BRISEIDE Training Package

Level 1: Background knowledge

Module: Risk Management

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BRISEIDE

RISK MANAGEMENT

The creation and evaluation of options for initiating or changing human activities or natural and artificial structures with the objective of:

- increasing the net benefit to human society and
- preventing harm to humans and what they value;

and the implementation of chosen options, and the monitoring of their effectiveness.

(International Risk Governance Council, 2006)

Level 1: Background Knowledge Module: **R**isk **M**anagement

COURSE OUTLINE

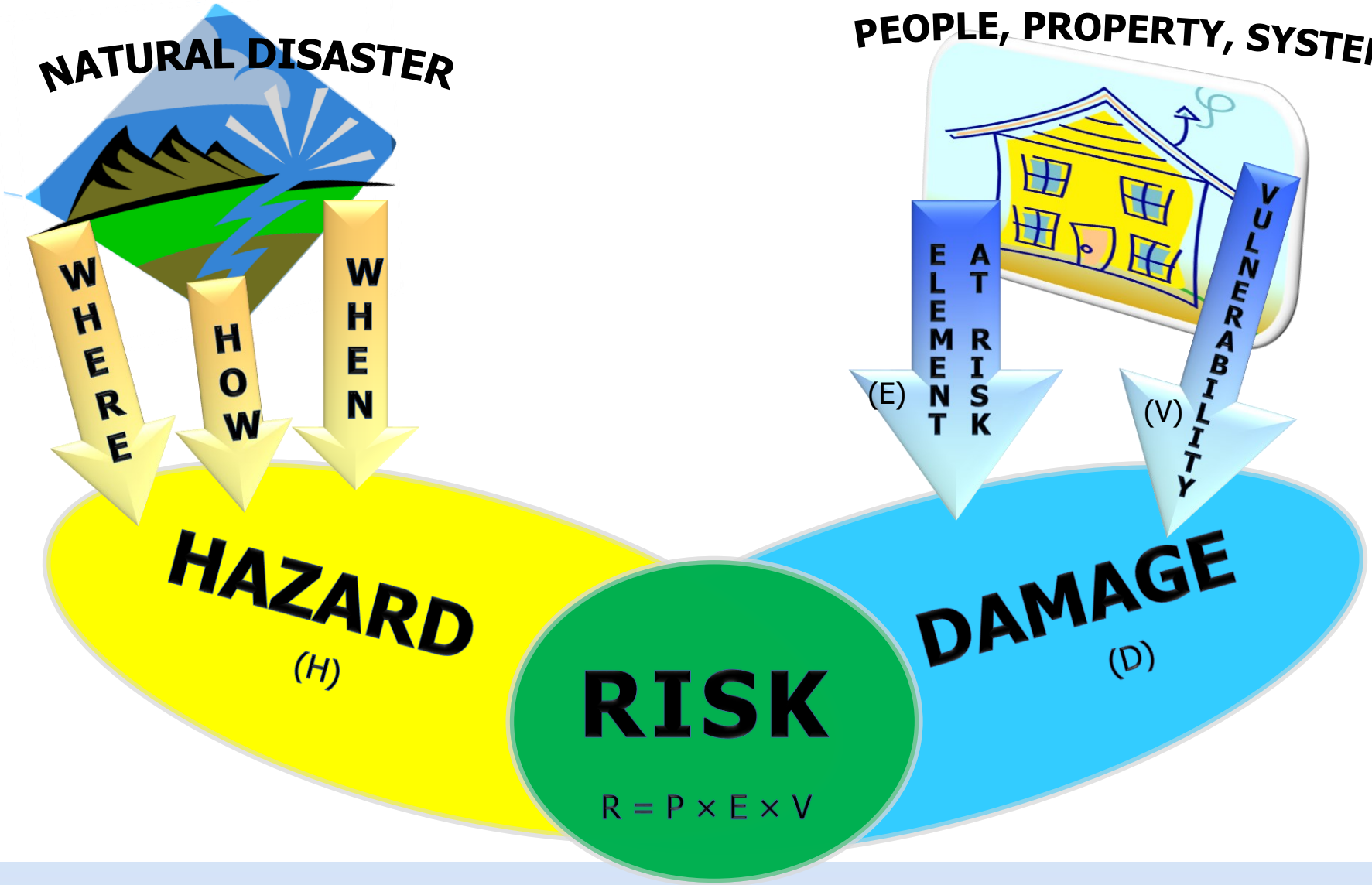
to know	• Module 1: key definition of natural risk • *RISK ASSESSMENT*
to deal with	• Module 2: risk management theoretical background • *RISK TREATMENT*
to manage	• Module 3: methods and processes of risk management
to practice	• Module 4: case studies

Module 1

to know risk

key definition of natural risk

RISK ASSESSMENT SCHEME



NATURAL DISASTER

Any natural event causing a serious disruption of the functioning of a community or a society with widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope with, using its own resources

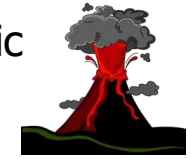
NATURAL DISASTER TYPOLOGIES

- Seismic:
  - Earthquake

  - Tsunami

- Hydrogeological:
  - Flood
  - Landslide
  - Coastal erosion
  - Subsidence
  - Avalanche

- Volcanic



- Meteorological:
  - Cyclone
  - Tornado
  - Hurricane
  - Winter storm
  - Heat wave

