

## Results of the reconstruction after the Belice earthquake (1968):

-Urban environments lacking character and roots in the geographical context

-Underused facilities



## Positive results:

-Money used for economic development, including the creation of an entirely new and flourishing wine sector





The importance of symbolic reconstruction: the memorial crafted by Burri (Cretto) with the debris

See Vale and Campanella, *The resilient cities. How modern cities recover from disasters*, Oxford University Press, 2005

Slogan was: “rebuild everything as it was where it was. Results:

-Fake historic centres

-Urban sprawl due to double reconstruction



Example: the Gemona case (Friuli earthquake, 1976)

-Double reconstruction and the persistence of “squatters”

-The difficulty to reconstruct land parcels in the cadastre and original owners emigrated (empty spaces)



Economic system



## Make the economic system more resilient

- guarantee human and financial resources
- diversified sectors
- check interdependencies
- check for present and “future” resources potential vulnerabilities
- functioning of the economic system (post office for example)

## More resilient economic activities

- business continuity plans
- access to credit
- dependance on other systems
- transferability
- insurance

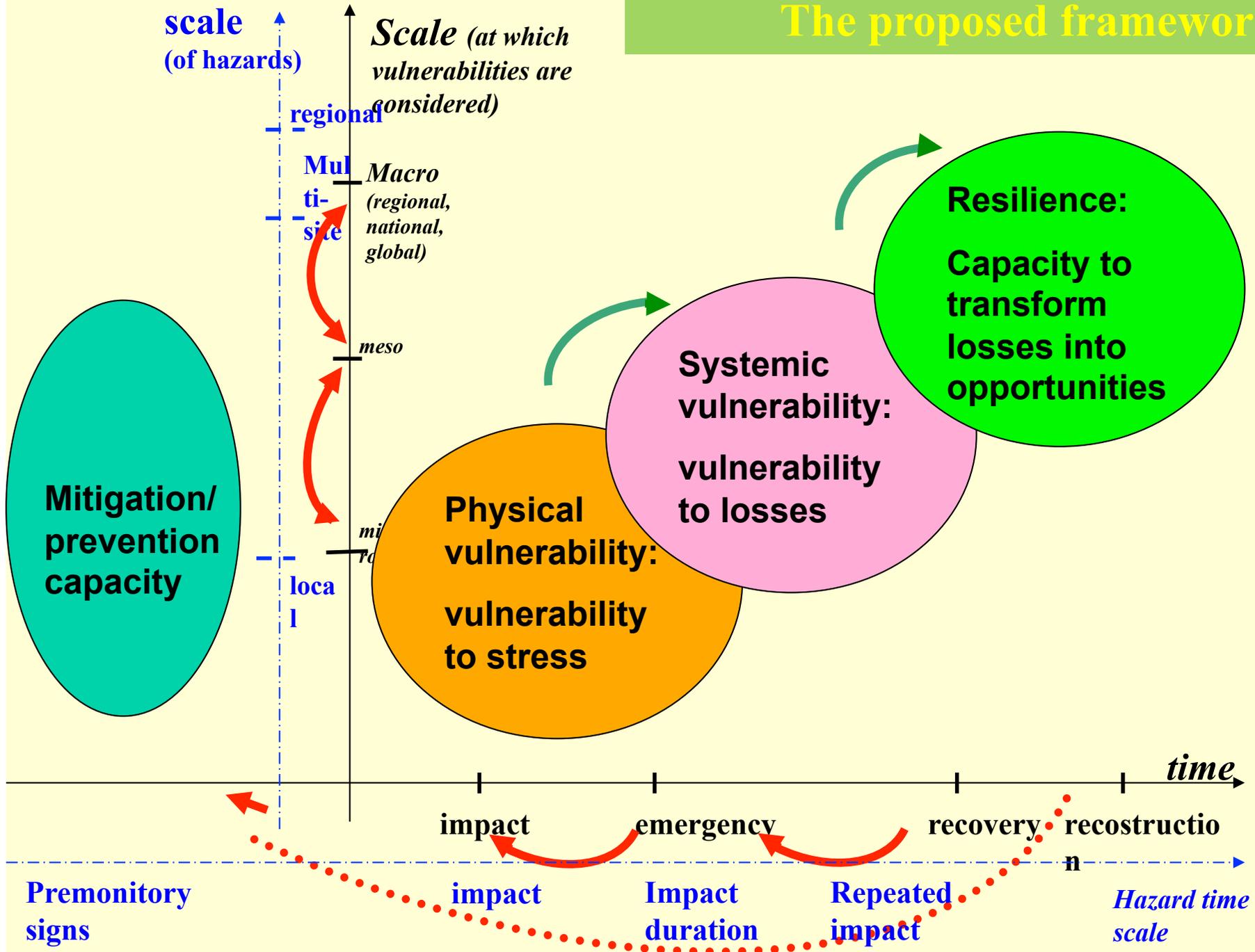


Risk: seismic		Fourth Matrix: Resilience: response capability in the long run				
System	Aspect	Parameters	Criteria for assessment	Descriptors	Scoring	
Built environment	Exposure and vulnerability of built environment Is the urban fabric/built environment able to recover reducing pre-event vulnerability?	Temporary transferability of facilities relevant for the settlement/city community life and economy	binary; type of relocation	yes/no; temporary/permanent	In the l'Aquila case all public services located in the historic centre were transferred to the School of the Financial Police in an external quarter nearby. The problem of leaving a centre empty of functions for a long while must be carefully considered	
		Existence of plans for reconstruction in case of severe destruction scenarios	binary	yes/no		
		Reconstruction plans considers lessons learnt from earthquake (including amplification zones)	binary and quality	yes/no; seismic zonation map made available for reconstruction/not available	In the Umbria Marche case (1997) provision of compensation was granted on the basis of a seismic zonation map showing the most critical amplification zones	
		Existence of skilled workers/firms for repairs and reconstruction (example historic sites)	binary; quality	Yes/no; availability with respect to expected need	In the Umbria Marche case, the lack of firms with workers skilled in the restoration of historic centres and in the meantime seismic retrofitting required careful consideration and creation of technical consultancy by the two regions	
		Level of sharing among stakeholders of reconstruction plans	degree	High/low; only formal/substantial	The Umbria Marche case showed a good level of integration between the central government and the two regions	
		Level of integration of physical reconstruction with community healing processes	degree	High/low; room for interpreting in the new/restored setting the meaning of the destruction		
		Relevance of potentially affected settlements in geographic/economic terms	level of importance	Central/peripheral		
Infrastructure and production sites	Critical infrastructures	Computerized mapping systems of infrastructures	binary	yes/no		
		In site devices for quick survey of damaged parts	binary	yes/no	The Kobe earthquake has shown that recovery time is strongly connected to the availability of personnel, maps of systems, material for repairs, capacity to handle car traffic in areas where repairs must be carried out	
