RECIPE 2nd Technical Workshop - Climate Change Impacts in Natural Risk Management and Civil Protection: an operational perspective on new challenges

# Hydraulic and hydrogeological risk and climate change: the approach of the Italian Department of Civil Protection

**Andrea Duro**

11st November, 2020

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# Introducing hydrogeological and hydraulic risk in Italy

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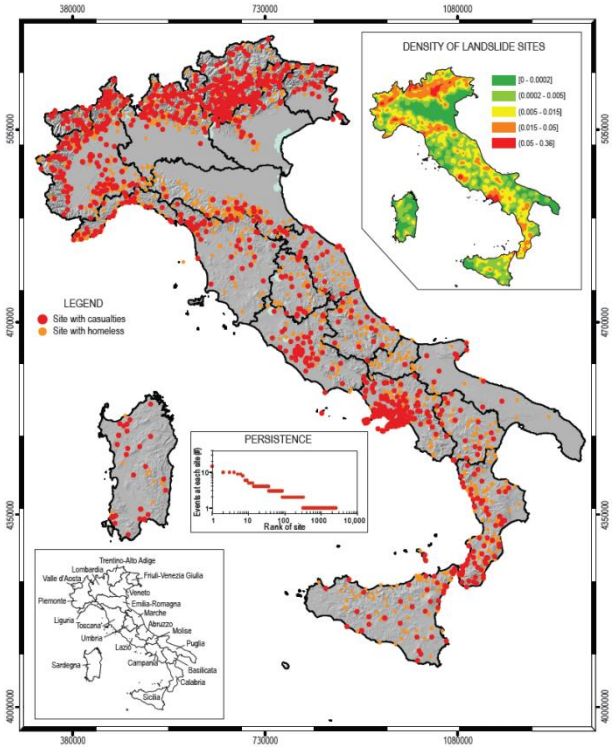
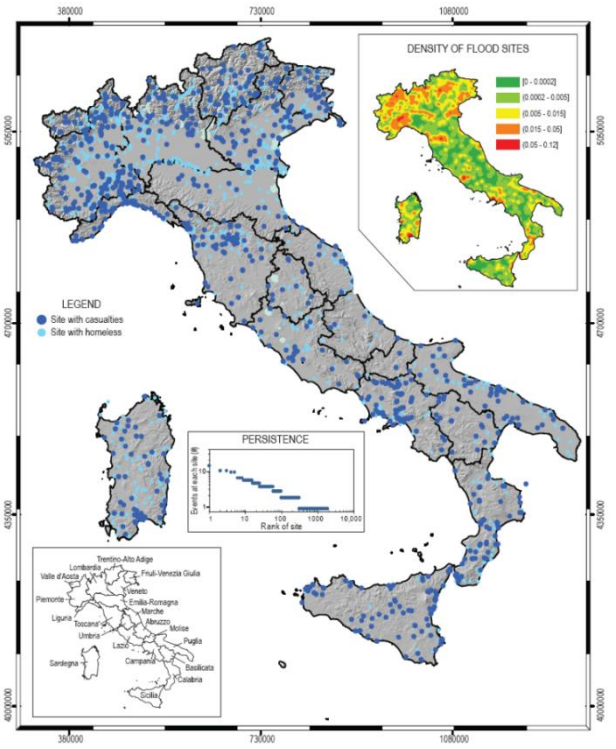
# Societal landslide and flood risk in Italy




Location of 2533 sites affected by **landslide** events with direct consequences to the population. **Period 650-2008**




Location of 1836 sites affected by **floods** events with direct consequences to the population. **Period 590-2008**

Source: Salvati et. al., 2010.

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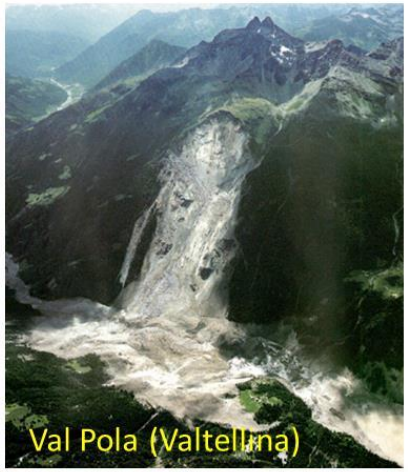
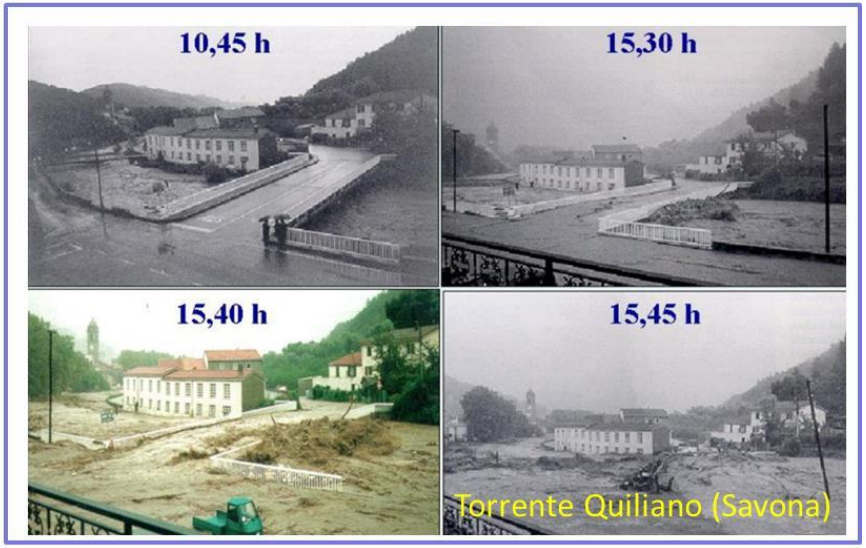
# Different types of hydrogeological phenomena





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# Inappropriate territorial and urban planning


Genova – Via Giotto (2011).

The building was demolished in 2013.