- Climate changes
  - Drought

  - Sea level rise

- Forest fire

natural hazard: COMPONENTS

WHERE: **SUSCEPTIBILITY**

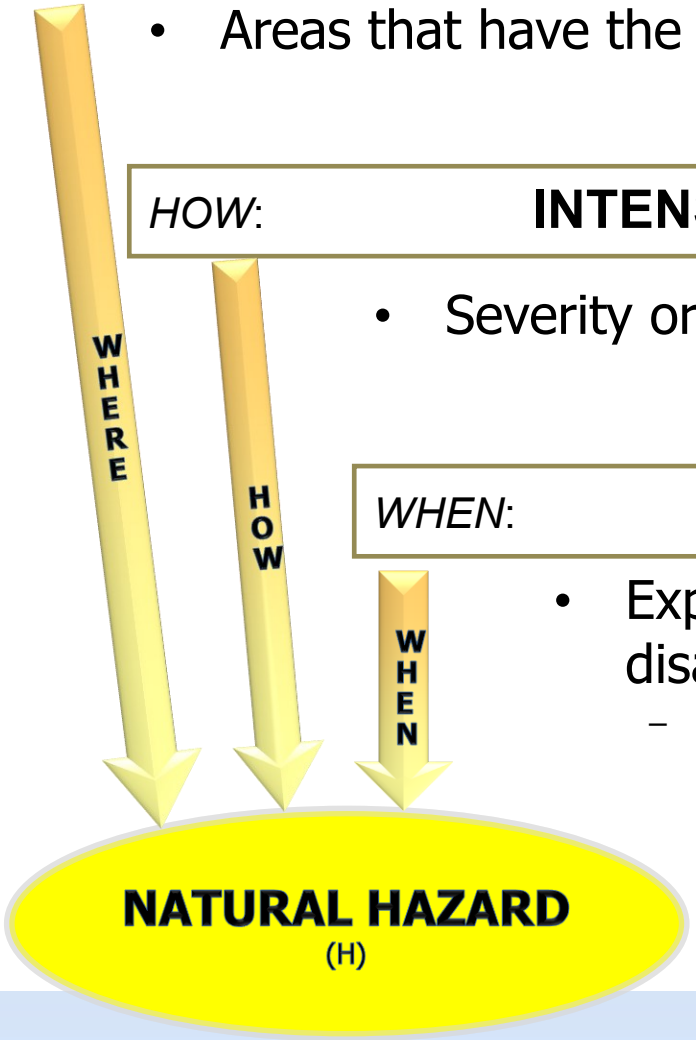
- Areas that have the potential for occurrence of natural disaster

HOW: **INTENSITY - MAGNITUDE**

- Severity or damage-causing potential of a natural disaster

WHEN: **RETURN PERIOD**

- Expected time interval of recurrence of a natural disaster
  - It can be expressed as return time of an event or annual probability



NATURAL HAZARD

- Probability that a natural disaster, with a given intensity, may occur in a specific time and area
  - Hazard has to be referred to a well defined intensity:

$$H = H(I)$$

ELEMENT AT RISK

- Population,
- properties,
- assets,
- public services,
- cultural heritage,
- environmental goods

  sited in an area

  exposed to hazard

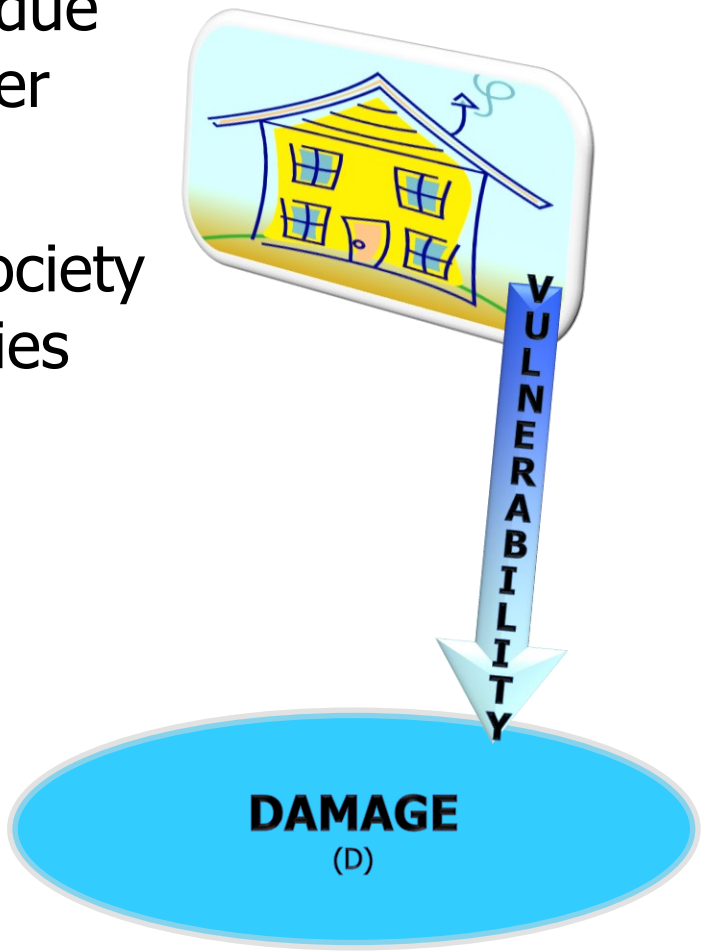
VULNERABILITY

- Degree of loss produced on a specific element or group of element at risk due to the occurrence of a natural disaster

- Vulnerability is the propensity of a society to experience disruption and casualties as a result of a natural disaster