		Availability of spare materials for fast repairs	binary; time needed to bring on site spare materials	yes/no; < 1 day/ several days		
		Availability of personnel for repairs	location and number of technicians	on site/in distant areas; number of available technicians with respect to expected need		
	Existence of protocols to proceed with repairs requiring inter-lifelines interventions	degree; number of different stakeholders to be coordinated in repair efforts	yes/partial/no; one main stakeholder/several stakeholders			
	Production sites	Temporary transferability of production in case of need	binary	applicable/not applicable		
Existence of funds for fast repairs		binary	yes/no			
Existence of inspection and guiding personnel for correct repairs		binary	yes/no/forecasted in the recovery plans			
		Economic sectors	Diversified or concentrated on few sectors	Few/many different economic sectors in the area		
Social system (agents)	People/individuals	Availability of psychological support for adults and children	binary	yes/no	In the l'Aquila case provision of psychological support for victims was extensive and helped to solve several problems in temporary tent camps	
		Availability of private resources to resettle/repair	binary; support by public agencies; rapidity of compensation process	yes/no; available/not available; rapid/slow		
		Access to insurance	binary and coverage	yes/no; percentage of coverage		
	Community	Is the affected community resilient to the consequences of a catastrophe?	Age structure	Areas vitality	Aging population; low fertility rates	
			Local condition of aged population	binary	autonomous/not autonomous; relatively healthy/not healthy	After the Friuli earthquake in 1976, several centres were rebuilt in areas that had experienced high levels of abandonment: several empty buildings can be found nowadays in the rebuilt zone.
			Employment rate	degree	high/medium/low	
			Annual population growth rate (over the last five years)	degree	high/medium/low/negative	
			Immigration index	degree	high/medium/low/negative	
			Social networking	degree	high/medium/low/negative	
	Institutions	Are institutions in charge of reconstruction transparent, reliable and trustable?	Criminality rate	degree	high/medium/low	
			Conflict among social/ethnic groups	degree	high/medium/low	
			Degree of trust in institutions	degree	high/medium/low (from sociological surveys when available)	
Economic stakeholders	Are economic stakeholders capable/wishing to reinvest in affected areas?	Transparency in funds allocation	Existence of public information and independent control mechanisms	yes/no	The Friuli earthquake in 1976 was a good example of transparency: a sort of collective control over money expenditure was developed, on the contrary the Irpinia reconstruction after the 1980 earthquake was object to several court and parliamentary trials for bribes etc.	
		Long term vision	Existence of strategic development/land use plans	yes/no		
		Insurance coverage	binary and coverage	Yes/no; percentage		
		Construction industry	level of development and modernization	high/average/low		

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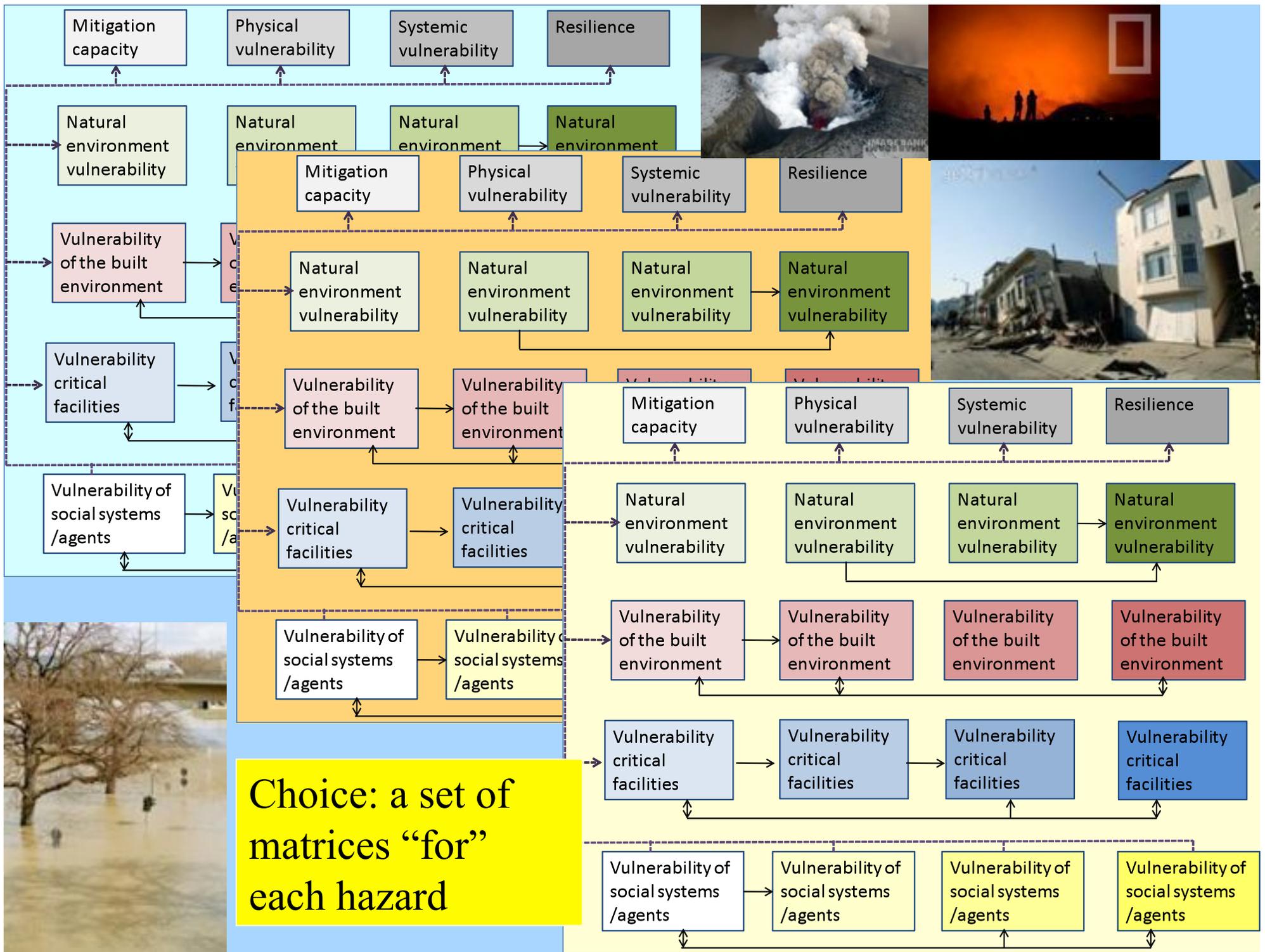
Social system (agents)	<i>People/ individuals</i>	Are people in the position to be resilient in the face of a catastrophe?	Availability of psychological support for adults and children	binary	yes/no	In the l'Aquila case provision of psychological support for victims was extensive and helped to solve several problems in temporary tent camps
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# The proposed framework



