The Ensure integrated project for the vulnerability and resilience assessment

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Something regarding the test areas and ideas about partners contribution

Ensure (Enhancing resilience of communities and territories facing natural and na-tech hazards)

BRGM	Coordination, seismic
UNIGE	Vulcanology
TAU	Drought, data mining
MDX	Floods
PIK	Climate change
ITC	Economic aspects
T6 ECO	Multihazard/multirisk
HUA	Systemic, urban
UNINA	Urban, na-tech
POLIMI	Scientific coordination

Quoting by heart from Vale and Campanella “The resilient city”

We may all be made to survive but it takes intelligence and competence to survive well

WHAT KIND OF PREVENTIVE STRATEGIES CAN BE FORESEEN AS A RESULT OF THE ANALYSIS?

Risk management strategies:

* Adaptation

* Mitigation

- preparare before **the-event**
- decide and face the **crisis**
- return to normalcy and learn from the event in the **event aftermath**

* Damage reduction

* Prevention

- avoid/prevent the **hazard**
- avoid **exposure**

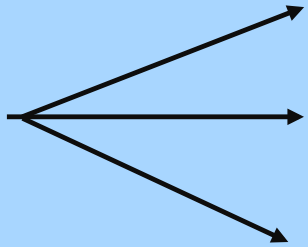
Risk management strategies:

* Adaptation

- Basically you try do adapt, to live with the risk in some mindful way
- It may be considered a sort of “passive” measure, based on knowledge

Risk management strategies:

* **Mitigation**



- preparare before **the-event**
- decide and face the **crisis**
- return to normalcy and learn from the event in the **event aftermath**

- You try to reduce the severity of the event, avoiding enchained effects, reducing the consequences of the impact (the consequences of losses on the built environment and on communities)

Risk management strategies:

* Damage reduction

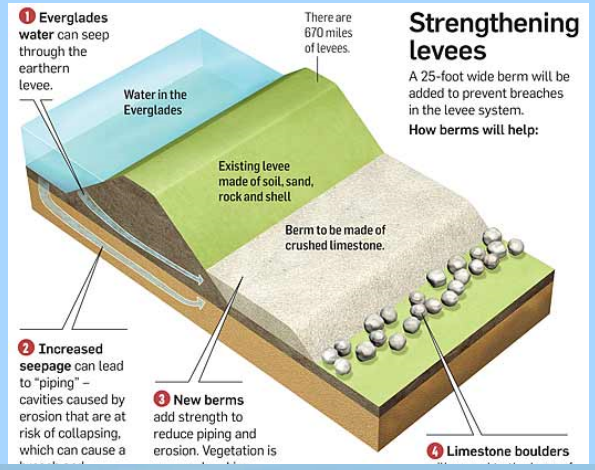
- It requires significant investment to reduce the damage, particularly physical damage to buildings and infrastructures

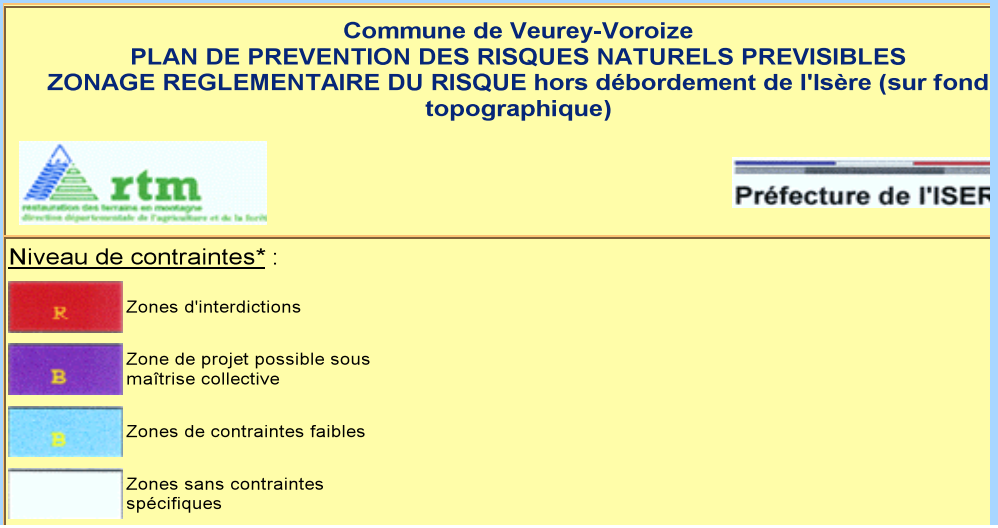
Risk management strategies:

* Prevention

-avoid/prevent the **hazard, not so effective, particularly for extreme events**

- avoid **exposure, land use planning, relocation, generally not so successfull because of political constraints, lack of compliance**





The choice between different risk management solutions (or combination of solutions) depend on various factors, among which:

- Constraints in time

- Constraints in financial resources

- Constraints in human resources

- Competing social demands (with limited resources)

To what extent risk assessment methods are actually good enough to support different risk management solutions and the decision making process to select the most suitable for the area, community at stake?

Which brings us back to the initial question:

WHAT KIND OF PREVENTIVE STRATEGIES CAN BE FORESEEN AS A RESULT OF THE ANALYSIS?

Hazard analysis: what mitigation strategies?