  – The vulnerability should be expressed
  by a scale starting from 0 (no loss) to 1 (total loss)
  related to Intensity of the event and
  Element at Risk typology:

  $$V=V(I;E)$$

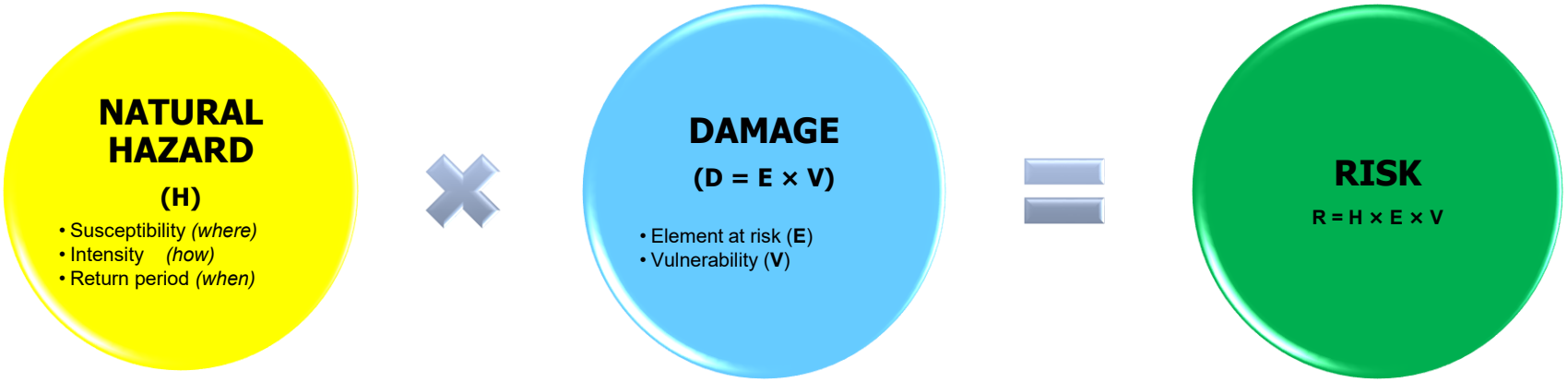


DAMAGE

- The amount of destruction or damage, either in health, financial, environmental functional and/or other terms as a consequence of an occurred natural disaster
  - It is commonly expressed in “economic loss” / “death toll”

NATURAL RISK
(R = H × E × V)

- Combination of the probability or frequency of occurrence of a defined natural disaster and the magnitude of the consequences of its occurrence
  - More specifically, risk is defined as the probability of harmful consequences, or expected loss (e.g. lives, injured people, property, livelihoods, economic activity disrupted or environment damaged) resulting from natural hazards



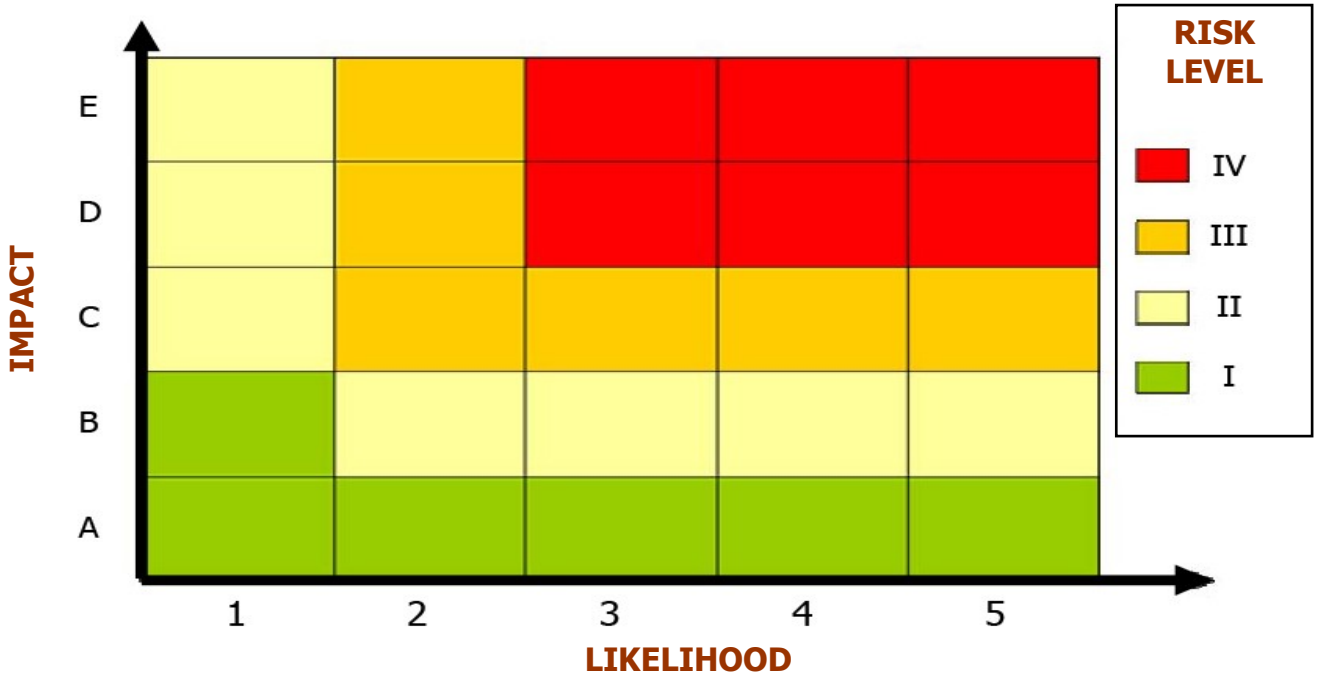
RISK ASSESSMENT

1) Risk **identification**, is the process of finding, recognizing and describing risks
2) Risk **analysis**, is the process to comprehend the nature of risk and to determine the level of risk
3) Risk **evaluation**, is the process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its intensity is acceptable or tolerable

*Risk Assessment could lead to **qualitative** or **quantitative** evaluations …*