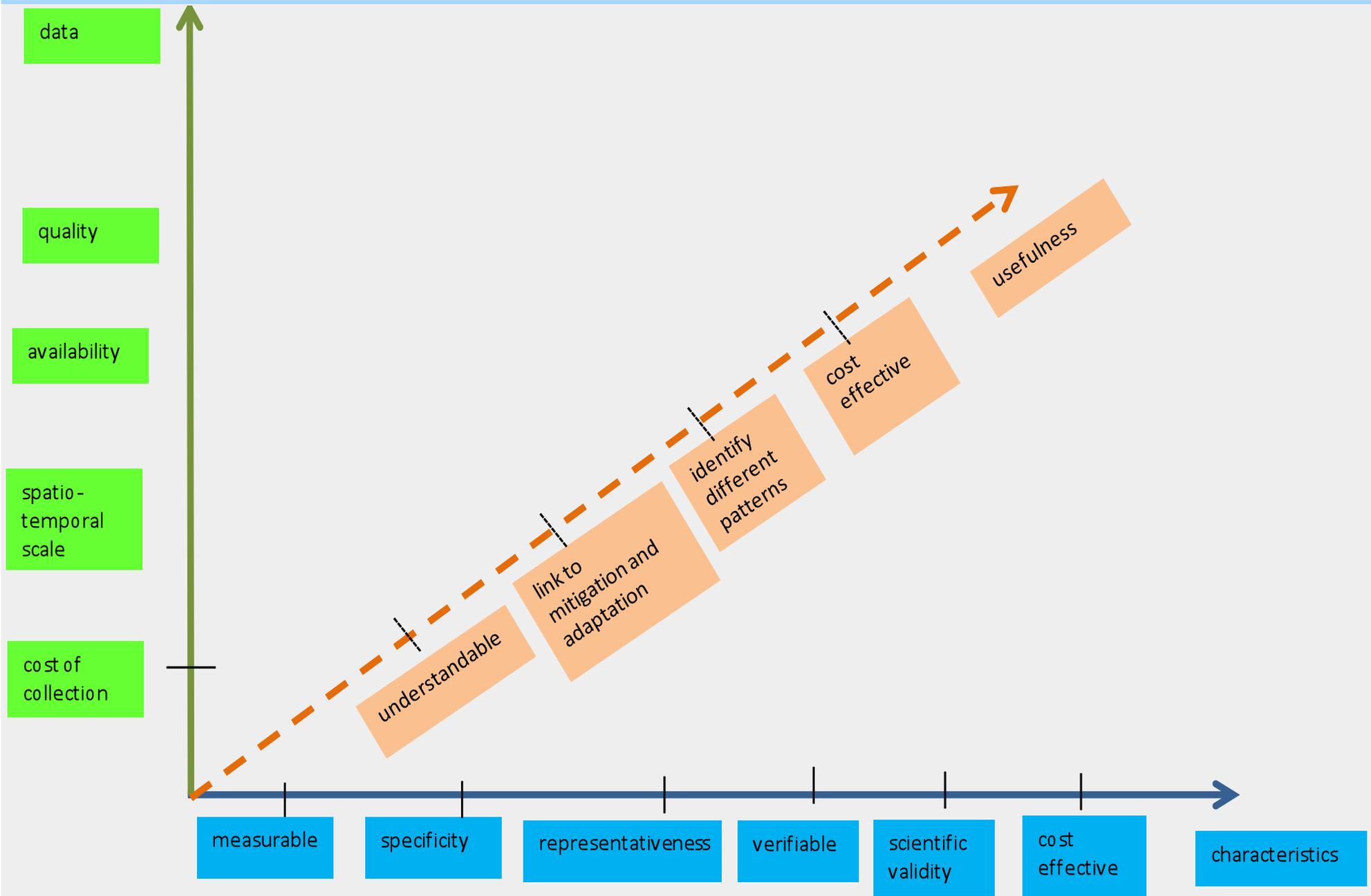
Risk: seismic		First Matrix: Resilience: Mitigation capacity				
System	Aspect	Parameters	Criteria for assessment	Descriptors	Application or comments from case studies	
Natural environment	Are natural hazards known and mapped?	Hazard maps including map for fault rupturing at the ground surface availability	At the following scales: country level; regional and provincial; lower scales	yes/no; quality as judged with respect to international standards and updated to new knowledge and technologies	In the Alaska case (earthquake 1964) geological hazards connected to seismic were well known and mapped, though not embedded in metropolitan master plans of Anchorage for example	
		Geological map of quaternary formation				
	Are hazards monitored?	availability of seismographs and accelerometers networks	binary and density	yes/no; dense/only individual sparse points	In Italy before the 70s the seismograph and accelerometers networks were significantly underdeveloped/absent in several zones	
		Availability of maps of landslides and estimation of their potential movement consequent to earthquakes	binary; quality	yes at appropriate scale/no; quality with respect to international standards	Induced and triggered hazards have been the object of study only recently; many regions though have developed such knowledge in the last ten/15 years	
Are induced/triggered hazards controlled?	Map of potential liquefaction zones	binary; coverage	yes/no; only spot like/covering the entire area of concern			
	Map of Tsunami hazard	binary	yes/no			
	Tsunami monitoring	binary	yes/no			
Built environment	Is exposure and vulnerability considered and acted upon in plans?	Vulnerability assessment of exposed built stock	binary; frequency	yes/no; updated at the same rate of urban growth/not updated	In Italy for example extensive vulnerability survey campaigns have been carried out in several regions	
		Risk maps and scenarios, including enchainned events	binary	yes/no		
		Vulnerability and exposure assessment considered in ordinary plans (example land use)	binary; mode of inclusion	yes/no; only formally/substantially with limitations in amplification zones and specific building requirements	Unfortunately available vulnerability assessment including the assessment of all public buildings vulnerability in Southern regions is not considered in development/restoration plans in the majority of Italian regions	
	Do rules for mitigation exist? What is their expected efficacy/quality?	Building codes/rules	binary; quality	yes/no; updated according to state of the art/old	Various cases, like the Kocaeli earthquake have shown the importance of considering the year when building codes were issued	
		Traditional building practice based on hazard knowledge	binary; capacity to reproduce traditional techniques correctly	binary; judgement about the capacity to conform to the "code of practice"	Expertise has been developed in Italy for example regarding the issue of "code of practice" connecting traditional local knowledge and earthquake resistance capacity; provisions for retrofitting have been attached to the financial law after earthquakes	
		Maintenance of built stock	binary	yes/no		
		Specific provisions for retrofitting	binary	economic incentives promoted/not promoted		
		Land use plans embedding risk mitigation and vulnerability reduction	binary/ expert quality judgement	yes/no; sectoral/comprehensive, specific/generic		
	Implementation capacity	binary; frequency of inspections; availability of trained personnel for inspections	yes/no; frequent/rare; yes/no and number/total of construction sites every year		In several recent earthquakes (Gujarat, 2001; Turkey, 1999; Algeria, 2003; L'Aquila 2009) poor compliance was one of the main causes of recent buildings failure	
		Integration to other measures (insurance)	binary	yes/no	Only in Turkey after the 1999 earthquake the program funded by the World Bank connects insurance to antiseismic development	
Infrastructure and production sites	Is vulnerability of critical infrastructures assessed and acted upon? Particularly with respect to na-techs and enchainned effects on depending systems?	Vulnerability assessment of critical infrastructure	binary; updating frequency	yes/no; each time new projects are drawn/only occasionally	Relevant in California	
		Maintenance programs embedding mitigation	binary; updating frequency	yes/no		
		New projects based on hazard/risk assessment	binary	yes/no	In California there is a tradition that permitted the seismic upgrading of lifelines in ordinary maintenance and new projects	
	Is the vulnerability of production sites considered particularly with respect to potential na-techs?	Level of coordination among stakeholders	degree	low/medium/high		
		Vulnerability assessment of production sites	binary; updating frequency	yes/no; each time new plants or transformation of existing ones occurs		
		Retrofitting measures for existing production sites	binary	yes/no		
New projects based on risk assessment	Na-tech explicitly accounted for in hazardous installations emergency plans	binary; expert judgement on quality	yes/no; special provisions for hazardous plants/generic rules			
	Existence of emergency plans that explicitly take into account earthquakes as threat to be prepared for	binary; expert judgement on quality	yes/no; good/poor quality			
Social system (agents)	Parameters are addressed to evaluate the capacity of individuals living in prone hazard areas of coping with hazardous events, which largely depends on the perception and awareness of risk conditions before the event occurs.	Risk perception/ awareness	degree	inexistent/average/good		
		Individual preparedness	regarding specific self protective measures; regarding measures included in emergency plans	low/average/high	Even in Kobe the individual preparedness proved to be poor despite national programs; few people had radio working with batteries; few had a bottle of water and basic commodities ready for evacuation	
	Parameters are addressed to evaluate the involvement of a community into decision-making processes related to risk prevention and mitigation, the capacity of institutions of improving risk awareness through information and education campaigns and the level of cooperation among different institutions in charge of risk prevention/ mitigation.	Participation in development and prevention/mitigation strategies	degree	low/average/high		
		Education programs & media campaigns	binary; frequency embedded in school programs	yes/no; every two years/only occasionally		
Parameters are addressed to evaluate the economic capacity to mitigate the economic capacity to mitigate the various stakeholders; the access to financial resources for mitigation	Coordination and cooperation among institutions in charge of risk	degree	low/average/high			
	GDP; QVA (Gross added value); measure of extent of marginalized groups	level dimension of poverty/marginalization	rich/average/poor country percentage of people living with less than x/year			