What can I do? Prevent the hazard potential (limited to a number of natural hazards)

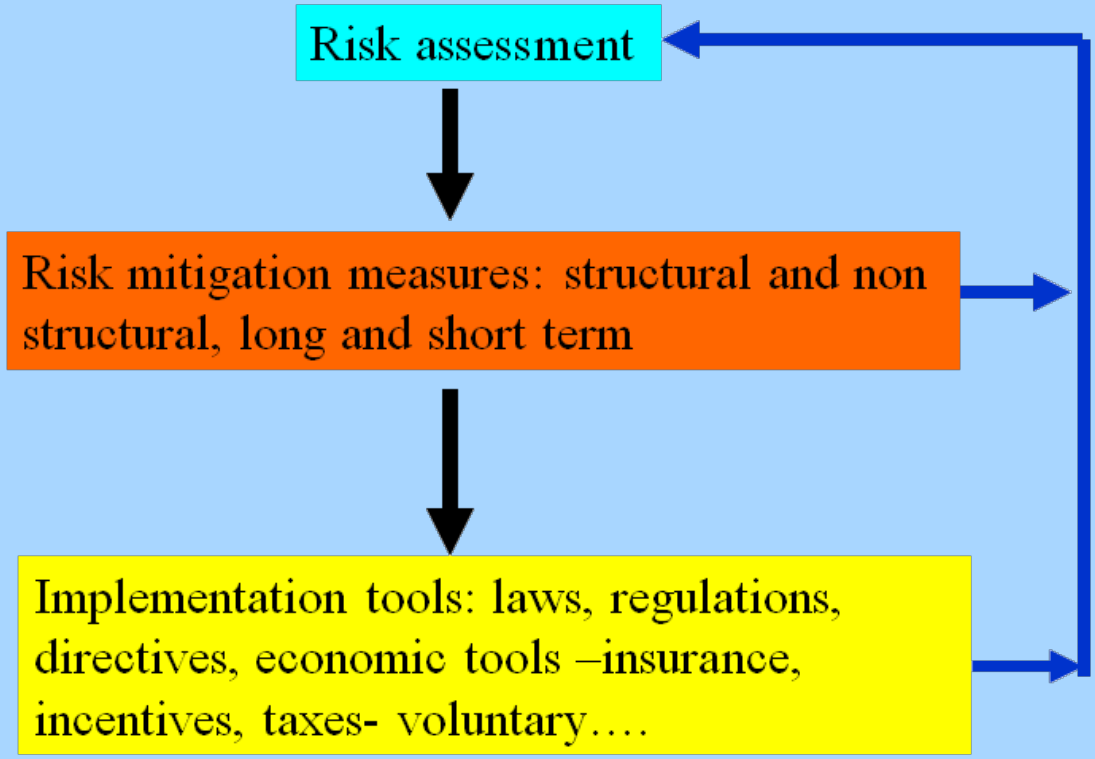
Exposure analysis: what mitigation strategies?

What can I do? Prevent/limit the exposure through land use planning or relocating

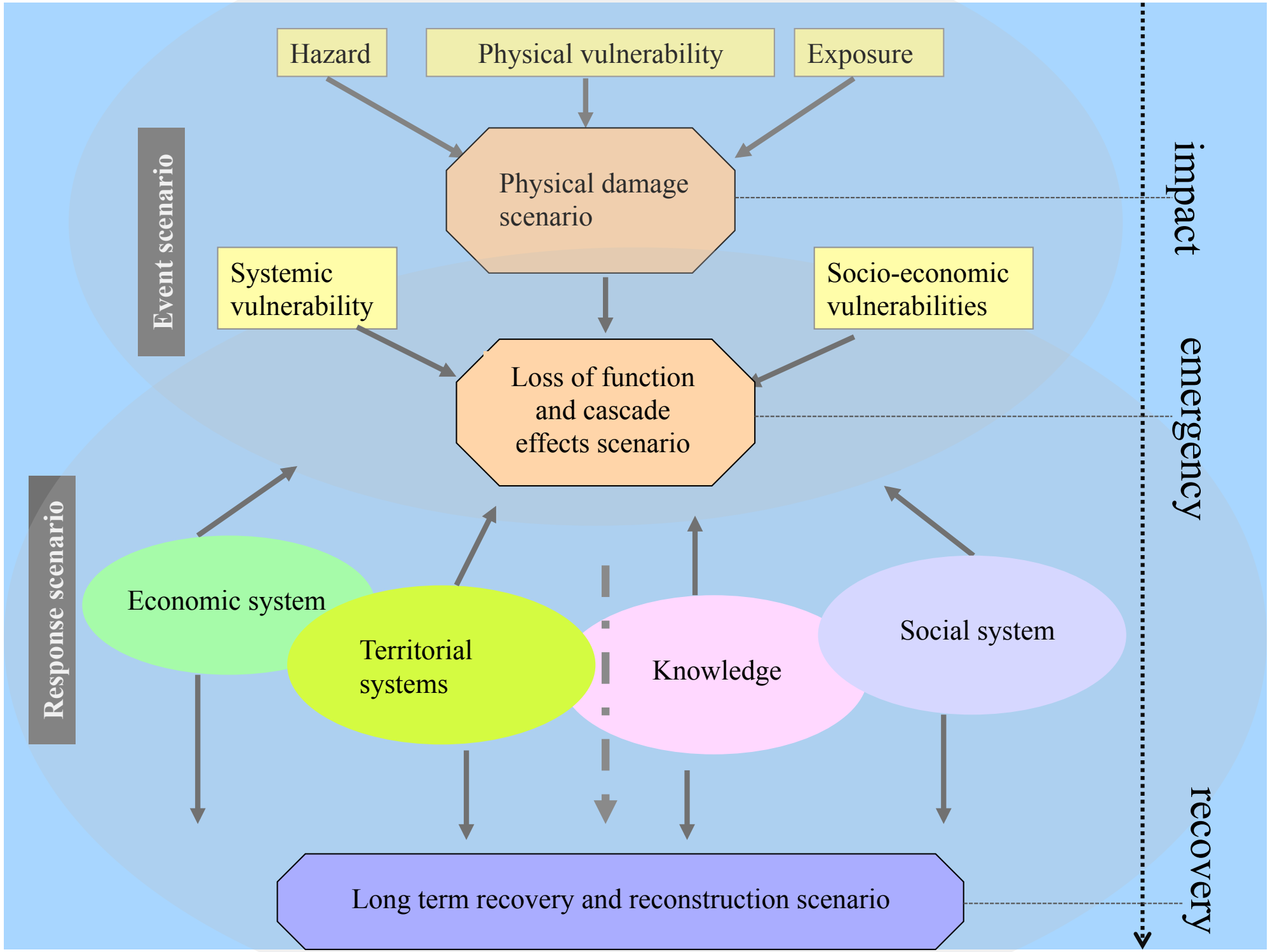
Vulnerability and resilience assessment: what mitigation strategies?