QUALITATIVE RISK ASSESSMENT

- RISK MATRIX
  - Relates the two dimension likelihood and impact. It is a graphical representation of **risk level** in a comparative way
  - The matrix is used as a visualisation tool when multiple risks have been identified to facilitate comparing the different risks



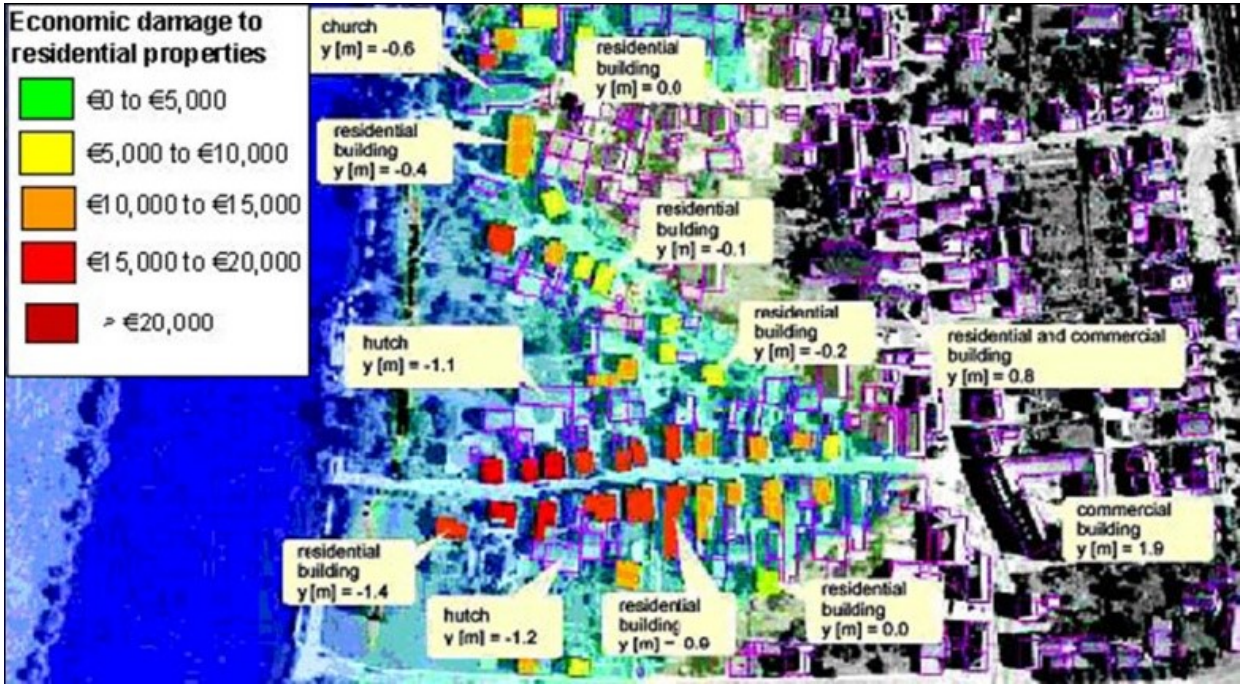
QUANTITATIVE RISK ASSESSMENT

- Measuring single elements

$$R = H \times E \times V$$

leads to quantify risk and treat them as values

- values are commonly expressed as economic loss

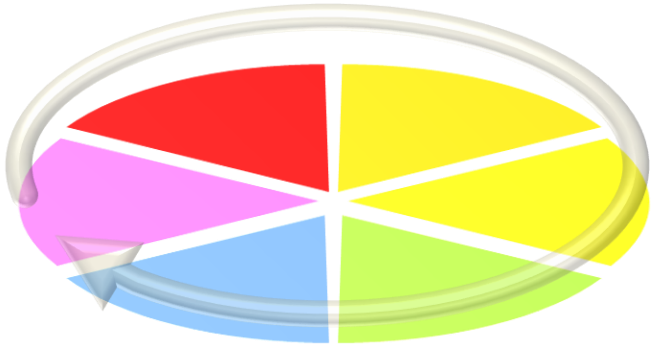


Module 2

to deal with risk

risk management theoretical background

RISK MANAGEMENT



- **R**isk **M**anagement is a **cycle**
  - Every step depends on the previous and affects the following
  - **R**isk **M**anagement acts as a chain: weak rings could break the process, thus each step needs to be well developed
  - In each step the system improve its capacity to face problems

RISK MANAGEMENT CYCLE

RISK ANALYSIS

- Risk assessment
  - Qualitative or quantitative analysis of risk related to a specific hazard

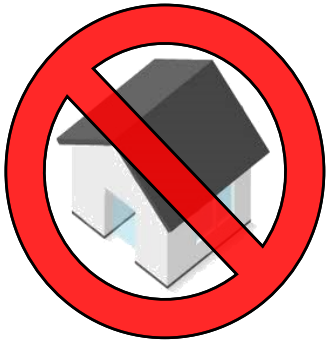
- Risk scenarios
  - A synoptical collage of an event, or series of actions and events, to test strategies against uncertain future developments

- Residual risk
  - The risk that remains in unmanaged form after an event, even when effective disaster risk reduction measures are in place

PREVENTION

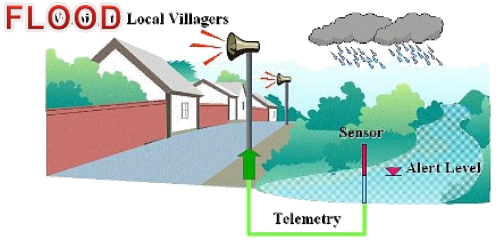
- Land use planning
  - A multidisciplinary approach to order and regulate land use in an efficient and ethical way