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	Rules and tools for risk mitigation	Do rules for mitigation exist? What is their expected efficacy/quality?	Building codes/rules	binary; quality	yes/no; updated according to state of the art/old	Various cases, like the Kocaeli earthquake have shown the importance of considering the year when building codes were issued	
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			Maintenance of built stock	binary	yes/no	connecting traditional local knowledge and earthquake resistance capacity; provisions for retrofitting have been attached to the financial law after earthquakes	
			Specific provisions for retrofitting	binary	economic incentives promoted/not promoted		
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			Integration to other measures (insurance)	binary	yes/no	Only in Turkey after the 1999 earthquake the program funded by the World Bank connects insurance to antiseismic	



Choice: a set of matrices “for” each hazard

# How to choose vulnerability and resilience indicators?



## Vulnerability and resilience assessment more like a diagnosis exercise rather than a “statistical analysis”

Considering the article by Ginzburg C., Morelli, *Freud and Sherlock Holmes: clues and scientific method*, in “History Workshop”, vol. 9, 1980



We are able to assess vulnerability factors, resilience factors, it is hard to “measure”, to know the two entities directly, just clues of can be actually tackled...  
But still be rigorous, as in medicine...

# Vulnerability and resilience assessment more like a diagnosis exercise rather than a “statistical analysis”

Tension between the individual and the global, between the “non Galilean” and the rigorous “scientific method”



- Classification to be applied on individual cases, considering spatial and time scale issues (including the time when the assessment is carried out)
- The parameters and indicators work as clues, as symptoms as the actual “vulnerability” or “resilience” is somehow inaccessible per se. So we are actually measuring vulnerability and resilience factors or clues

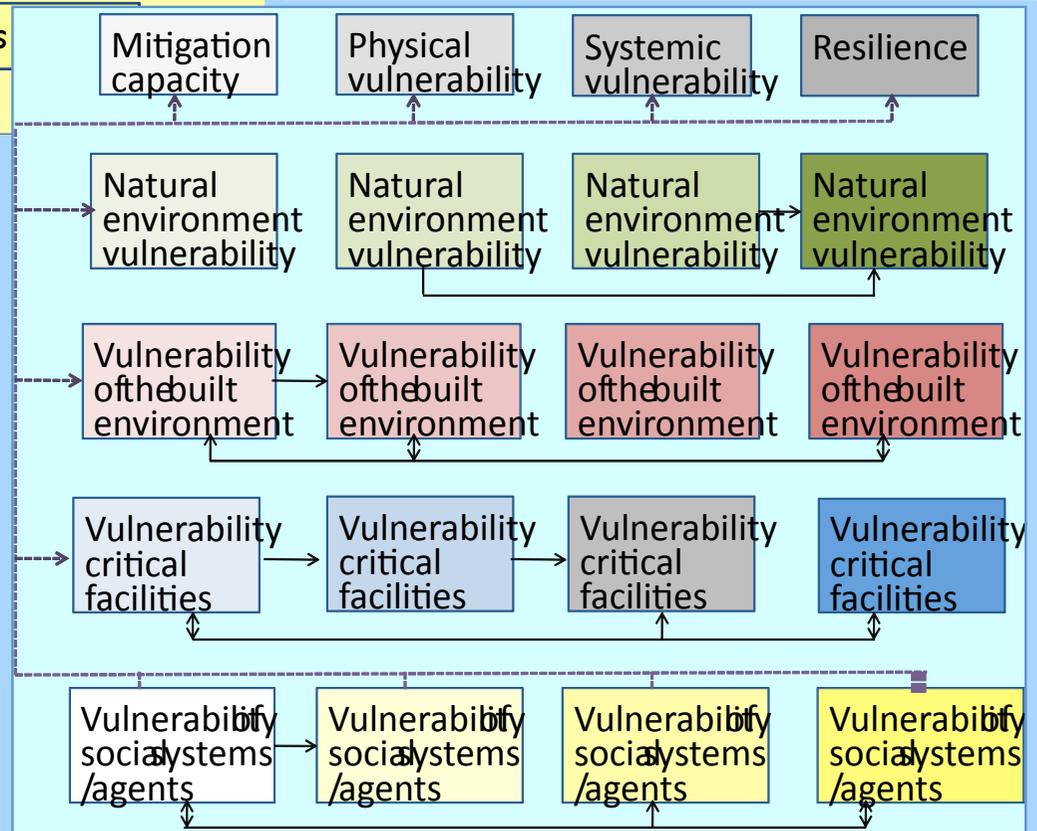
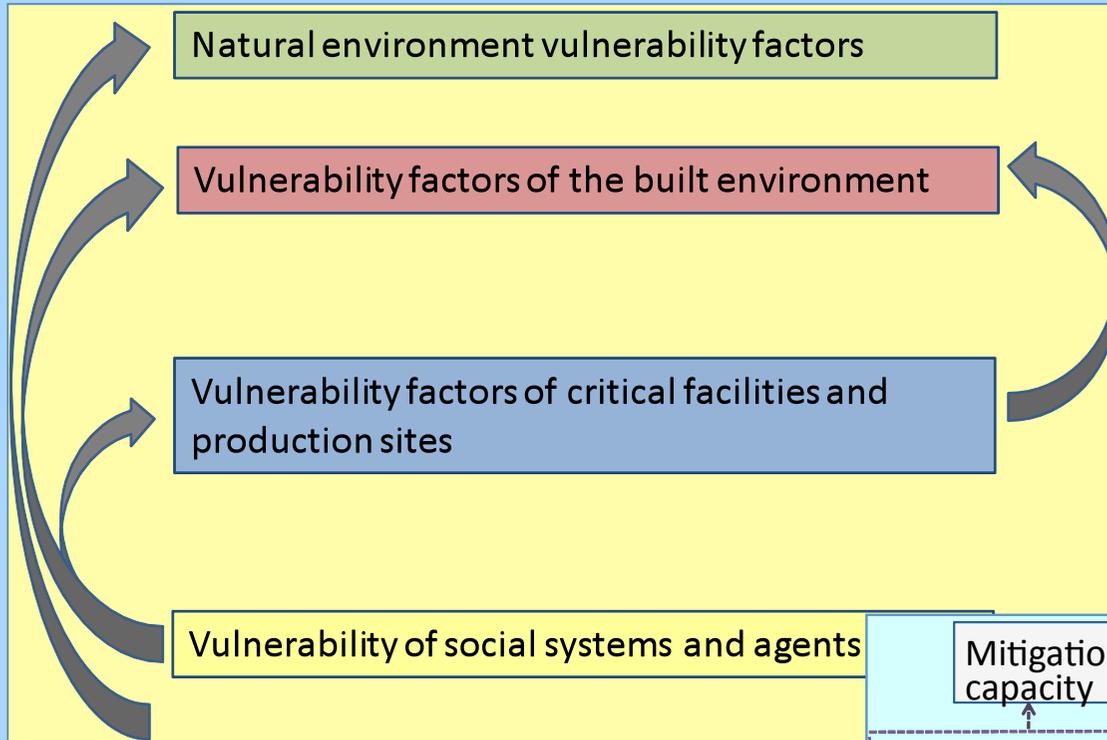
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-In fact retrospective analysis is only possible when causes are too complex or unknown and can be derived only from studying the effects (what would be called back analysis)