Monzuno (BO)

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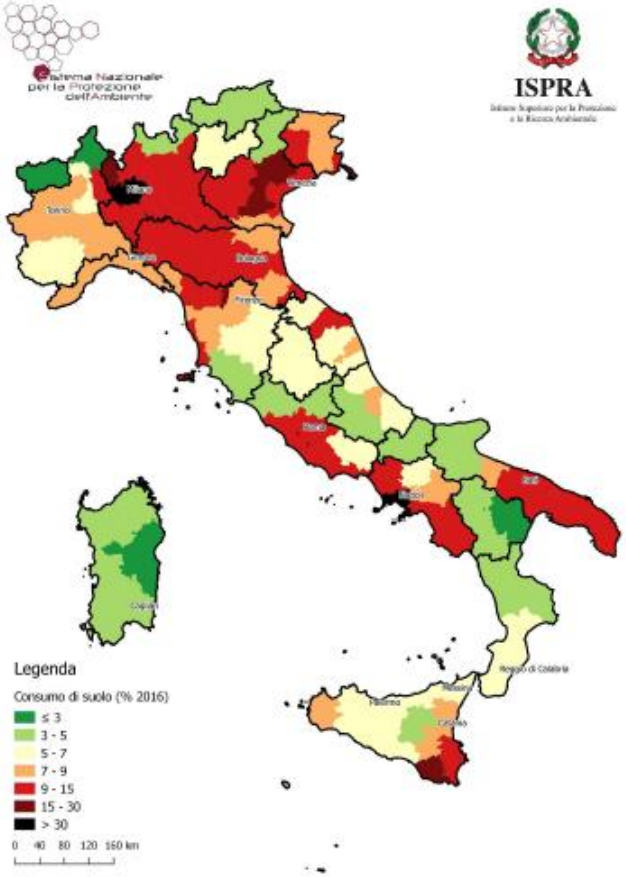
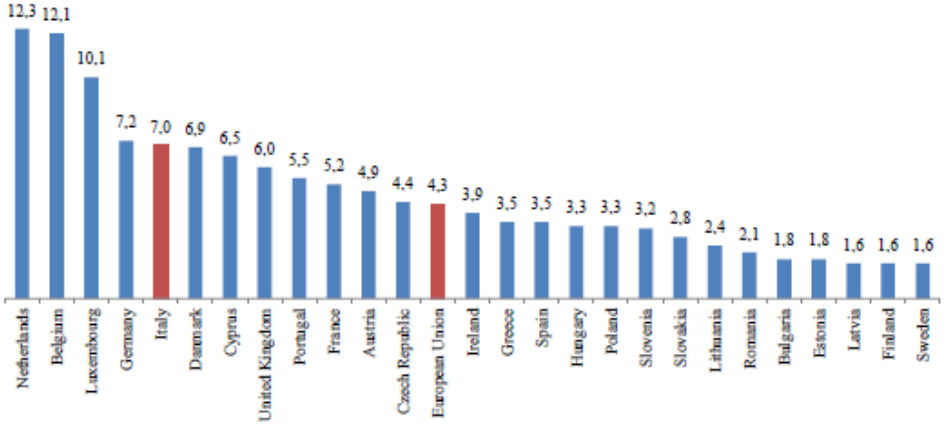
# Soil consumption




Percentage of soil consumption in 2016, on provincial basis. Source: ISPRA, 2017.

Construction of a shopping center in Rome. The same site in 2015 (left) and 2016 (right). Source: ISPRA, 2017.




Percentage of soil consumption in European Countries in 2012. Source: Eurostat in ISPRA, 2017.

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# Urban floodings

Catania, Oct. 2018.
Source: www.severeweather.eu.

Climate change and growing soil sealing will cause an increase of urban floodings.

The cause of urban floodings is the lack or inadequacy of drainage in an urban area.

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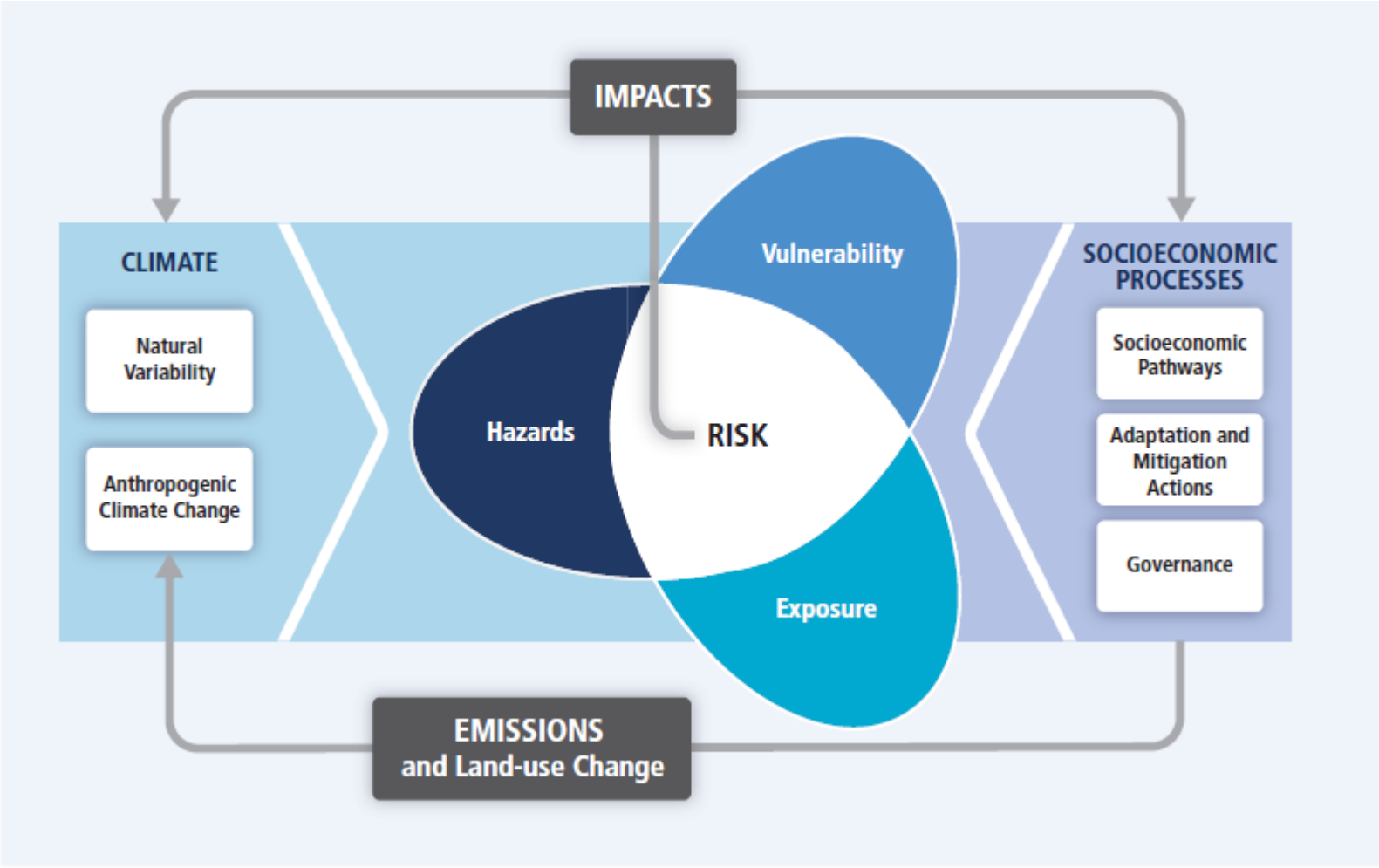
# Climate change and risk