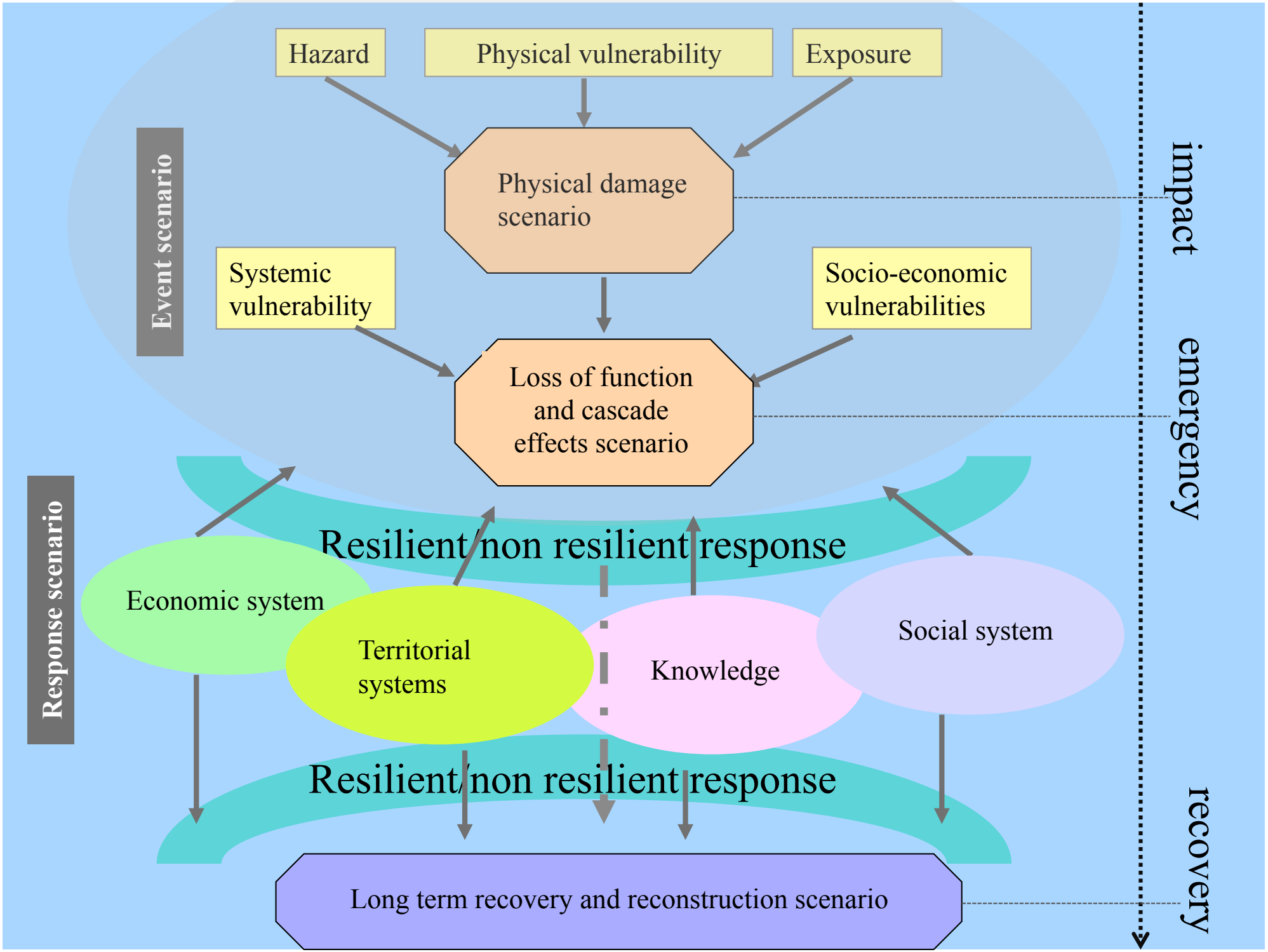
What can I do? Reduce physical vulnerability, mitigate systemic, enhance response capacities

How risk assessment is carried out has a strong and fundamental influence on the type of risk management strategies and prevention measures that can be decided



In the Ensure project the focus has been on vulnerability and resilience assessment


Hazard
Physical vulnerability
Exposure
Event scenario
Physical damage scenario
Systemic vulnerability
Socio-economic vulnerabilities
Loss of function and cascade effects scenario
Response scenario
Economic system
Territorial systems
Knowledge
Social system
Long term recovery and reconstruction scenario
impact
emergency
recovery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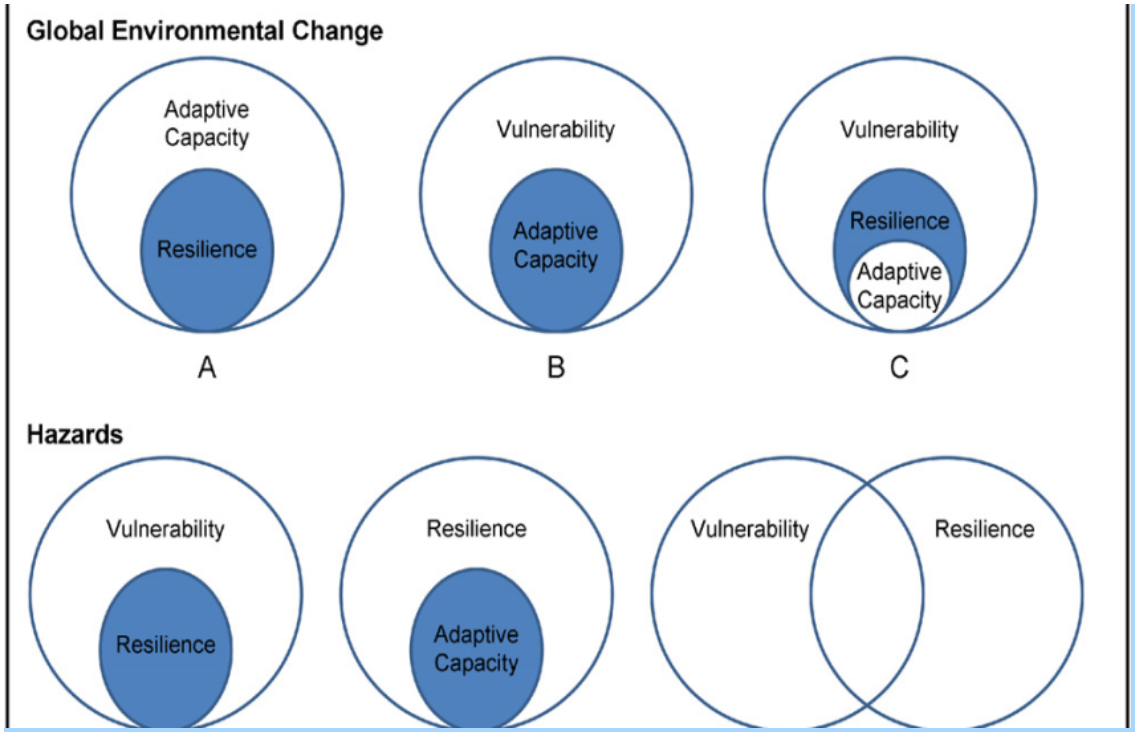
Long term recovery and reconstruction scenario