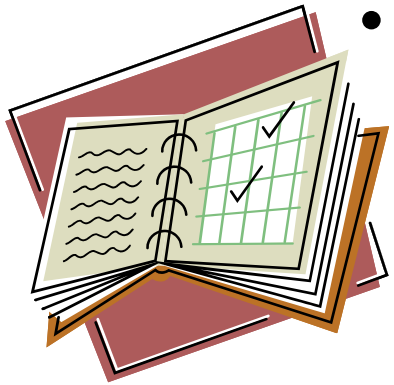
- Mitigation structural and non-structural
  - The lessening or limitation of the adverse impacts of hazards and related disasters
    - STRUCTURAL: man-made structure
    - NON STRUCTURAL: acts and prescriptions focused on damage prevention; plans and programs to increase risk awareness; warning systems



PREPAREDNESS

- Early warning systems
  - systems composed by sensors connected to an operation center that inform population of an imminent or current risk





- Civil protection plans
  - structured deployment of men and means for an emergency intervention, organised logically and coordinated in time
- Risk awareness
  - common knowledge about disaster risks and individual and collective actions to reduce disaster impact

EMERGENCY MANAGEMENT

- Alarm and evacuation
  - first emergency services to save lives

- First aid and rescue
  - emergency services and public assistance immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people

- Instructions
  - provision of essential knowledge to people affected by disaster to avoid harmful consequences
- Information
  - correct news dissemination to prevent panic effects and means dissipation

DAMAGE ASSESSMENT

- Residual risk analysis
  - A process used to determine the impact and magnitude of damage and the resulting unmet needs of individuals, businesses, the public sector, and the community as a whole
    - Residual risk is assessed on the basis of the significance of environmental effects of the proposed project and the ability to confidently manage those effects to minimise harm to the people and to the environment

RISK	STRUCTURAL	NON STRUCTURAL	EXTERNAL	GEOTECHNICAL
LOW				
LOW WITH INTERVENTION				X
HIGH				

EMERGENCY MITIGATION

- Temporary restoration
  - Temporary recovery of the essential functionality in order to prevent risk worsening
- Recovery
  - Restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of communities, including efforts to reduce risk
- Relocation
  - Policy aimed to reduce definitely risk trough relocation of exposed elements in hazardless area

RISK *TREATMENT*

Risk **M**anagement
is an endless cycle

- Each new event is a challenge to test and improve the system
- Every progress in knowledge should strengthen risk evaluation
- Each land use change bring to re-evaluate damage
- Each mitigation action must be consistent with risk scenarios

Module 3

to manage risk

methods and processes of risk management

APPROACH METHOD

Though each natural hazard requires particular approach, some common elements can usually be defined, at least qualitatively:

- **Hazard** :
  - typology
  - intensity/magnitude
  - extent /scale
  - triggering factor
  - amplification factors
  - recurrence
  - monitoring
  - hazard modeling
  - scenarios
- **Damage** :
  - elements at risk
  - vulnerability
- **Risk** :
  - mitigation options
  - acceptability
  - management

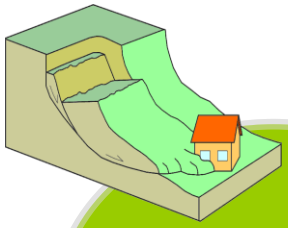
to manage natural hazard and risk

Risk Management cycle represent the general framework, but each different natural hazard follows it in a specific way

This section will compare three cases:

EARTHQUAKE

FLOOD



LANDSLIDE

hazard – **TYPOLOGY**

- **SHALLOW-FOCUS**
  hypocenter less than 20 km deep
- **MID-FOCUS**
  hypocenter between 20 and 100 km deep
- **DEEP-FOCUS**
  hypocenter deeper than 100 km

- **INLAND**
- river flood
- pluvial flood
- flash flood

- **COASTAL**
- tidal flood
- tsunami
- storm surge

- **MOVEMENT**
- falls
- topples
- slide - rotational
- slide - translational
- lateral spread
- flows
- *complex*

- **MATERIAL**
- bedrock
- debris
- earth

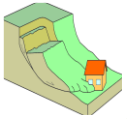
- **ACTIVITY**
- active
- suspended
- reactivated
- inactive

hazard – **INTENSITY / MAGNITUDE**

- **INTENSITY**
- MERCALLI SCALE (macro seismic effects): qualitative classification of effects induced by the earthquake on people, buildings and natural environment
- **MAGNITUDE**
- RICHTER SCALE: seismological parameters retrieved by seismograms
- **PGA (PEAK GROUND ACCELERATION)** max ground acceleration during a seismic event (measured by accelerometers)

- **SIZE**
- water depth
- flow extent

- **DISCHARGE**
- flow velocity
- speed of flood onset
- inundation duration
- residence time of water



- **VELOCITY** mm/yr → m/sec

- **DIMENSION**
- volume (tens to millions of cubic meters)
- rupture surface depth
- deposit height

- **KINETIC ENERGY**

hazard – **EXTENT / SCALE**

- **regional**, major fault zones, tens to hundreds km in length, scale < 1:50,000
- **local**, minor fault zones, less than 10 km in length, scale > 1:50,000

- **transnational/ national**, major rivers, scale < 1:500,000
- **regional**, wide basins, scale between 1:500,000 and 1:50,000
- **local**, small catchments, scale > 1:50,000

- **regional**, major widespread events, with hundreds of phenomena, scale < 1:25,000
- **local**, wide mountain slopes, scale between 1:25,000 and 1:10,000
- **site**, minor events, scale > 1:10,000

hazard – **RECURRENCE**

- **PGA recurrence period**
- with a probabilistic method it is possible to estimate for a specific site the recurrence period of a given PGA