Source: IPCC (2014).

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# The Italian National Service of Civil Protection

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# CIVIL PROTECTION… A SYSTEM

**Civil protection in Italy**
**IS NOT an assigned task to a SOLE ADMINISTRATION**
**BUT a function entrusted to a SYSTEM**

Such system is the **"National Service of civil protection"**
**Coordinated by the Department of civil protection**

**Established with law no. 225 of 1992 and today regulated in compliance with the Code of civil protection - D. Lgs. no. 1 of 2 January 2018**

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# OPERATIONAL STRUCTURES

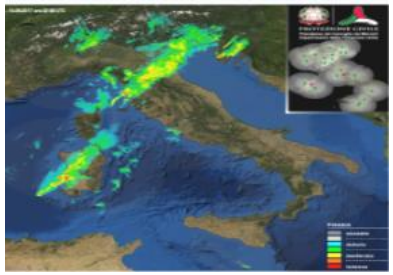
- National Fire Fighters
- Armed Forces
- Police Forces
- Research boards and institutes
- National Health System
- Voluntary work, Red Cross, National alpine and cave rescue service.
- National Environment Protection System (ISPRA)
- National Weather Service network
- Regions with their own operational structures
- Others (private companies, national registers of engineers, geologists etc.)

# COMPONENTS

- State
- Regions and Autonomous Provinces
- Territorial public authorities

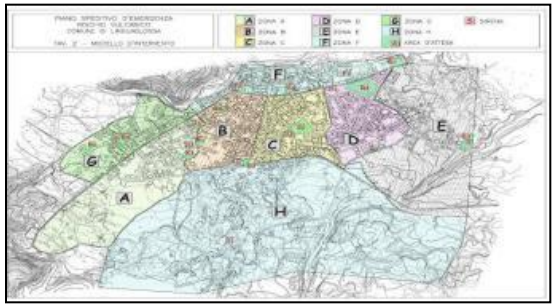

# ACTIVITIES AND TASKS OF CIVIL PROTECTION

d.lgs. 1/2018 - art. 2



## Prediction

Set of activities aiming at identifying and studying possible risk scenarios (**probabilistic terms**)



## Prevention and mitigation

Non-structural activities

- Civil protection planning
- Training
- Drills - Exercises
- Information to the population
- Alert systems
- Application of technical regulations

Structural activities: organization and implementation of prevention politics

## Emergency management

Integrated and coordinated set of measures and interventions for assistance and rescue

## Overcome of the emergency

Removing obstacles for the recovery of normal conditions

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# Hydraulic and hydrogeological risk: some case histories

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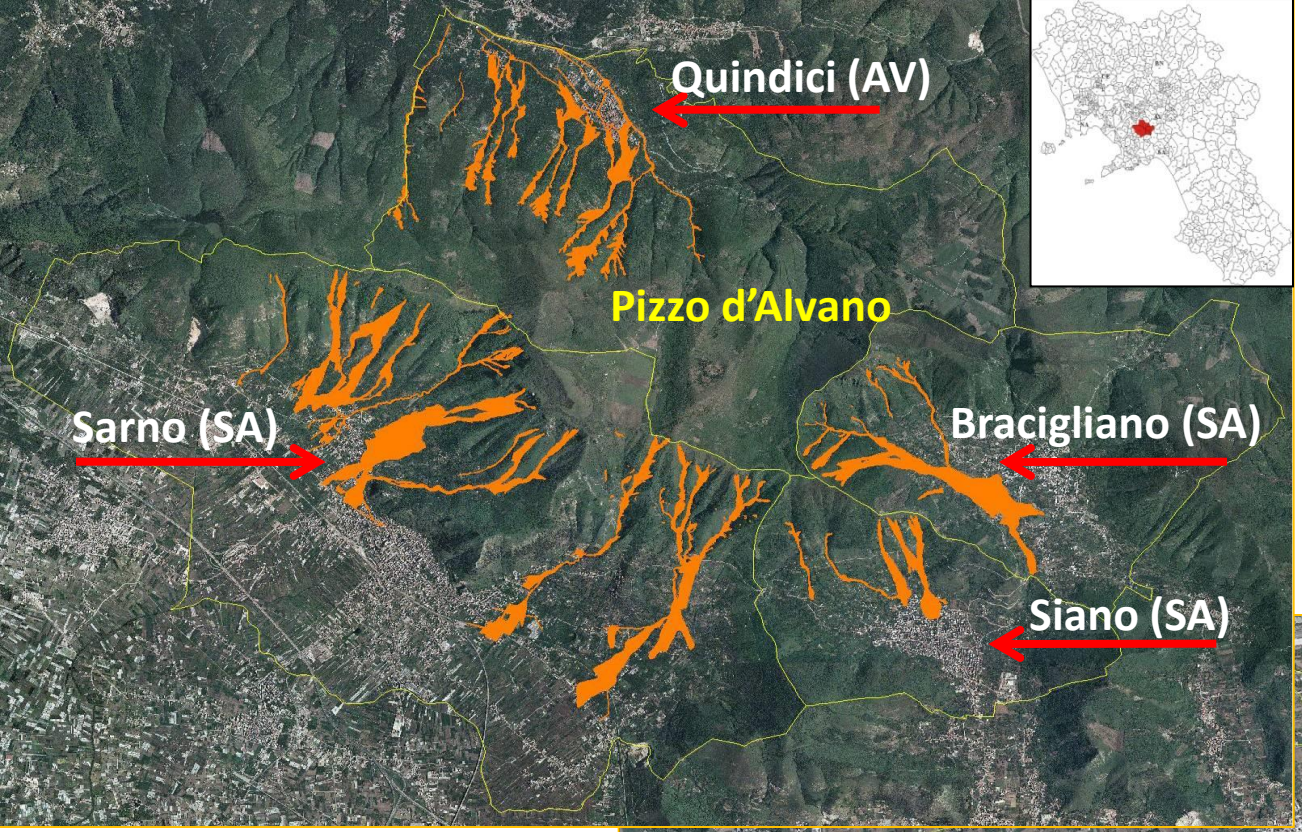
# Sarno - May, 5th – 6th 1998