resilience ~ vulnerability

vulnerability:

how prone is a system to be damaged in case of a given stress

Resilience

→ capacity to bounce back and even more: to transform damage into opportunities

→ capacity to face uncertainties

→ capacity to face change (is change always negative? Do we need resilience also to face positive change?)

Methodology

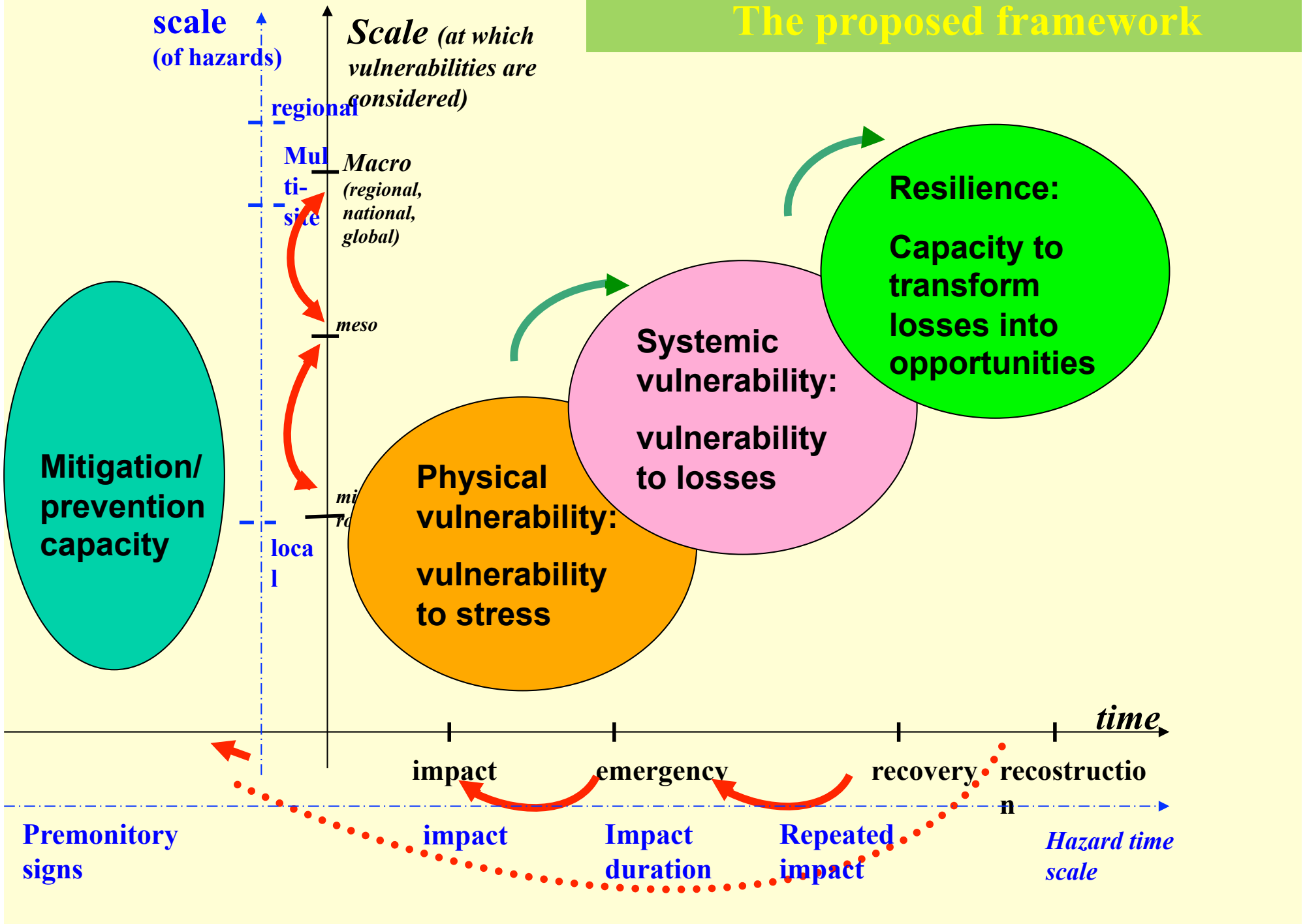
*exctracting concepts

* Case studies from previous studies, literature test areas of the project

* development of a framework basically a model for vulnerability and resilience assessment

