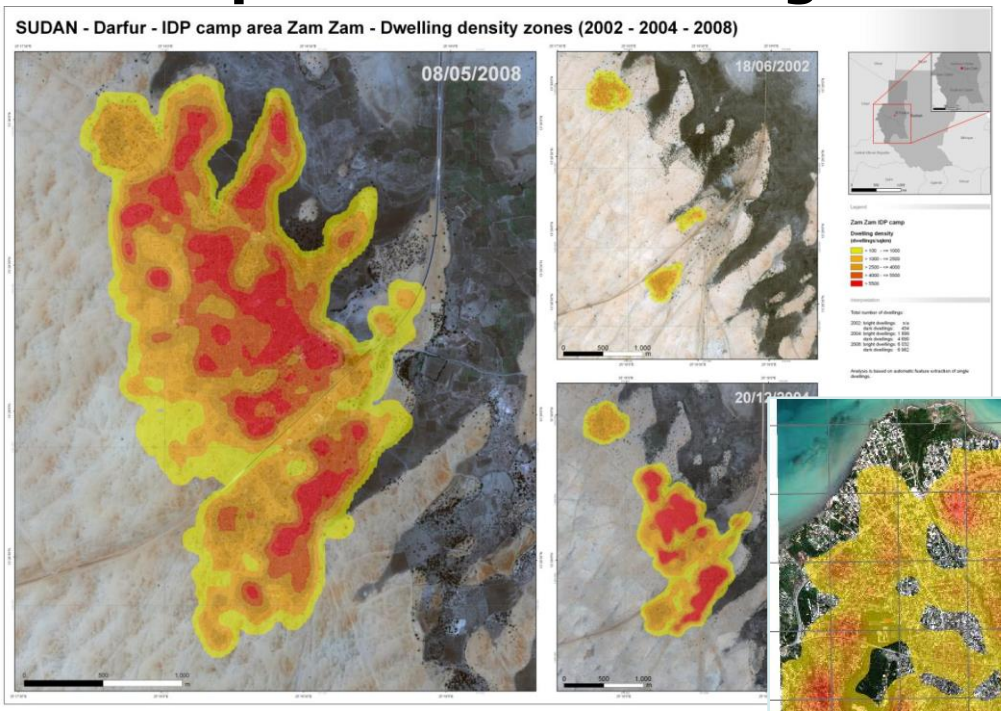
GI in Exposure Reduction



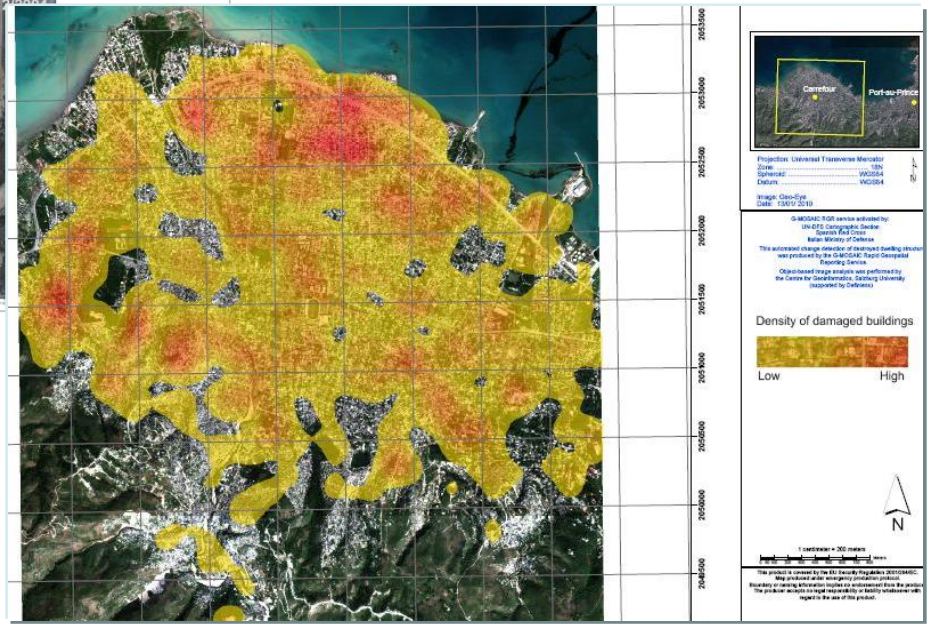
Disaggregated population data within contamination zones of fictitious plume (simulated nuclear power plant accident)