-Constraints in “prospective” analysis, yet we need scenarios...



On the basis of the identification of pre-selected/pre-identified scenarios, some components, some aspects, some connections emerge as more relevant than others

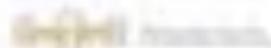


ENSURE Final Workshop 10 May 2011

Vulnerability to forest-fires in a Mediterranean context: A dynamic loop in space and time

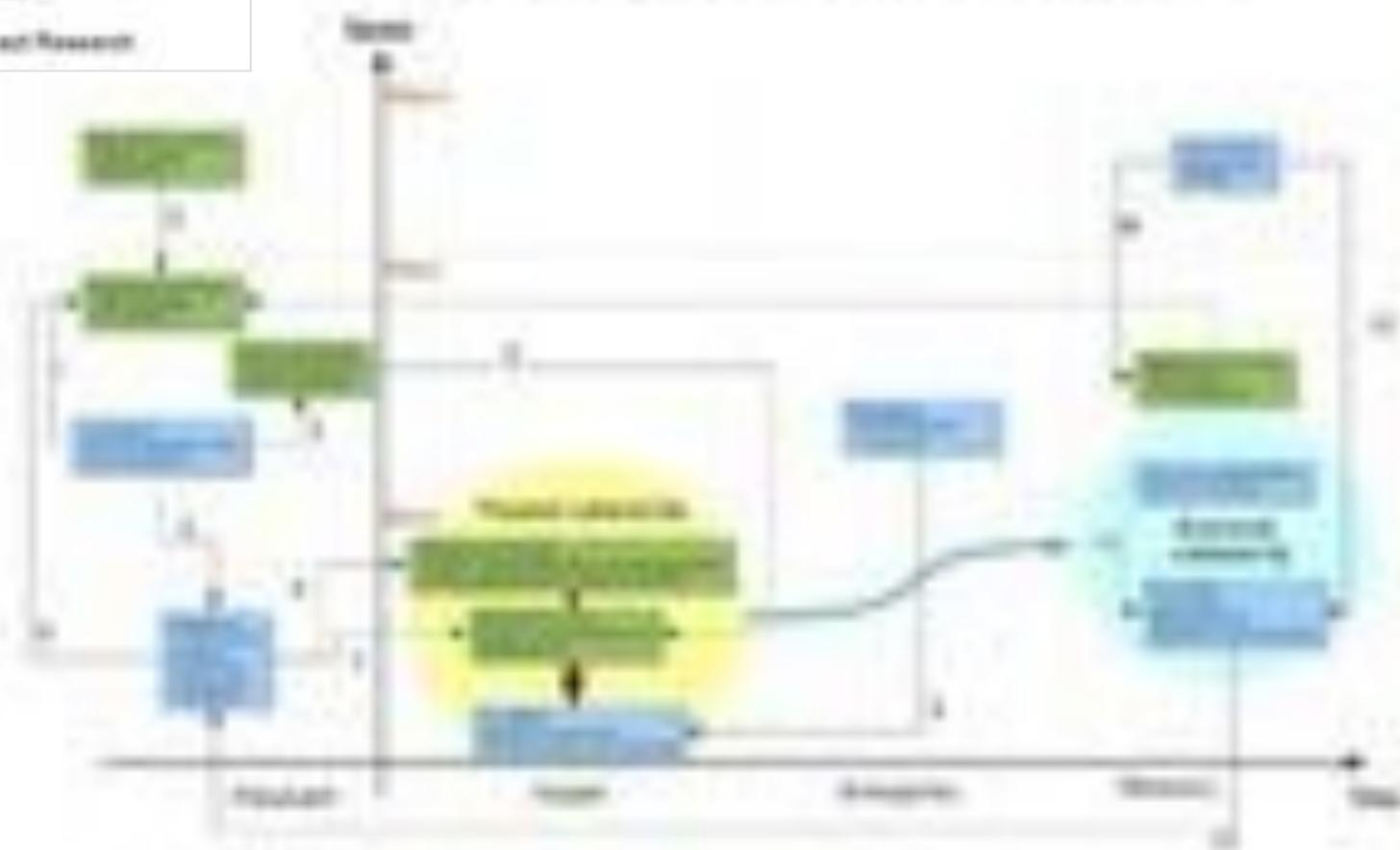


Lutz Eitzinger and Jürgen Knapp



European Commission  
Petroleum Institute for Climate Impact Research

## Forest fires in a Mediterranean context



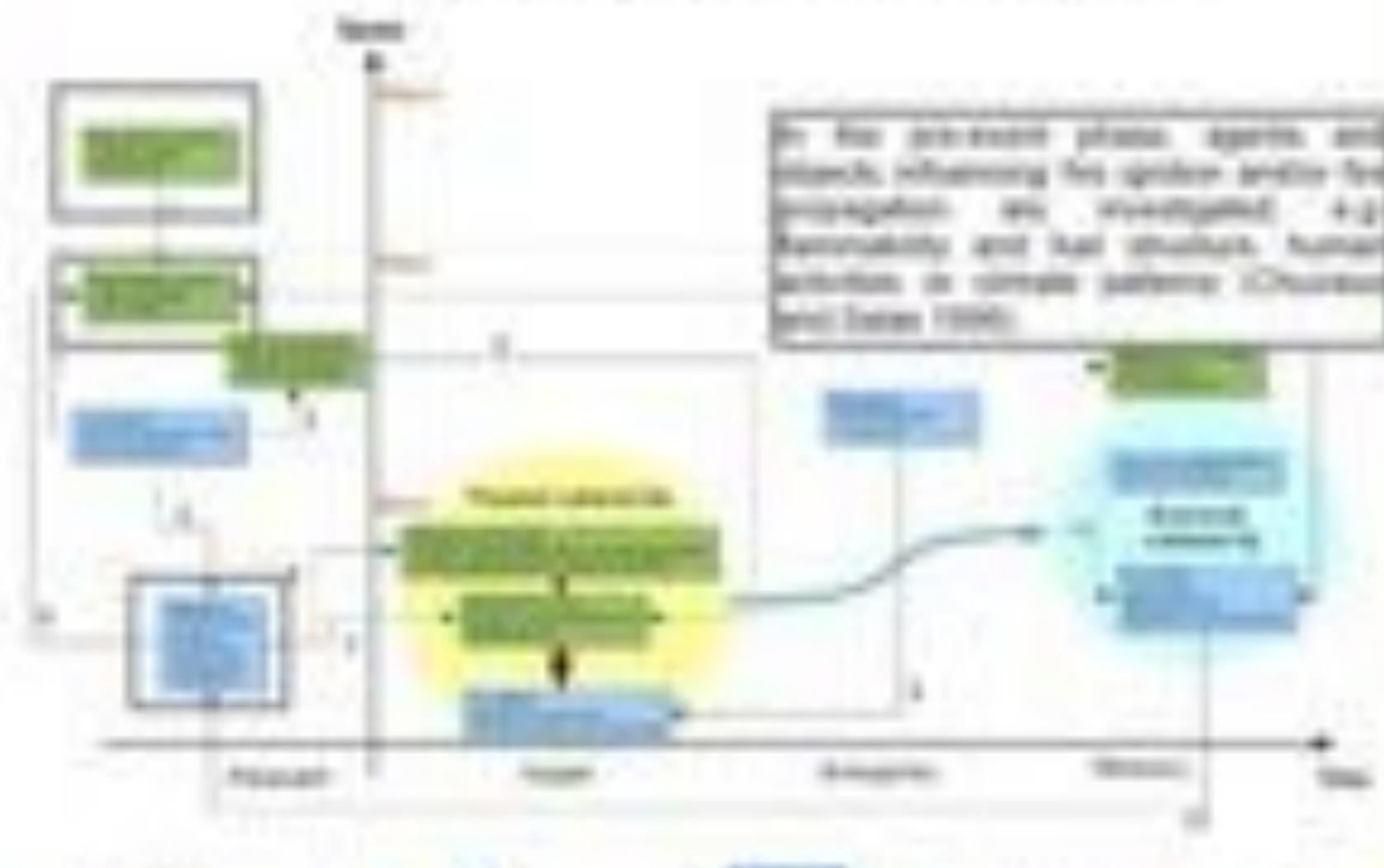


6th Framework Programme



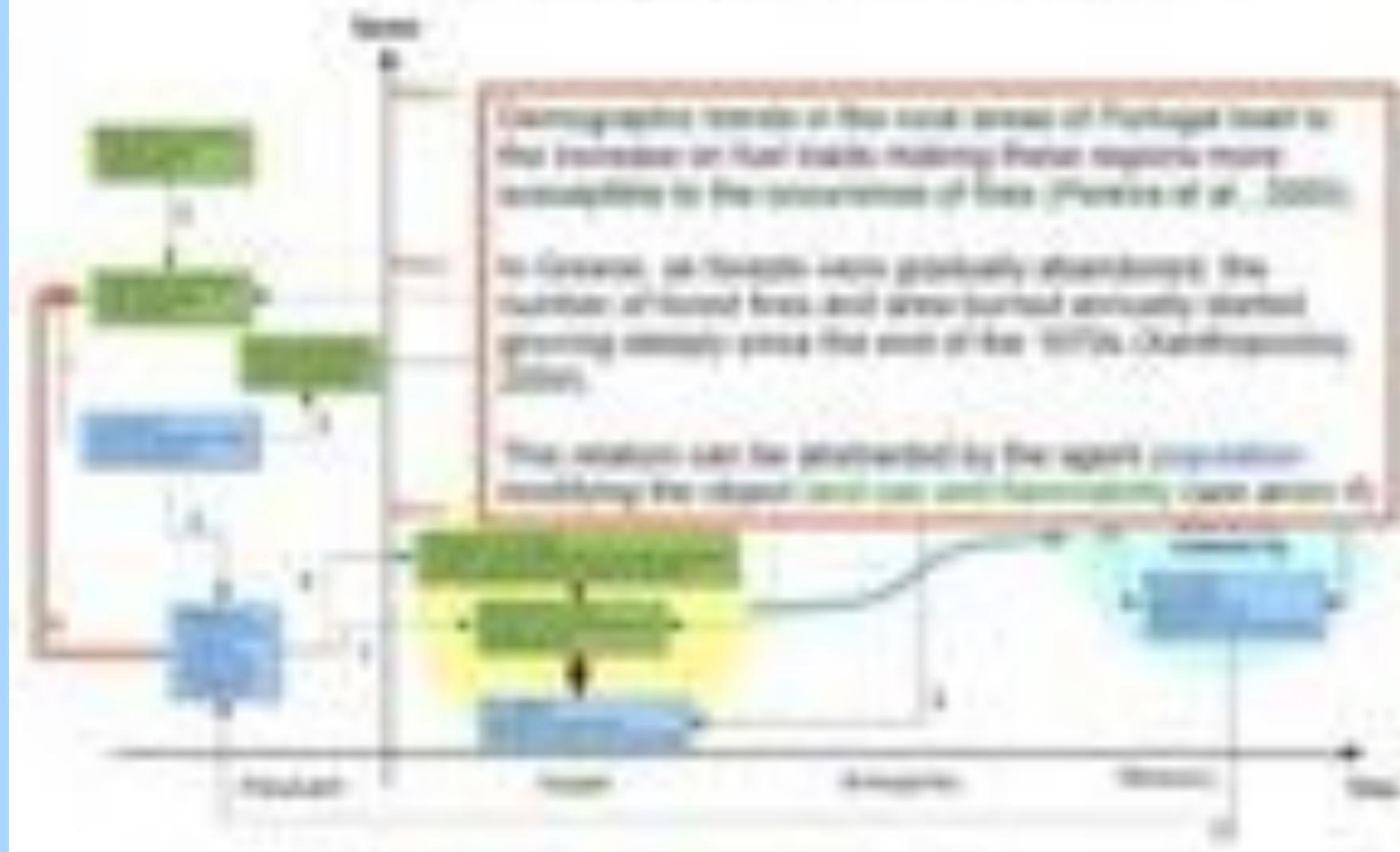
Priority initiative for Climate Impact Research