* verify on case studies

The proposed framework



vulnerability

space

time

temporal

Past
vulnerability creation

Present
vulnerability evolution assessment

Future
Scenarios

reconstruction

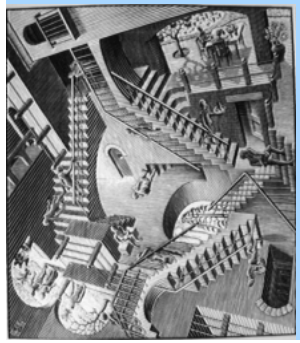
Pre-disaster

spatial

scales for vulnerability assessment

regional

local

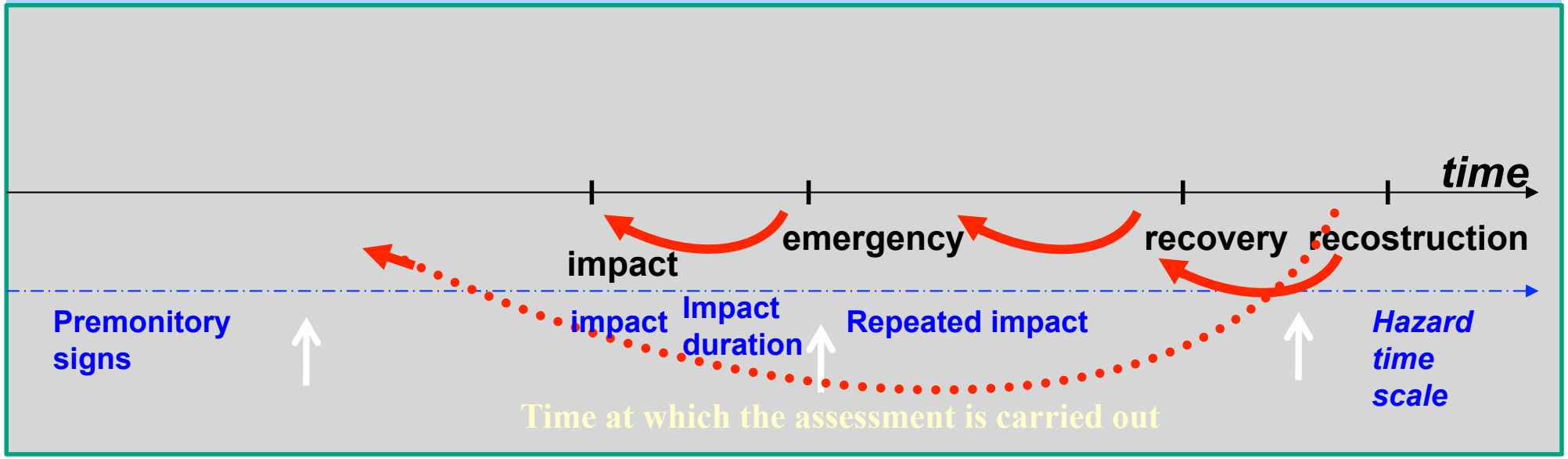


Turner et al., 2003, "Vulnerability rests in a multifaceted coupled system with **connections operating at different spatiotemporal scales** and commonly involving stochastic and non-linear processes".

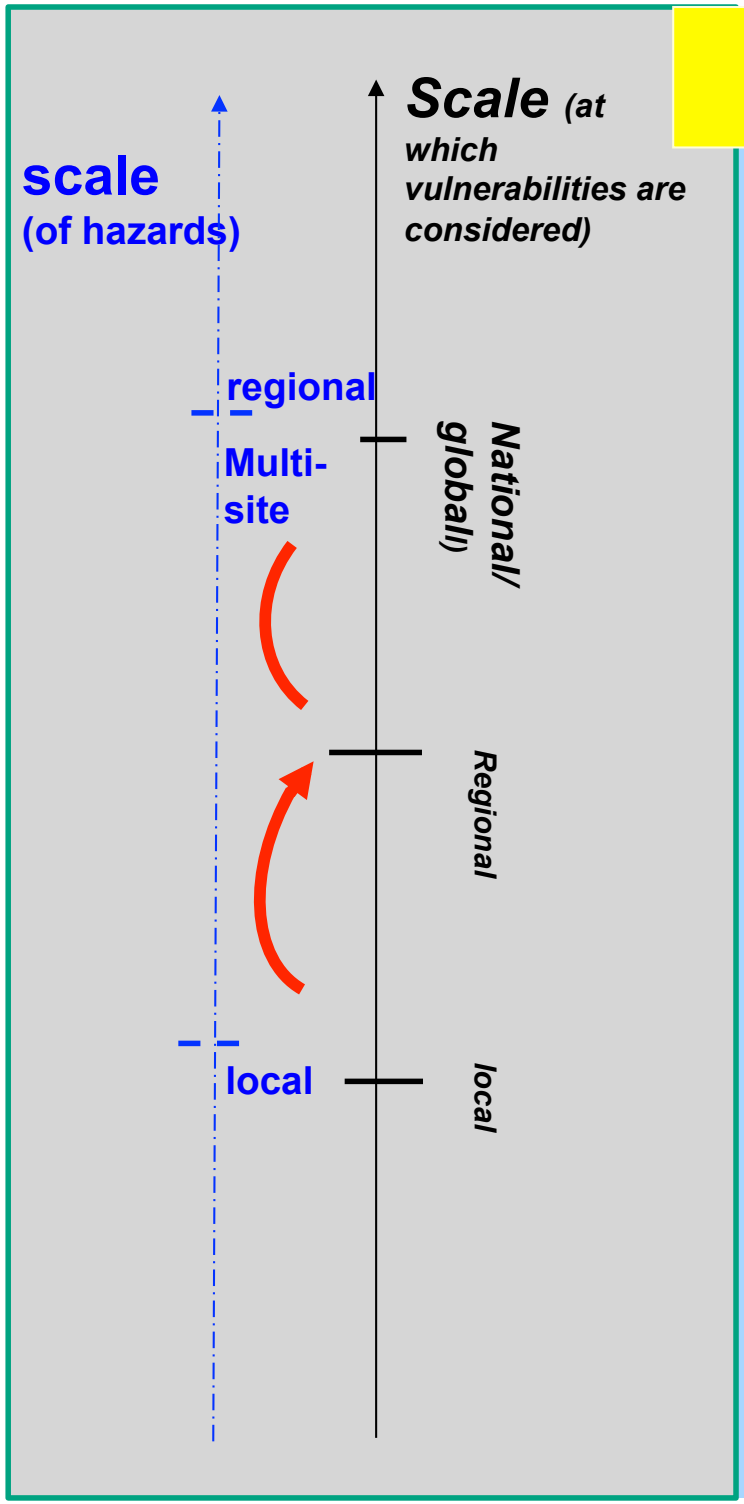
Time scale: some thoughts

Key points:

* Time at which the assessment is carried out (different time available as well)
* Time scale of the hazard does not coincide with event time scale (aftershocks, duration)
* Time cross – level relations



Spatial scale: some thoughts



Key points:

* Tension between local scale and larger scales

* Emergent aspects (relevant for systemic vulnerability for example)

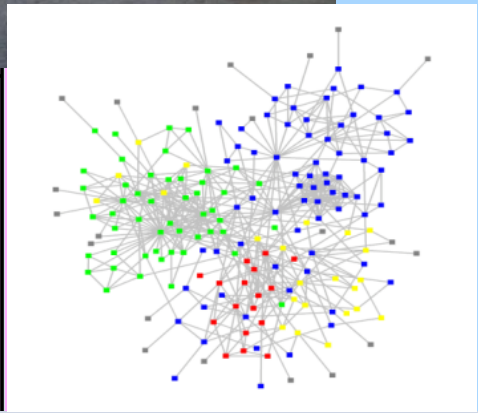
* Cross-level relationships: influence of vulenrability at one scale (agency for example) on another scale (laws, regulations, stretegies)

resilience: mitigation capacities		
systems	**parameters**	**depending on:**
natural environment		capacity of
		systems to:
built environment	* existence of build.	* embed prevention
(structures including	codes for new	into ordinary
strucutral mitigation	* existence of codes	activities
measures)	rules for re	
urban fabric	* mitigation	
	in ordinary	
critical infrastruc	* build in res	
and facilities	in new pro	

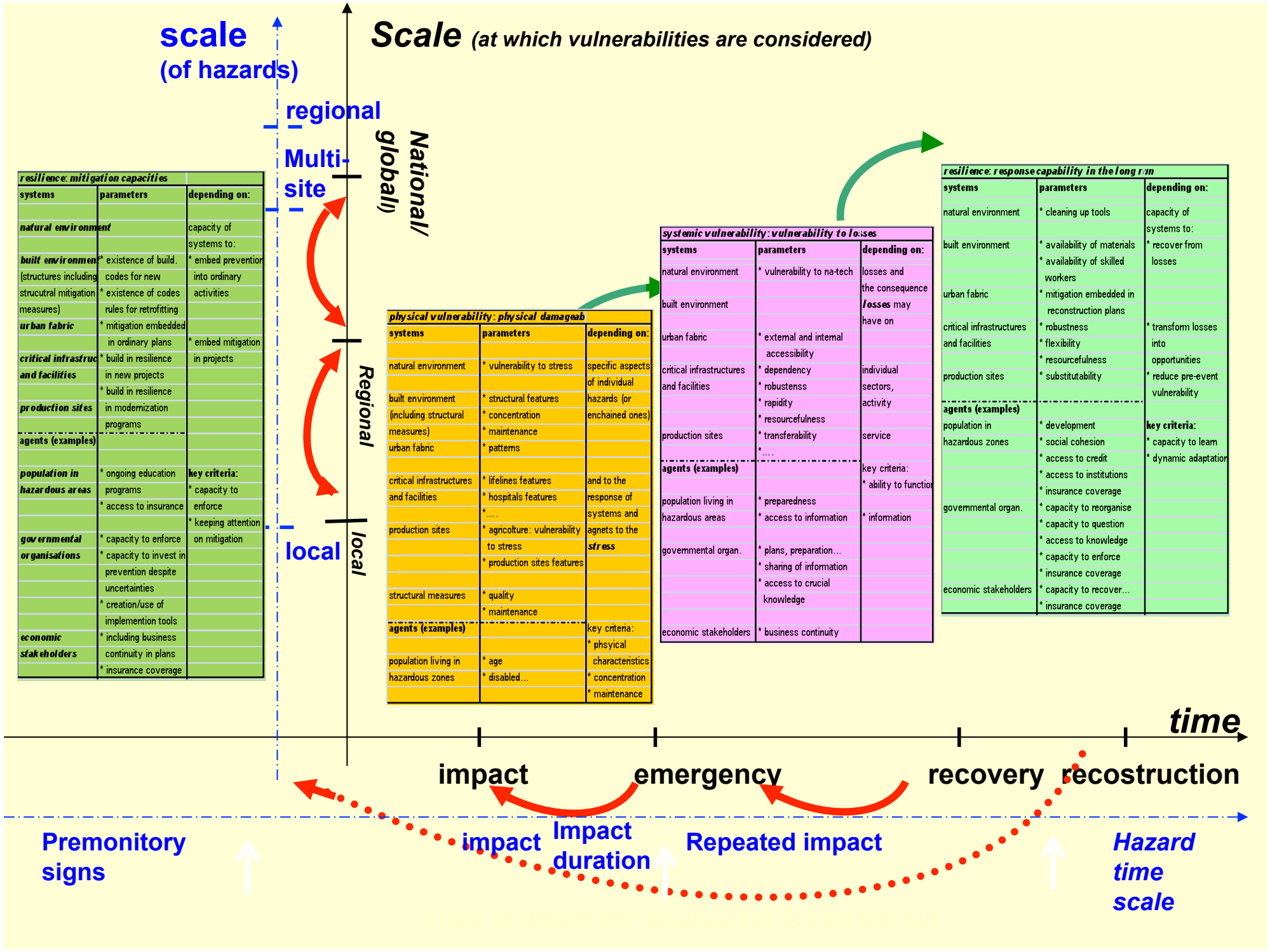
Semplification: each matrix address a specific aspect of the exposed systems across time and space

physical vulnerability: physical damageab		
systems	**parameters**	**depending on:**
natural environment	* vulnerability to stress	specific aspects
		of individual
built environment	* structural features	hazards (or
(including structural	* concentration	enchained ones)
measures)	*	
urban fabric	*	

systemic vulnerability: vulnerability to		
systems	**parameters**	**depending on:**
natural environment	* vulnerability to na-tech	losses and
		the consequence
built environment		***losses*** may
		have on
urban fabric	* external and internal	
	accessibility	