GI in Resilience Improvement

Population Monitoring

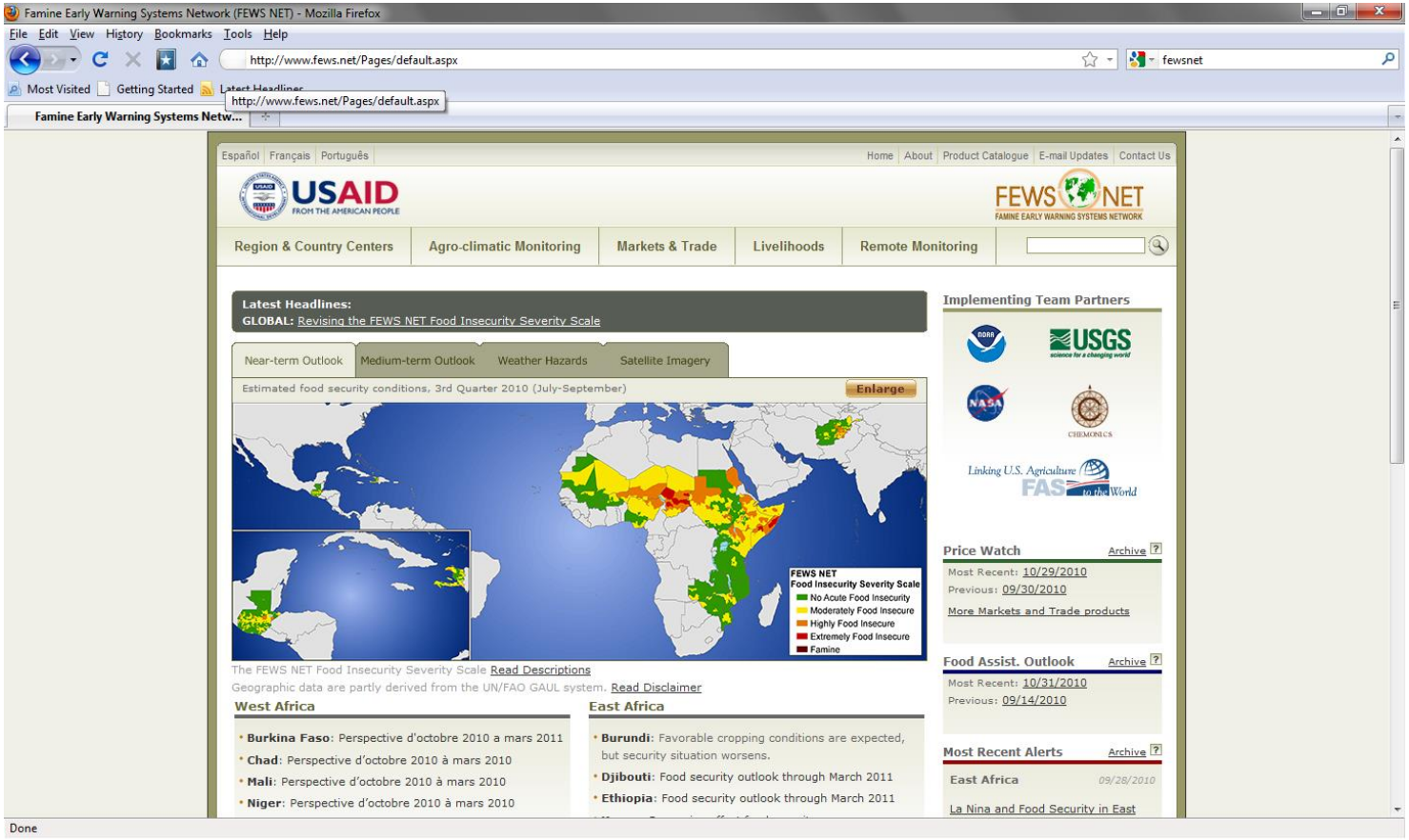


Rapid Mapping



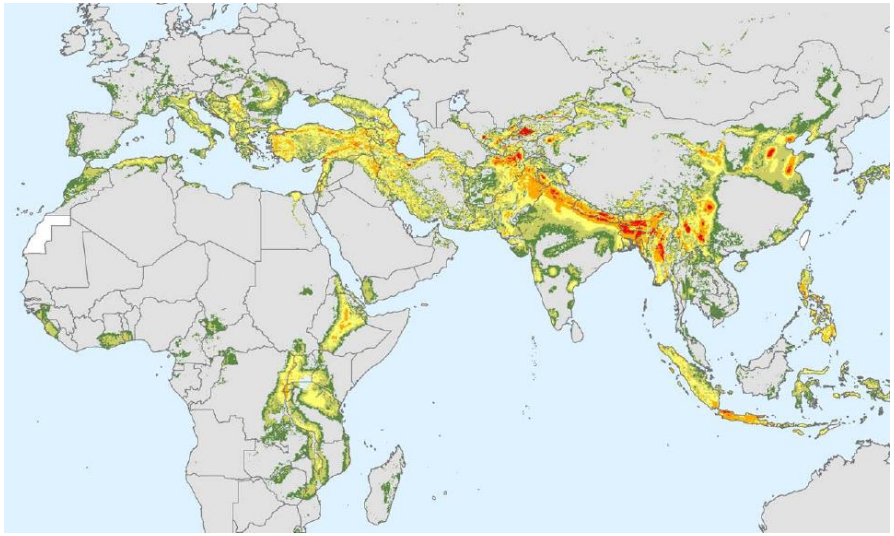
GI in Resilience Improvement

Early Warning



Scale levels

Global Level



Earthquake Risk
(Schneiderbauer 2007)

Different tools needed …acting is local!

to

Local Level