- **flood return time**
- expected return time of a flood event of given intensity (expressed in years or in % annual probability)

- **frequency**, based on the integration of:
- historical series analysis of effects
- temporal series analysis of causes
- geomorphologic and geotechnical data
- monitoring

hazard – **TRIGGERING FACTORS**

- **tectonic movements along active faults**
- volcanism

- **rainfall**
- tides
- dam break
- earthquakes, for tsunamis

- **rainfall**
- water level change
- river / runoff erosion
- **earthquakes**
- volcanic eruption
- snowmelt
- thermal excursions
- human activity

hazard – **AMPLIFICATION FACTORS**

- site effects (geological, geomorphologic) causing local PGA amplification

- soil consumption (soil sealing due to urban sprawl)
- climate changes (enhancing extreme events)

- **land use**:
- wrong agriculture/farming practice
- deforestation
- countryside and mountain abandonment
- fires
- terrain loading in detachment areas

hazard – **MONITORING**

- seismic networks (location of epicenters and magnitude evaluation)
- satellite and in situ precise measures of topographic surface (GPS, SAR interferometry aimed at investigating geodynamic crustal movements)

- weather forecast and nowcast (real-time)
- warning and alert system (inflow-outflow models based on real-time measurements)

- **movement detection**
- displacement: absolute–relative, shallow–deep (topographic survey, SAR interferometry)
- deformation (extensometer)
- inclination (inclinometer)

- **hydraulic conditions**
- precipitations
- pore pressure
- temperature

hazard – **MODELING**

- **PROBABILISTIC** statistic analysis of past events lead to estimate the probability of an event of a certain intensity in a given time period
- **DETERMINISTIC** processing events catalogue, source zones data and attenuation models lead to describe a singular event and its propagation in surrounding areas

- models define seismic MACROzonation, then further studies are needed to point out local effects: MICROzonation

- based on historical series, and remote sensing (photointerpretation of aerial photos or satellite images)

- hydrological and hydraulic numerical modeling mono/bidimensional (rainfall-runoff models, peak flow or return time based)

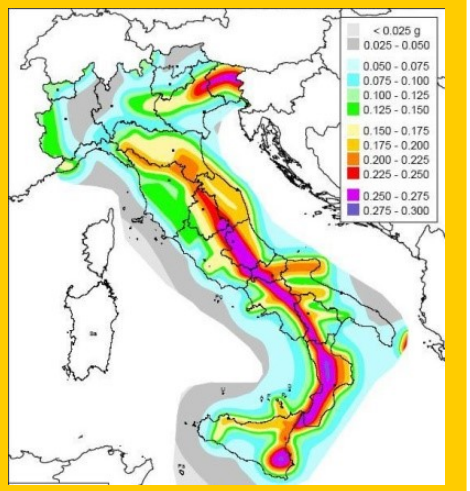
- **based on landslide inventory map:**

- **QUALITATIVE**
- geomorphologic analysis
- indexed maps overlay (heuristic approach)

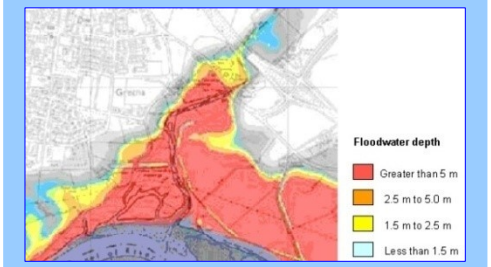
- **QUANTITATIVE**
- statistical (bivariate, multivariate, neural network)
- deterministic (stability index, safety factor)
- probabilistic

hazard – **SCENARIO**

- maps of expected max acceleration values with given probability of exceeding in a given time interval

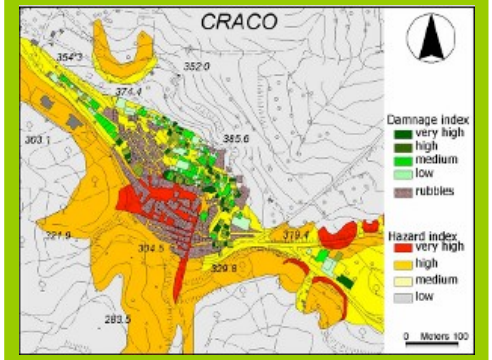


- maps of flood hazard for specific return time and water depth (mostly qualitative, showing water depth intervals)

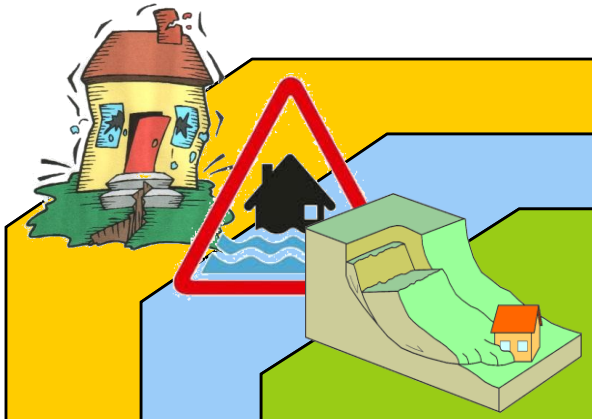


- numerical model simulations

- landslide hazard models can be coupled with vulnerability maps to design specific measures for risk reduction



damage – **ELEMENTS AT RISK**, common to all hazards



- **population**: distinct by density, age
- **settlements**: public structures, residential, commercial, industrial
- **infrastructures**: roads, railroads, lines, pipelines
- **assets**
- **agriculture**
- **cultural heritage**
- **natural environment**