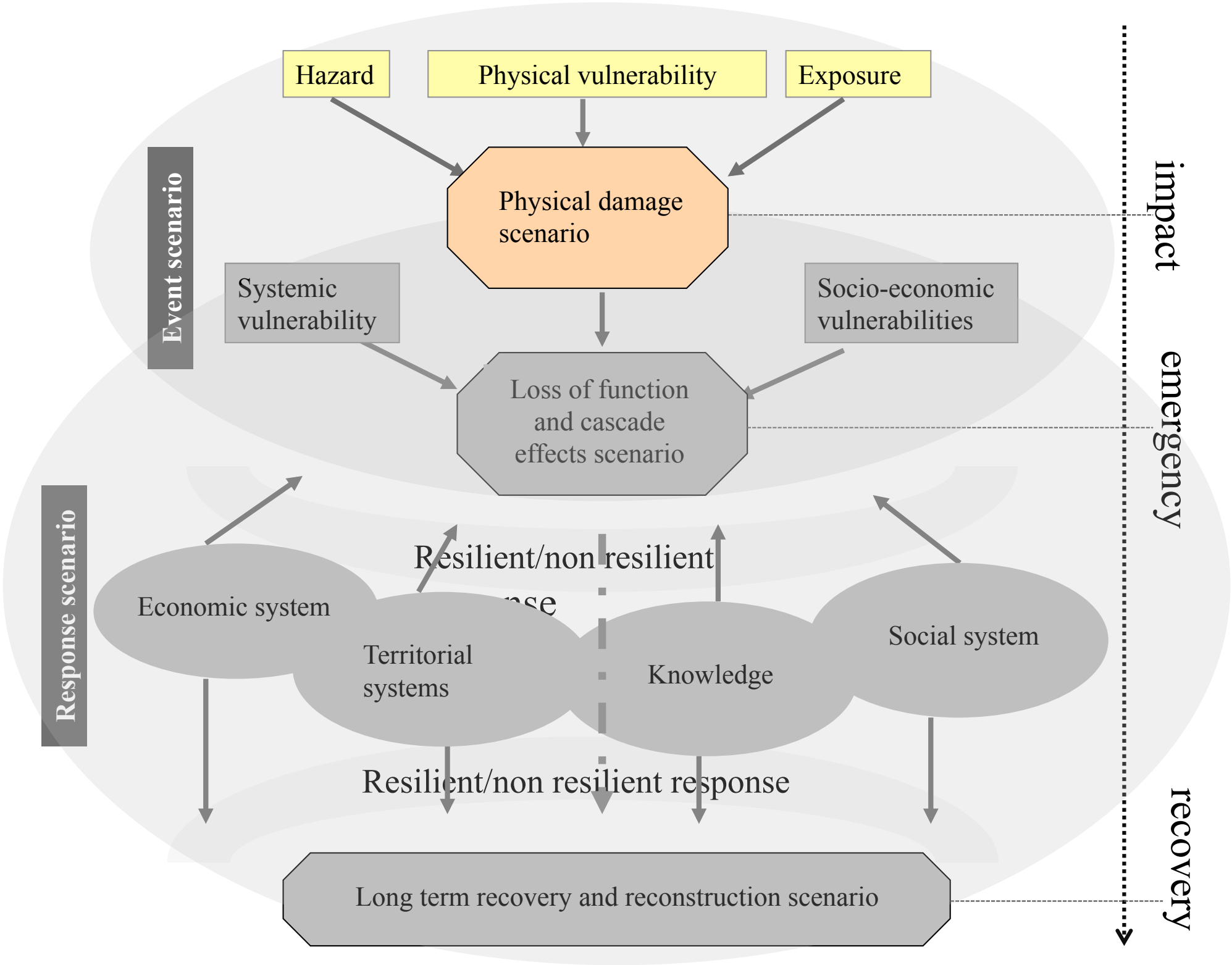
resilience: response capability in the long run		
systems	**parameters**	**depending on:**
natural environment	* cleaning up tools	capacity of
		systems to:
built environment	* availability of materials	* recover from
	* availability of skilled	losses
	workers	
urban fabric	* mitigation embedded in	