## Forest fires in a Mediterranean context





## Forest fires in a Mediterranean context



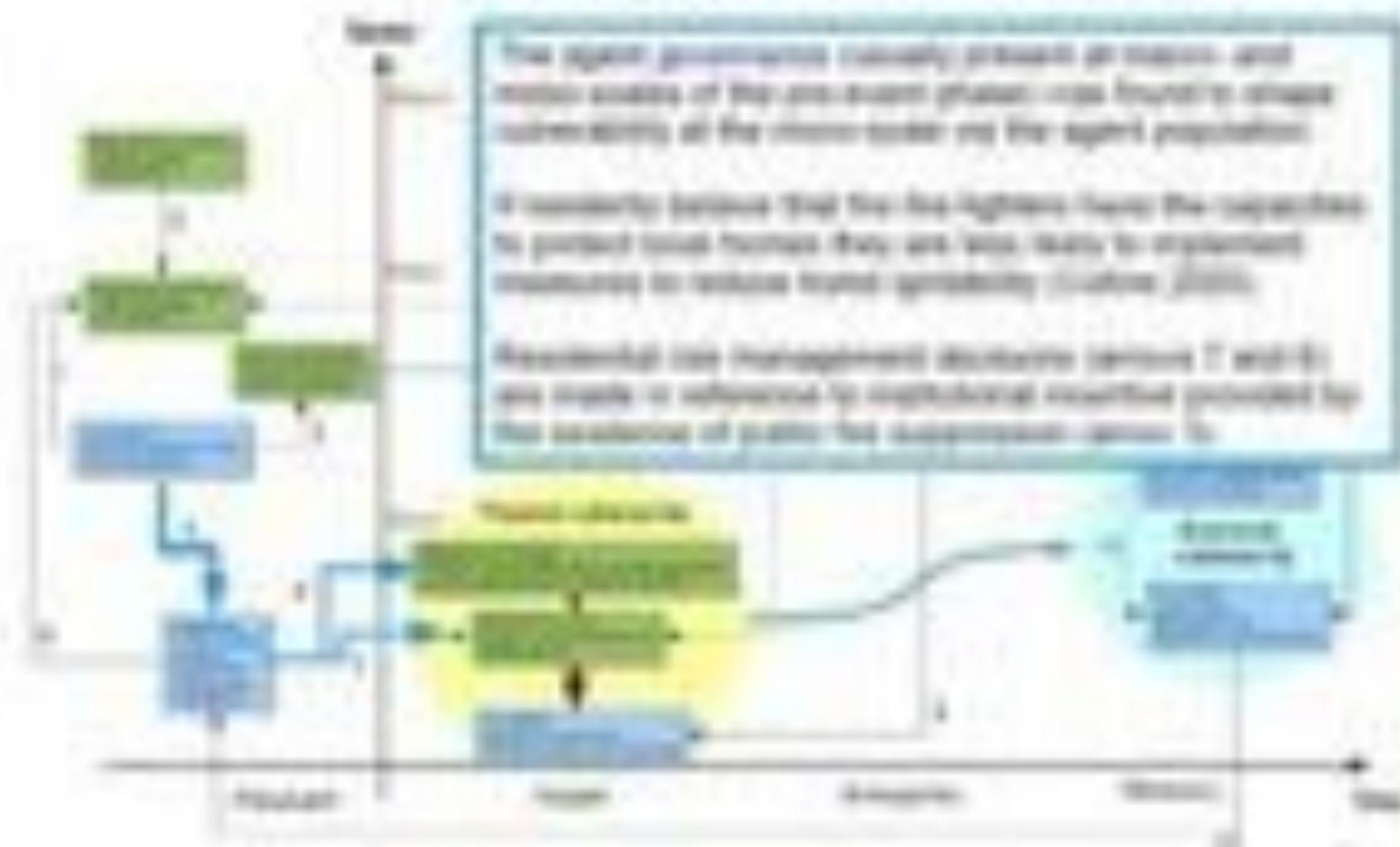


6th Framework Program

FP6

Priority initiative for Climate Impact Research

## Forest fires in a Mediterranean context





Let's Forest, Let's Live

EU FP7

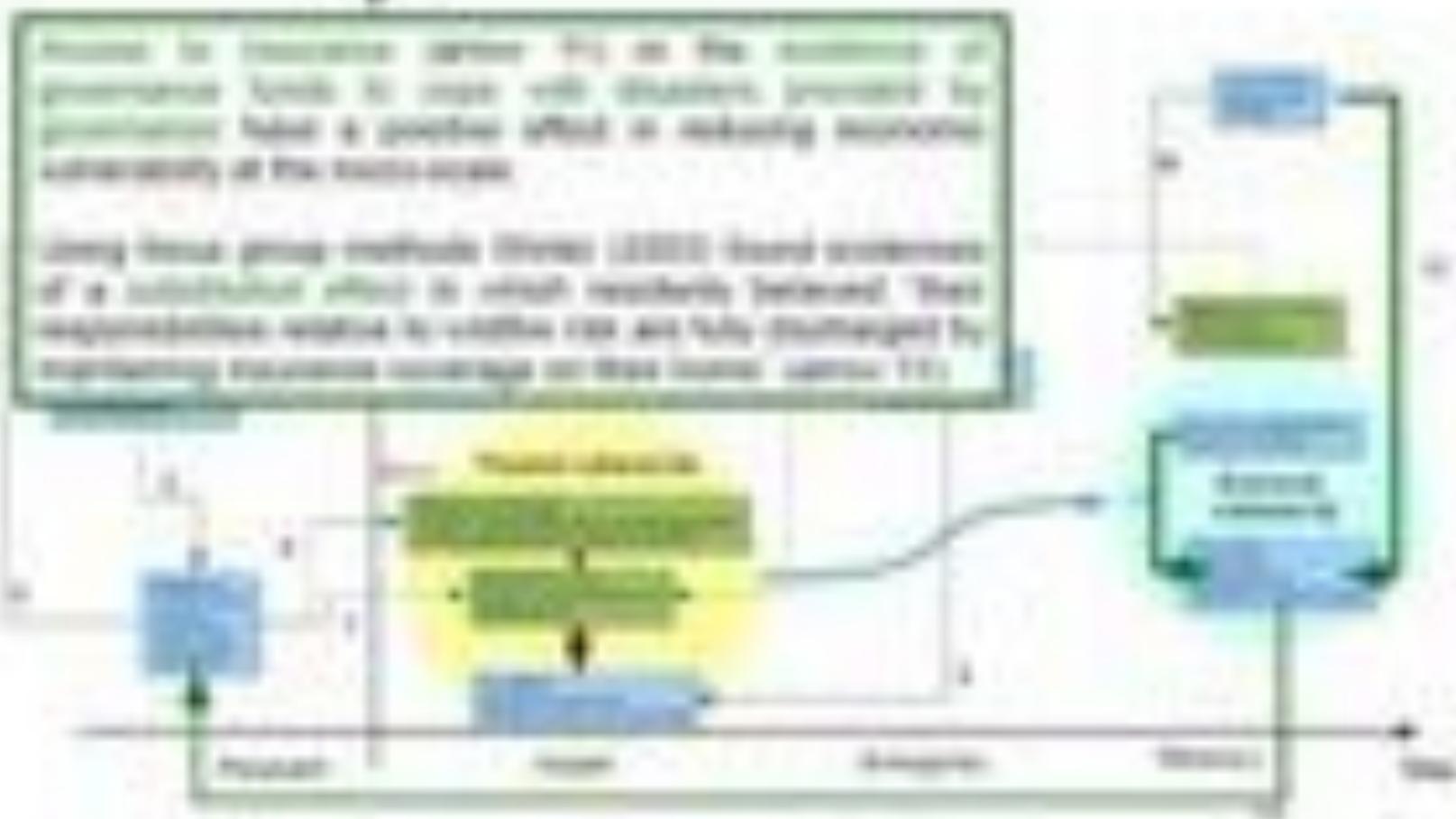
Future research for Climate Impact Research

## Forest fires in a Mediterranean context

Project funded by the European Union FP7 (2007-2013) under the contract number 226457

Topic 6

6





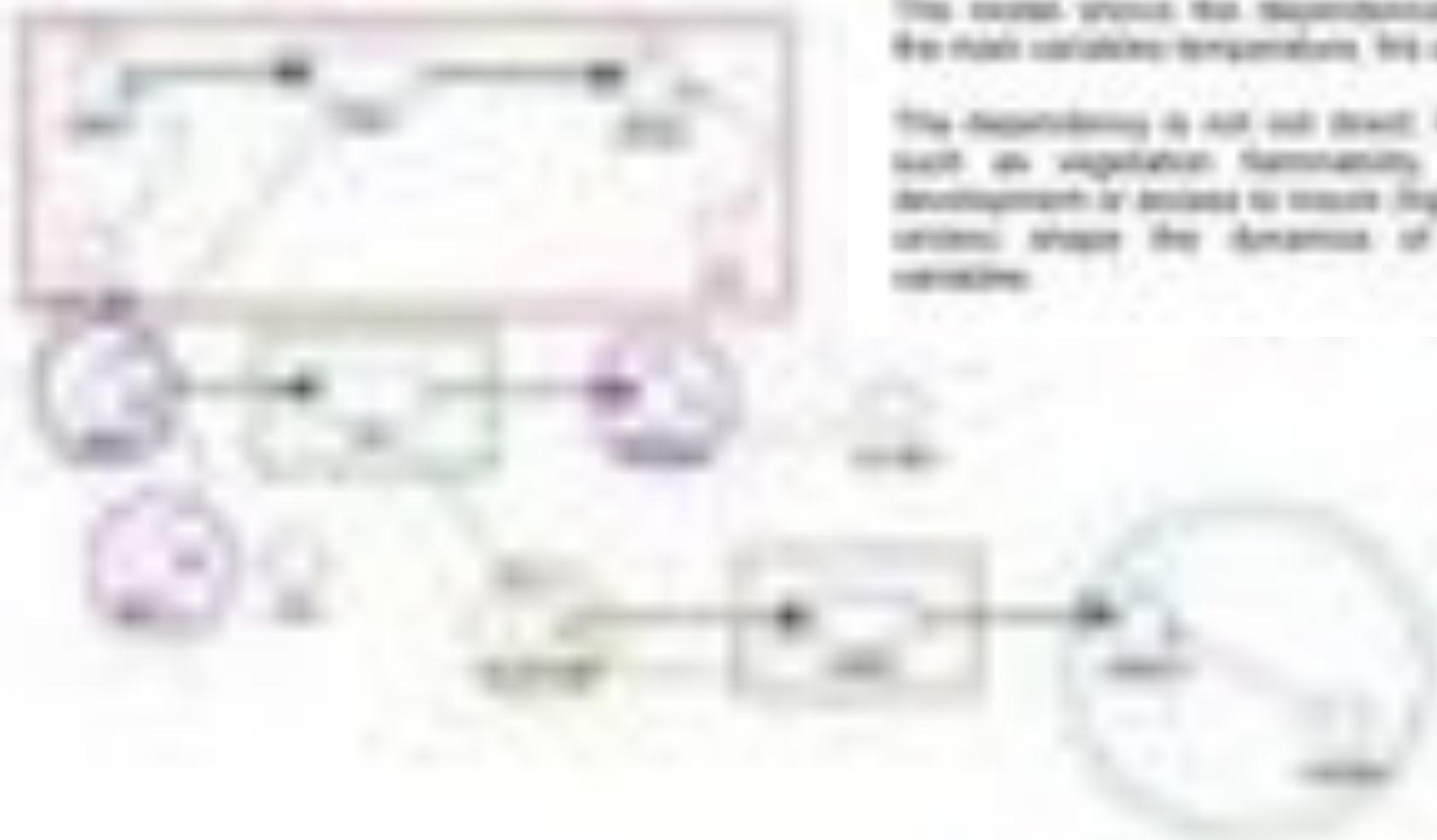
Let's extend Jäger-Knapik



Future methods for Climate Impact Research

The model shows the dependencies between the main variables: temperature, fire and forest.

The dependency is not too direct. Parameters such as vegetation flammability, settlement development or access to water (highlighted by circles) shape the dynamics of the main variables.



# Rethinking the entire issues of vulnerability and resilience indicators

## Strengths and limitations of the proposed framework

- Provides information on the most critical situation;
- Addresses the relations among scales and systems
- Identify open questions for research
- Try to operationalise otherwise difficult to “apply” concepts

- The framework cannot contain everything;
- The complexity is inevitably simplified
- Several “cuts” are operated in the connections among systems
- A large room for subjective and even arbitrary judgement is still unavoidable

# The way ahead.....



<http://www.ensureproject.eu/>



Such a methodological effort is inevitably iterative, and requires to be rethought after applications and further improved...