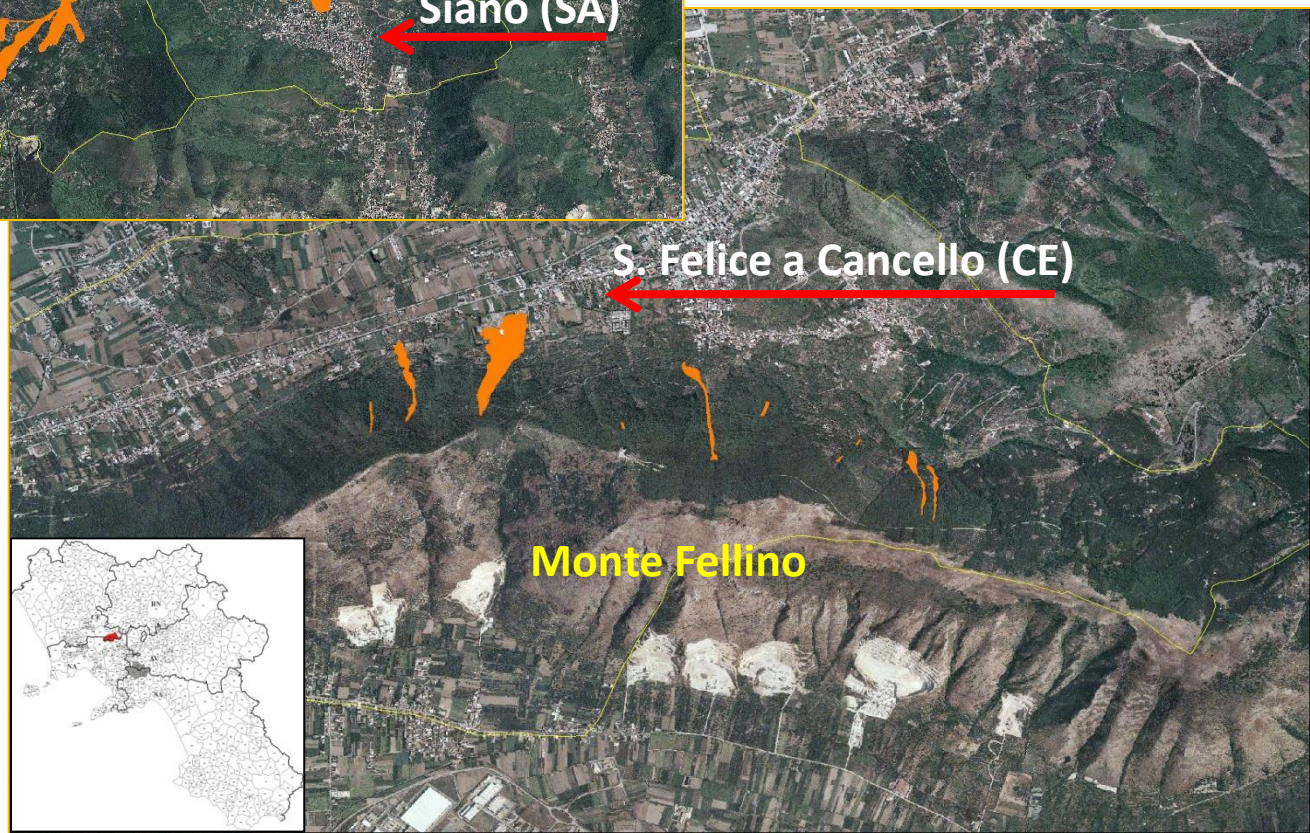



# Sarno - May, 5th – 6th 1998

**240-300** mm/72 hours

**150** Landslides in less than 10 hours

**2** Mmc of pyroclastic material




**160 fatalities**

60 kmq - 42 catchments

154 destroyed buildings

397 unfit buildings

126 partially unfit buildings

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# Soverato – September, 10th 2000