scale
(of hazards)
Scale (at which vulnerabilities are considered)
regional
Multi-
site
National/
global)
Regional
local
local
resilience: mitigation capacities
systems
parameters
depending on:
natural environment
capacity of systems to:
built environment (structures including strucutral mitigation measures)
* existence of build. codes for new
* existence of codes rules for retrofitting
* embed prevention into ordinary activities
urban fabric
* mitigation embedded in ordinary plans
* embed mitigation in projects
critical infrastructures and facilities
* build in resilience in new projects
* build in resilience in modernization programs
production sites
agents (examples)
population in hazardous areas
* ongoing education programs
* access to insurance
key criteria:
* capacity to enforce
* keeping attention on mitigation
governmental organisations
* capacity to enforce
* capacity to invest in prevention despite uncertainties
* creation/use of implemention tools
economic stakeholders
* including business continuity in plans
* insurance coverage
physical vulnerability: physical damageab
systems
parameters
depending on:
natural environment
* vulnerability to stress
specific aspects of individual hazards (or enchained ones)
built environment (including structural measures)
* structural features
* concentration
* maintenance
urban fabric
* patterns
critical infrastructures and facilities
* lifelines features
* hospitals features
*....
and to the response of systems and agnets to the stress
production sites
* agricolture: vulnerability to stress
* production sites features
structural measures
* quality
* maintenance
agents (examples)
key criteria:
* phsyical characteristics
* concentration
* maintenance
population living in hazardous zones
* age
* disabled...
systemic vulnerability: vulnerability to losses
systems
parameters
depending on:
natural environment
* vulnerability to na-tech
losses and the consequence losses may have on
built environment
urban fabric
* external and internal accessibility
critical infrastructures and facilities
* dependency
* robustenss
* rapidity
* resourcefulness
individual sectors, activity
production sites
* transferability
*....
service
agents (examples)
key criteria:
* ability to function
population living in hazardous areas
* preparedness
* access to information
* information
governmental organ.
* plans, preparation...
* sharing of information
* access to crucial knowledge
economic stakeholders
* business continuity
resilience: response capability in the long run
systems
parameters
depending on:
natural environment
* cleaning up tools
capacity of systems to:
built environment
* availability of materials
* availability of skilled workers
urban fabric
* mitigation embedded in reconstruction plans
critical infrastructures and facilities
* robustness
* flexibility
* resourcefulness
* substitutability
* transform losses into opportunities
production sites
* reduce pre-event vulnerability
agents (examples)
population in hazardous zones
* development
* social cohesion
* access to credit
* access to institutions
* insurance coverage
key criteria:
* capacity to learn
* dynamic adaptation
governmental organ.
* capacity to reorganise
* capacity to question
* access to knowledge
* capacity to enforce
* insurance coverage
economic stakeholders
* capacity to recover...
* insurance coverage
time
impact
emergency
recovery
recostruction
Premonitory signs
impact
Impact duration
Repeated impact
Hazard time scale

Organisation of each matix: different “components” of vulnerability

	System	Aspect	Parameters	Criteria for assessment	Descriptors	Application to case study
Natural environment	*Natural ecosystems*	Are natural ecosystems fragile to the potential effects of hazard(s)?	Are different crops/agricolture productions vulnerable?			
		Can natural systems interact with hazard(s)?	Is there a possibility of solid trasport mechanisms			
		Are natural ecosystems vulnerable to mitigation measures taken particularly during the eemrgency phase?	Is there a possibility of water diversion that will subtract water from needing areas			
Built environment	*Exposure and vulnerability of built environment*	What are the factors that make buildings, the urban fabric and public facilities vulnerable to the stress?	Buildings structural vulnerability			
			Position with respect to hazardous zones			
			Content of buildings			
			Vulnerability assessment of public facilities			
			Vulnerability of the urban fabric			
Infrastructure and production sites	*Critical infrastructures*	What are the factors that make critical infrastructures vulenrable (mainly lifelines)	Water treatment plants; electical power plants; other lifelines plants			
	Production sites	What are the factors that make production sites vulnerable (including na-tech potential)	Vulnerability assessment of production sites			
Social system (agents)	*People/individuals*	What are the factors that may lead to injuries and fatalities?	Location with respect to vulnerable buidlings, roads, industrial sites			
			Preparedness			
			Depth of flood dangerous for individuals			
			Age; mobility impairment, other impairment			
	Community and Instituions	What are the factors that may lead to large number of victims?	Population density in vunerable areas			

	System	Aspect	Parameters	Criteria for assessment	Descriptors	Application to case study
Natural environ	*Natural ecosystems*	Are natural ecosystems fragile to the potential secondary effects of hazard(s)?	Are crops and other agricoltural productions vulnerable to contaminated water	by type of production and concentration/type of contaminant	detailed analysis of potential contaminants sources in the area needed	
			Areas that may be vulnerable to secondary contamination	along the river, considering dispersion mode of contaminants	Contaminants, rock, stones, boulders, mud; transportation pocesses	
Built environmenl	*Exposure and vulnerability of built environment*	What are the factors that make buildings, the urban fabric and public facilities vulnerable to losses?	Existance of public facilities: hospitals, fire brigades, emergency control rooms	yes/no; functional capacity of such facilities	assessment of functional potential of facilities	
			Accessibility to vulnerable areas	redundancy; quality of roads; usability; expected travel time		10,000 motorists stranded on motorway system. 500 rail passengers stranded. Tens and thousands more with disrupted
Infrastructure and production sites	*Critical infrastructures*	What are the factors that make critical infrastructures stop functioning?	Existance of lifelines	binary	yes/no	
			Continuity plan for lifelines, individually and in a coordinated fashion	binary	yes/no; considers all potential threats/does not	
			People and areas depending on lifelines in potentially affected zones	number/area dimension	number of customers who may be affected; geographic area	Number affected through loss of potable water supplies: 135,000 homes or 350,000 people for 17 days: i.e. 340,000 people outside the flood risk zone. Adaptation comprised providing large number of bottled water supplies but not without availability problems in some areas.
			Business continuity plan	binary	yes/no	Business continuity planning has become relatively well developed in the UK in the past decade and so we would expect many flood risk firms to have considered how they would ensure business continuity during a flood disaster. How many would probably not have considered prolonged loss of potable water supplies caused by flooding in the summer 2007 floods.
Social system (agents)	*People/ individuals*	What are the factors that may reduce coping capacity during crisis?	Access to understandable information	binary and redundancy	yes/no; radio and TV/special telephone number/internet	Everyone is able to obtain geographically specific flood warning information and flood advice (including on flood resilience measures) by telephoning the Environment Agency's FLOODline. Radio information is also available.
			Preparedness in case of event	degree	good/partial/low	People received severe weather and flood warnings but most did not expect utilities to suffer outages and so they were not prepared for this in most cases.
	Community and Institutions	What are the factors that may hamper effective crisis management?	Existance of contingency plan fro threats at stake	binary; date of last production or update	yes/no; recent/old	
	Economic stakeholders	Are economic stakeholders prepared to face crises?	Capacity to run economy and respond to crises	degree	yes/partially/no	
			Capacity to invest in recovery and take preventive actions	Binary or degree	Yes/no or none/partial/high	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