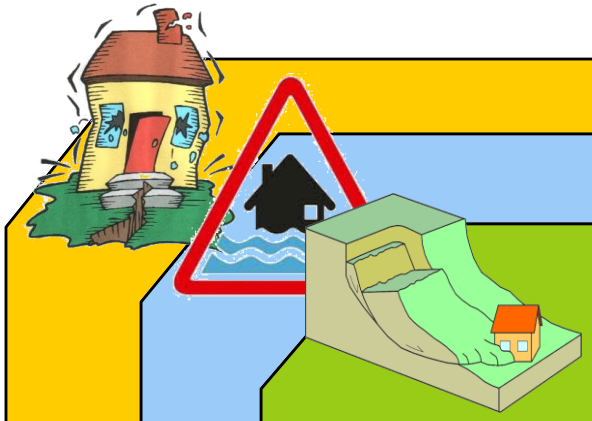
damage – **VULNERABILITY**

- **for BUILDING it depends on**
- structural typology
- location
- geometry
- state of maintenance

- **depends on**
- structural typology of buildings
- depth of floodwater
- duration of flooding
- self-movement capability of resident (age, long-term illness)

- **depends on**
- displacement velocity
- structural typology of buildings
- exposed element location Vs. landslide typology

DAMAGE – concept common to all hazards



- **damage evaluations should consider 3 main categories**
- POPULATION
- GOODS
- ACTIVITIES

FRANCE, DRM (1990)
Plan d'Exposition aux risques

relative costs about human life

dead	injured	homeless
1	2 – 3	0.2 - 1

relative costs per hectares of land

land use	goods	activities
agricultural zones	1	0.5
isolated houses	6	2
settlement	10	1
urban areas	23	8
industrial/ /commercial areas	8	28
urban centers	16	30

risk – **MITIGATION OPTIONS**

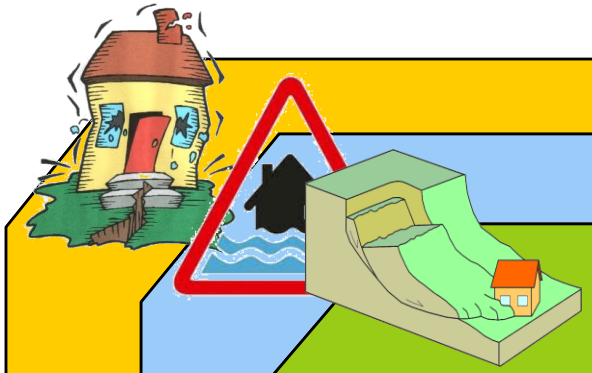
- **damage reduction**
- strengthening of vulnerable elements
- assessing of emergency plans
- seismic risk awareness

- **knowledge improvements**
- more reliable seismic hazard assessment
- precursors analysis

- flood defense
- land-use restrictions in areas prone to flood occurrence
- warning and alert systems

- **structural:** active / passive (e.g. walls, drainage network, anchor)
- **non-structural** (monitoring, warning and alert systems, land-use restrictions)

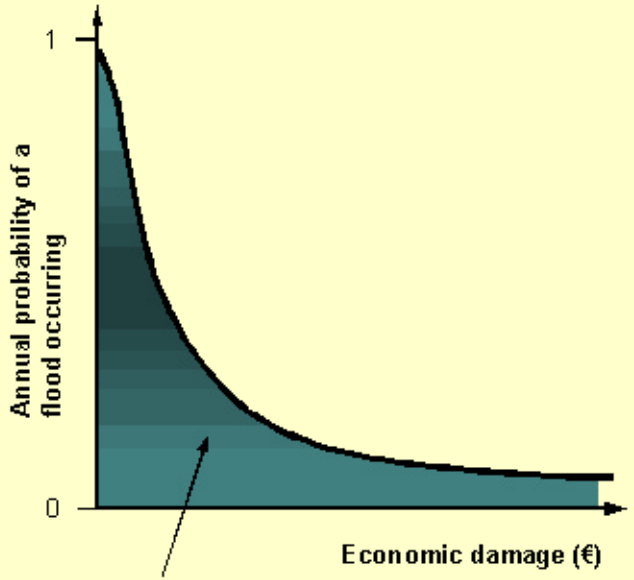
risk – **ACCEPTABILITY**



RISK can be differently accepted by the involved population according to their level of awareness (i.e. comprehension of the phenomena) and on their availability to accept to cohabit with the residual risk, depending on the efficacy of the undertook mitigation measures.

Insurance cover to natural hazard may improve people awareness.

Acceptability is usually based on Average Annualised Damage (calculated separately for properties and agriculture) compared with mitigations cost.