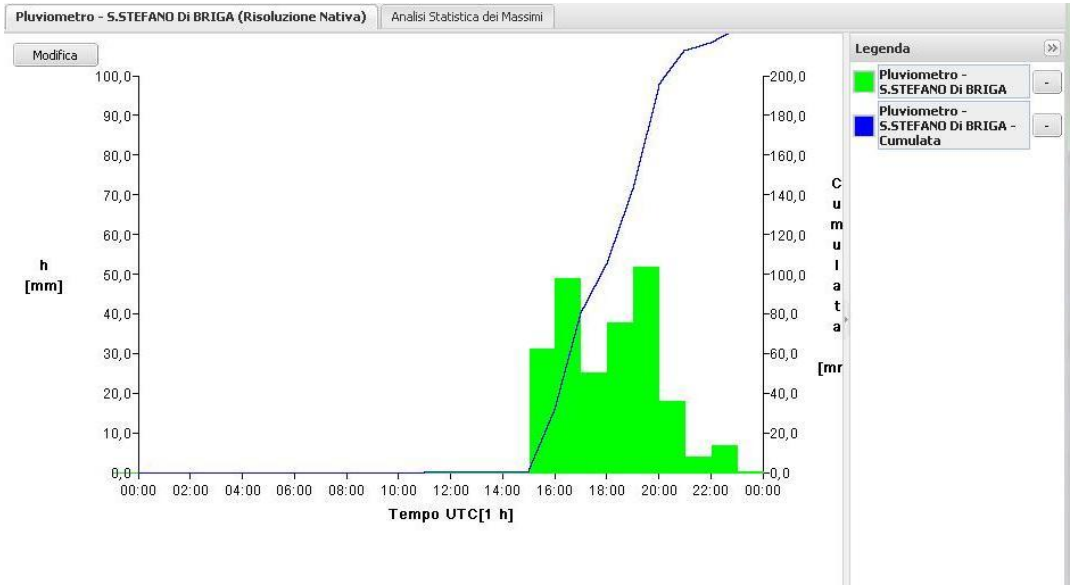

**600 mm** in 72 hours (8-10 settembre 2000)

**Overflowing of Beltrame Creek**,

**13** fatalities

Source: *CNR-IRPI*

# Messina – October, 1st 2009



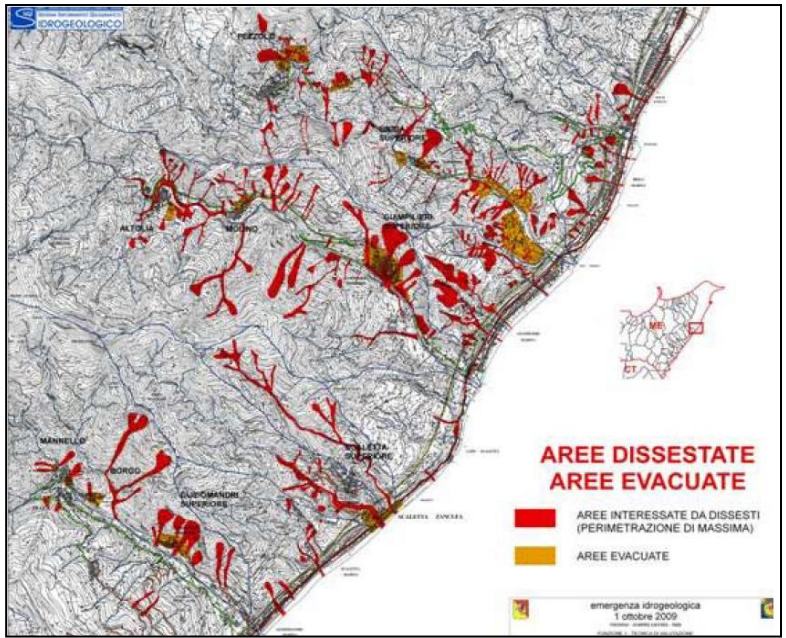

37 fatalities

50 kmq interested by landslides

Mudflows and debris/mudflows

Areas interested by landslides

Evacuated areas



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# Messina – October, 1st 2009

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# Messina – October, 1st 2009

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# Atrani – September, 9th 2010

Flash flood

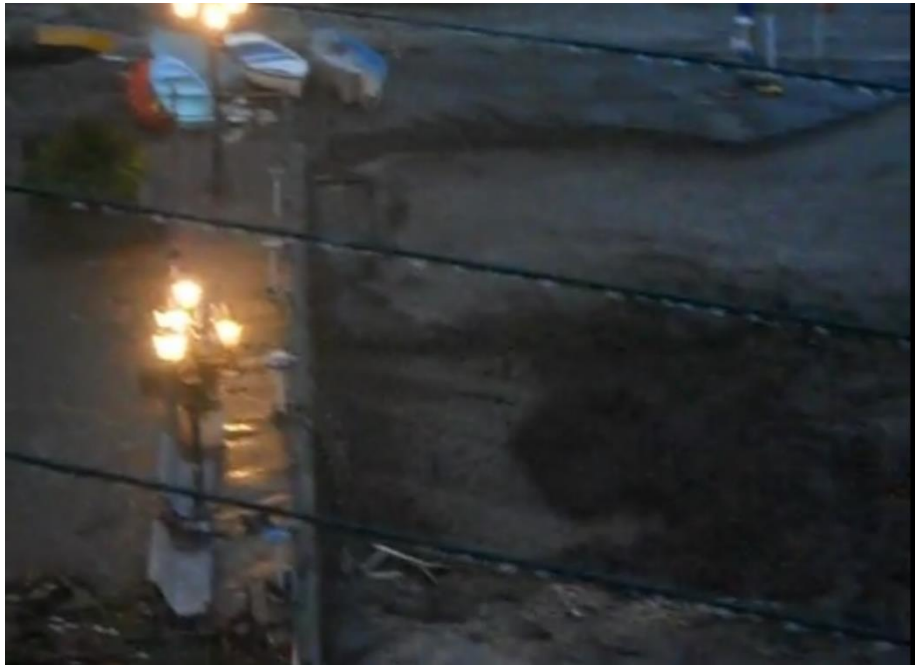
Catchment: 9 kmq

Duration of the event: 1 h

Intensity rainfall peak: 120 mm/h

Mobilized volume: 25.000 mc

One person died during the event.



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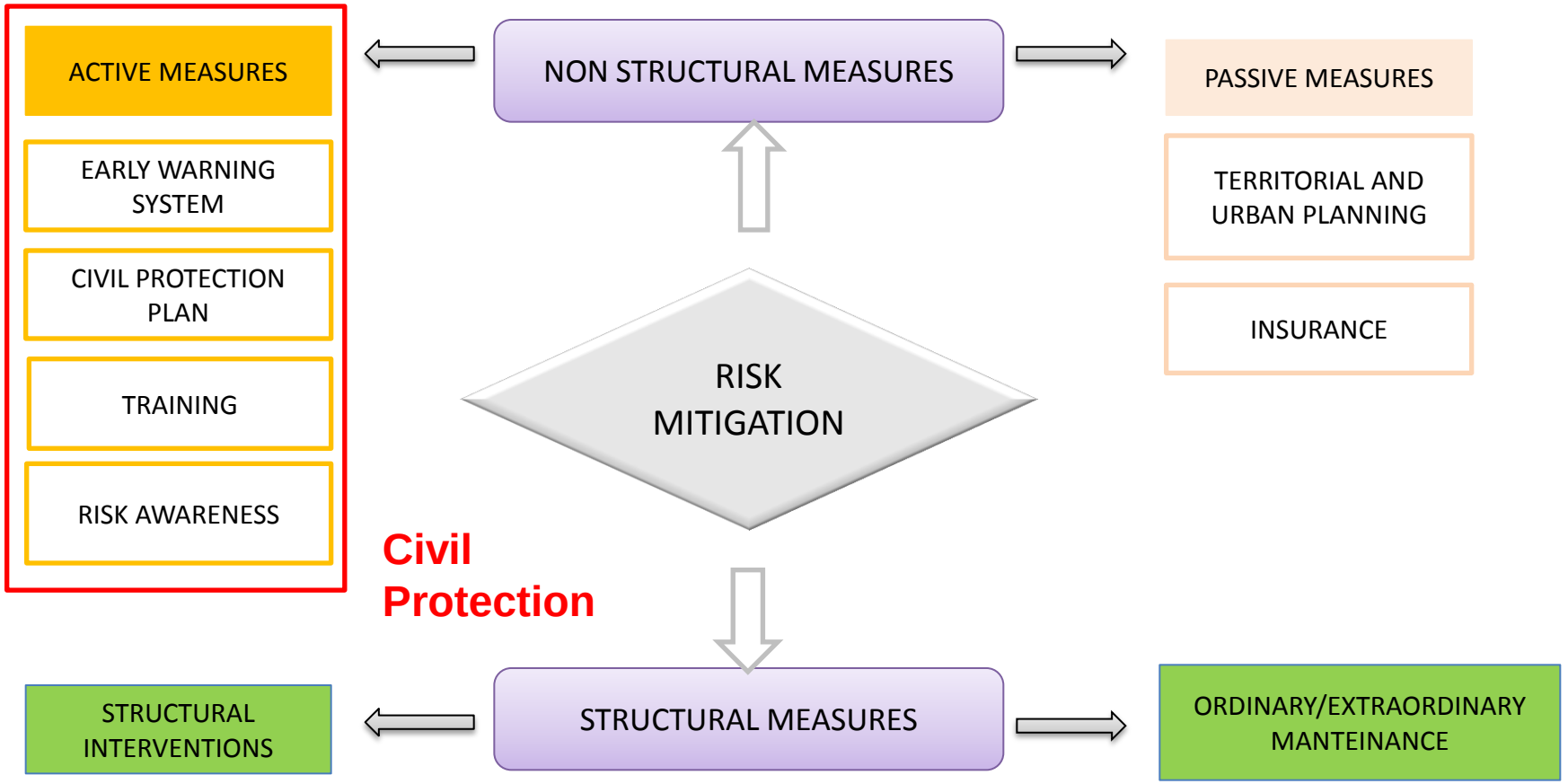
# Reducing hydrogeological and hydraulic risk: a civil protection perspective

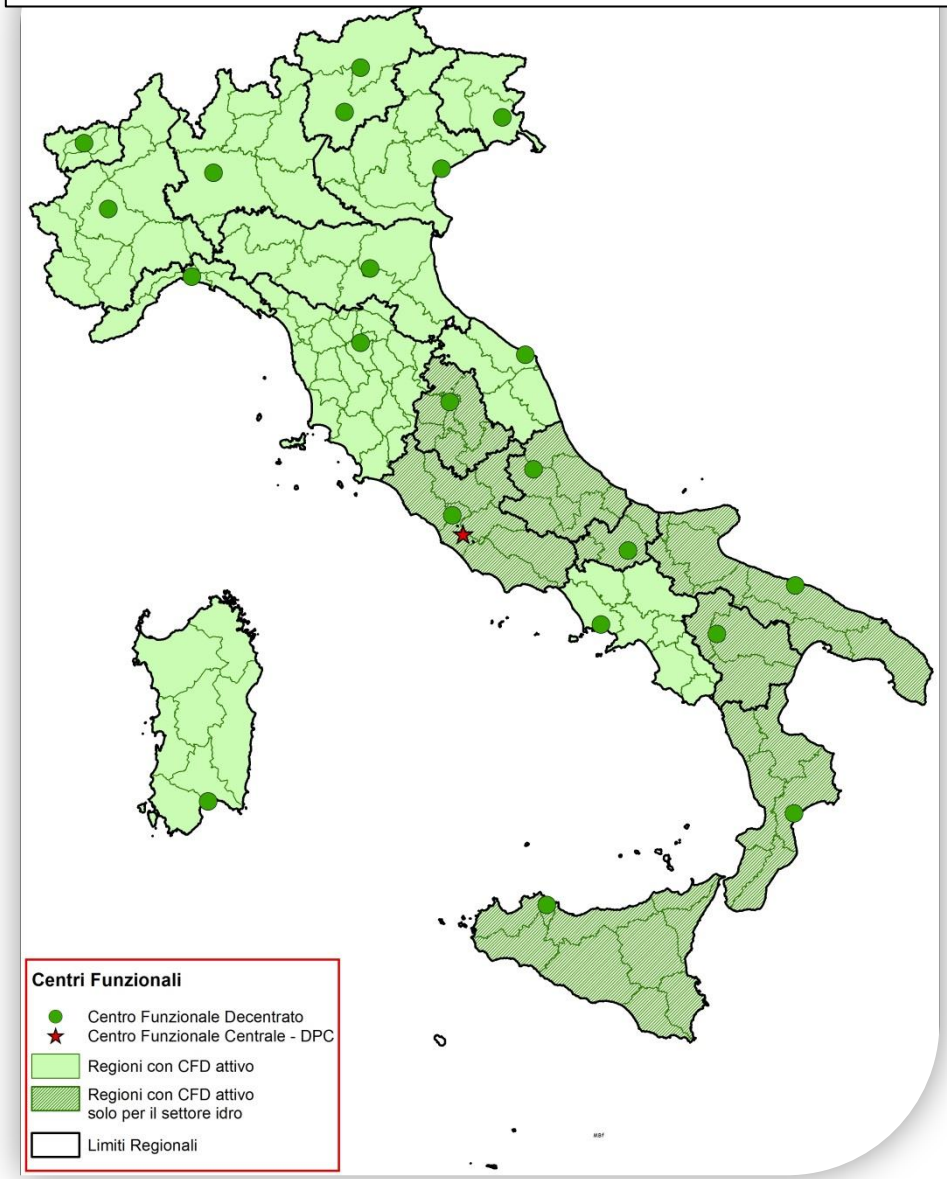
# Hydrogeological and Hydraulic risk Mitigation measures



# THE ITALIAN EARLY WARNING SYSTEM

The national **early warning system for hydrogeological and hydraulic risk** is managed by the **Civil Protection Department** and all the **Italian Regions** through the **Centres for Forecasting and Survaillance network**

**Dir. P.C.M. 27/02/2004**




## TASKS

- ❑ Announcement, monitoring and survaillance of risk scenarios in real time
- ❑ Declaration of the expected severity levels
- ❑ Warnings → activation of operative response in real time at different territorial levels

2 phases

1. FORECAST
2. MONITORING AND SURVAILLANCE

2 areas

1. METEOROLOGICAL
2. HYDROGEOLOGICAL AND HYDRAULIC

National centres for forecasting and monitoring network


FORESEEN SEVERITY LEVELS

NO significant phenomena foreseeable

ordinary

moderate

high

REGIONS

**ALERT LEVELS**

YELLOW Alert

ORANGE Alert

RED Alert

On-site assessment and local early warning system

MUNICIPALITIES

ACTIVATION OF OPERATIONAL PHASES as foreseen in the MUNICIPAL EMERGENCY PLAN

**Attention**

**Pre-alarm**

**Alarm**

CITIZENS

**Self-protection rules**

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# The relevance of risk awareness

IO NON RISCHIO
BUONE PRATICHE DI PROTEZIONE CIVILE

Io non rischio – I don't take risks is a national communication campaign on best practices of civil protection.


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# IT - Alert

New technological platform
For Early Warning System

A system working in order to reach all mobile phones connected to the cell of an area affected by a specific natural risk to alert citizens connected to that cell.

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# Towards resilient communities

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# The risk equation: the "classical" version

$$R = H \; x \; E \; x \; V$$

**R = risk**
Means the expect number of lives lost, persons injured, damage to property, or disruption of economic activity due to a particular phenomenon.
**H = Natural hazard**
Means the probability of occurrence of within a specific period of time and within a given area of a particularly damaging phenomenon.
**E = Elements at risk**
Means the population, properties, ecomomic activities, including public services, etc., at risk in a given area.
**V = vulnerability**
Means the degree of loss to a given element or set of elements at risk, resulting from the occurrence of a natural phenomenon of a given magnitude. It is expressed on a scale from 0 (no change) to 1 (total loss).

Source: Varnes, 1984.

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# The risk equation: an update

$$R = f\,(H, E, V, C)$$

**R = disaster risk**
The potential loss of life, iniury, or destroyed or damaged assets which could occur to a system, society, or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.

**H = hazard**
A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

**E = exposure**
The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

**V = vulnerability**
The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

**C = capacity**
The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience.

Source: UNDRR, UNGA, 2016.

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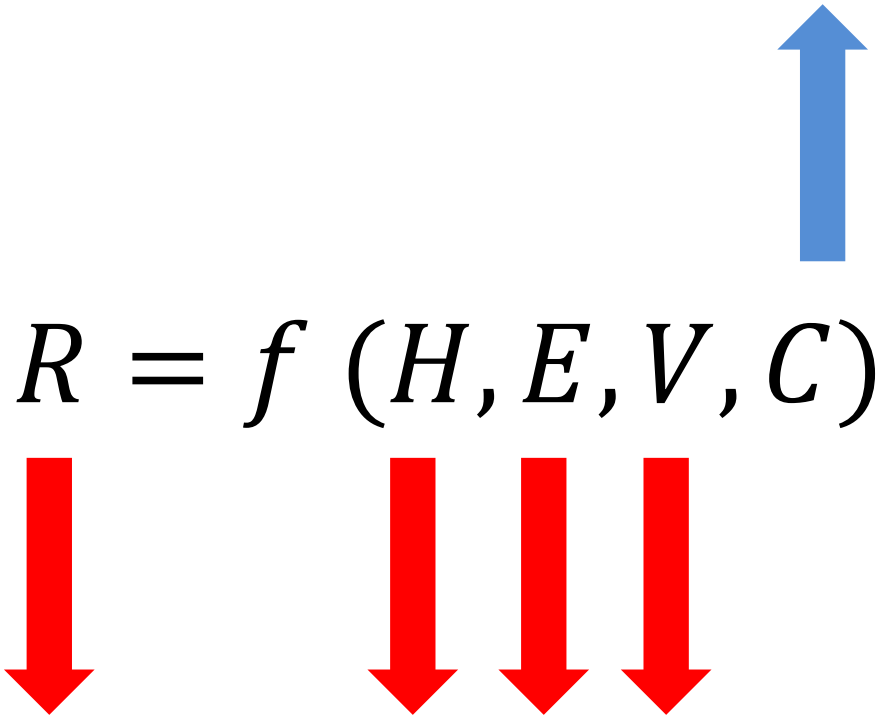
# How to reduce risk?



$$R = f\,(H, E, V, C)$$

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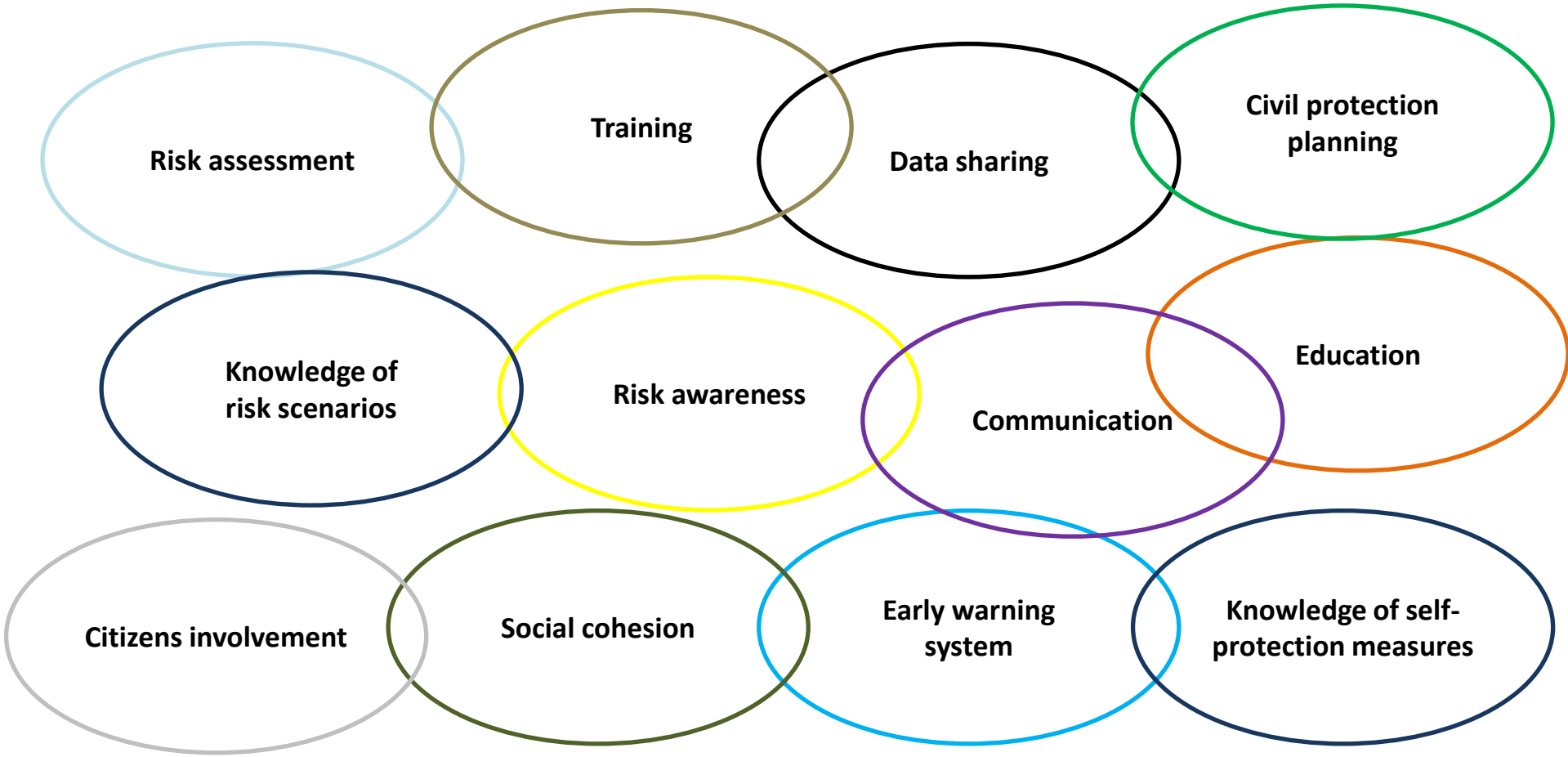
# The C factor

**C increases with:**



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# New operational needs

| | | |
|---|---|---|
| Better meteorological and nowcasting models | → | Enhanced early warning systems |
| Real-time integration of instrumental data e non instrumental data | → | Improved monitoring tools |
| In-depth knowledge of event and risk scenarios | → | Better civil protection planning |
| Increase of risk awareness among the population | → | Wide adoption of self-protection rules |
| Strengthening of cooperation among institutional actors | → | Enhancement of the efficiency of the civil protection action |

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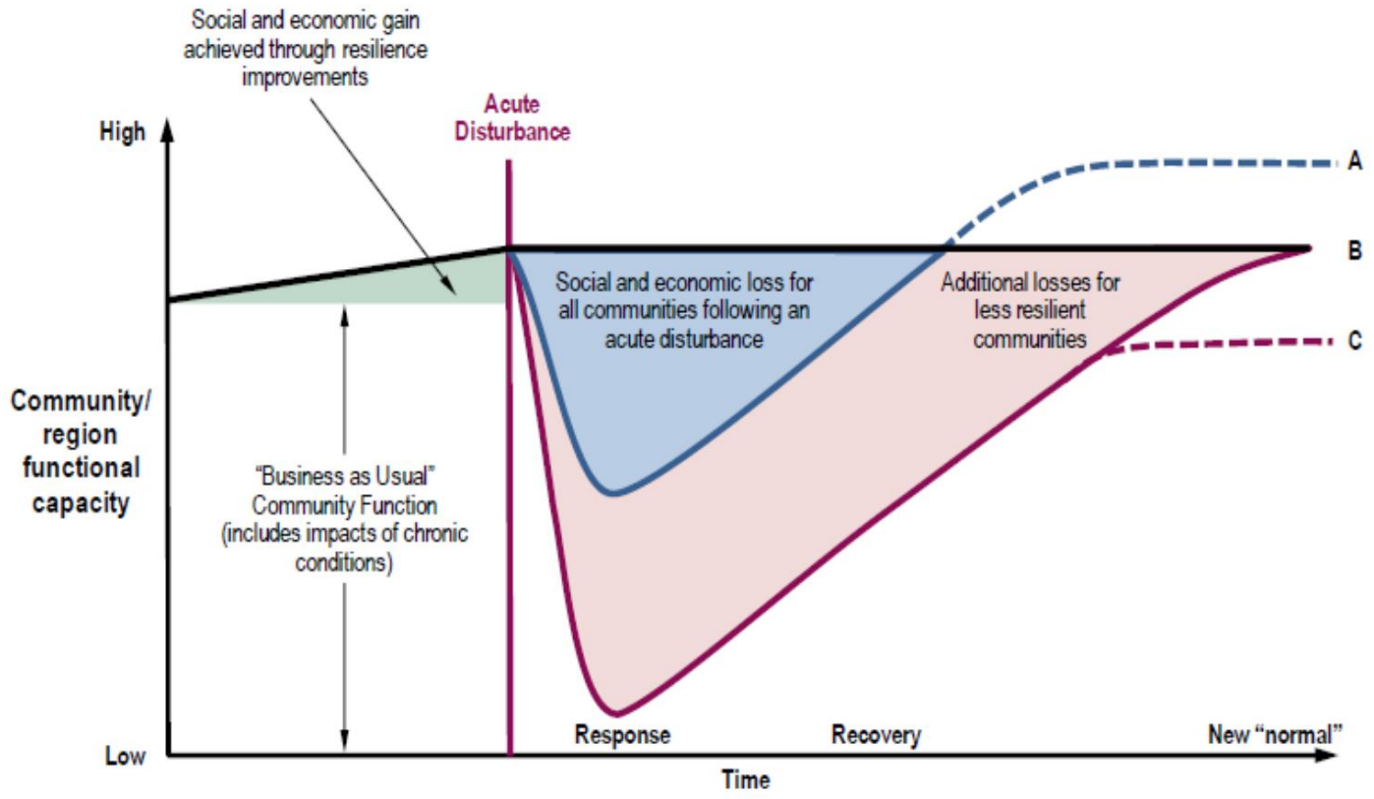
# The Resilience Loss Recovery Curve



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# The Climate divide

Hurricane Sandy, New York, October 2012. Source: Pinterest.

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Thank you for attention!

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