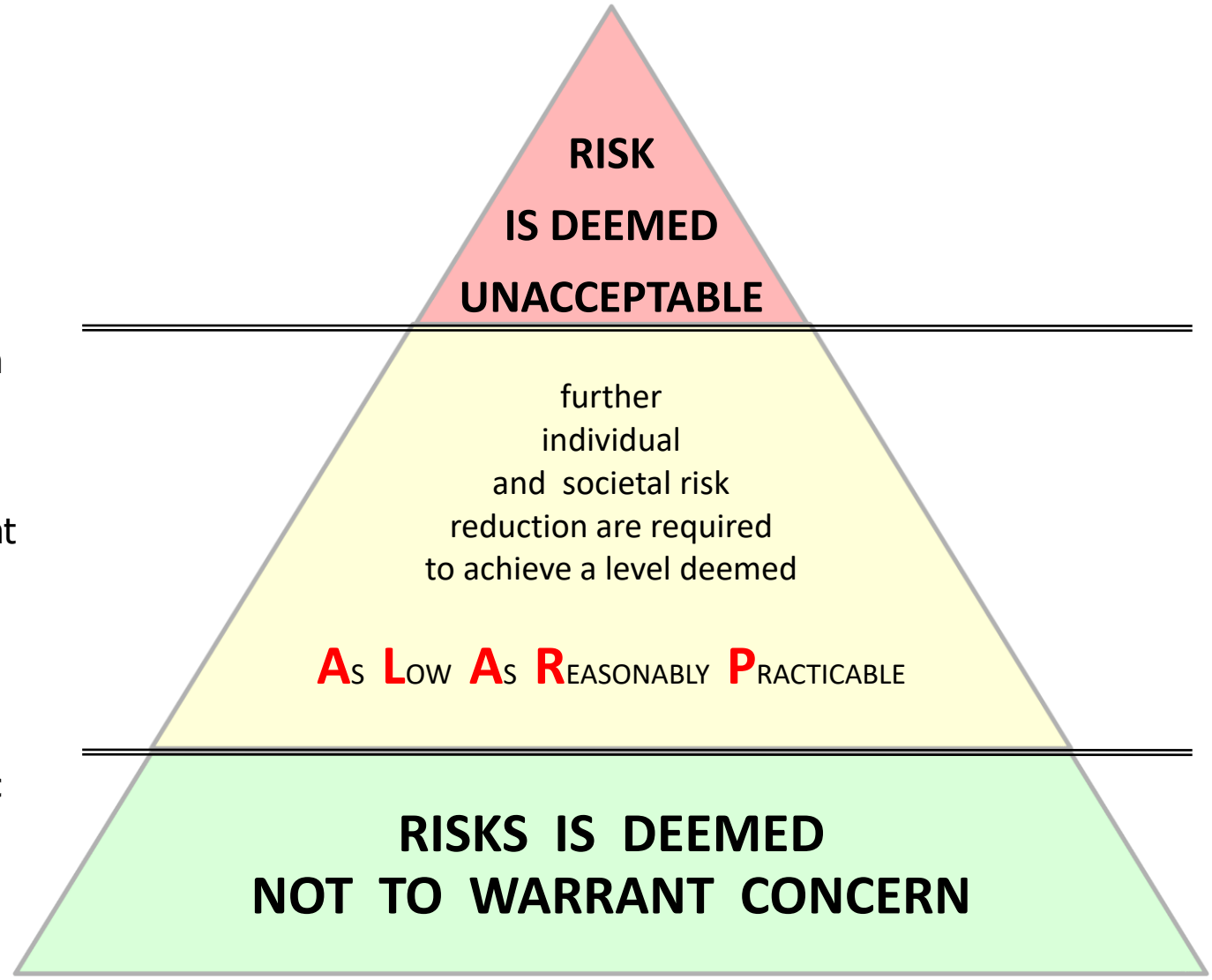
Area under the curve gives the Annualised Average Damage (AAD)

risk – ACCEPTABILITY: the **ALARP** method

A general framework for acceptability criteria has been developed for industrial process safety applications

This general framework gives a first impression on how risk acceptance can be approached

From a social science point of view it must be stated that the realms of acceptance and non-acceptance may differ significantly between persons, and that a public consensus on risk acceptance may not exist



risk – **MANAGEMENT**

- **RISK REDUCTION**
- alert systems
- buildings reinforcement
- emergency plans and people preparedness
- evacuation routes

- **FLOOD SOURCE**
- increase rainfall infiltration (good agriculture practice, reforestation)

- **FLOW PATH**
- river channel maintenance
- flood defense (embankments, natural flood storage, dam)

- **RISK REDUCTION**
- warning/alert systems
- urban area reduction in floodplain
- emergency plans and people awareness
- evacuation routes

- **STRUCTURAL MEASURES**
- hydrogeological environmental restoration
- slope stabilization
- land-use rationalization
- buildings reinforcement

- **NON STRUCTURAL MEASURES**
- delocalization
- monitor and early warning systems
- emergency plans assessment

MULTI-RISK ASSESSMENT

- The main purpose of a multi-risk approach is to put together in one map the various information on a study area to provide a natural hazards scenario of varying magnitude, frequency, extent.

- Many natural hazards can be caused by the same natural event (i.e. heavy rainfall inducing floods and fast-moving landslides), so that to depict a multiple hazard map is mainly possible for hazards that can be related to similar triggering factors.

Module 4

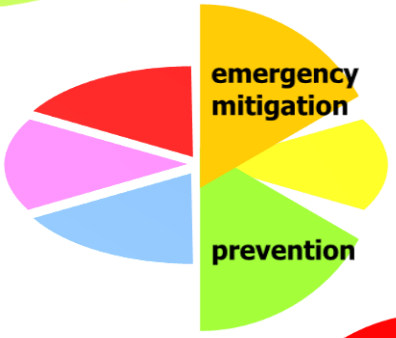
to practice

risk management case studies

RISK MANAGEMENT TASKS

Risk management tasks mainly concern:

→ SCIENTIFIC INSTITUTIONS



→ GOVERNMENTS

→ EMERGENCY MANAGEMENT ORGANIZATIONS

Several entities practice risk management all around the world …

RISK MANAGEMENT: deferred time tasks

SCIENTIFIC INSTITUTIONS

- Geologic Surveys
- Universities
- Research Institutes

GOVERNMENT AUTHORITIES

- International
  - UN Programs, EC Directives, etc
- National
- Local

RISK MANAGEMENT: emergency organizations

International Organizations

International Federation of **Red Cross** and **Red Crescent** Societies

UN Office for Disaster Risk Reduction

World Bank, Global Facility for Disaster Reduction and Recovery

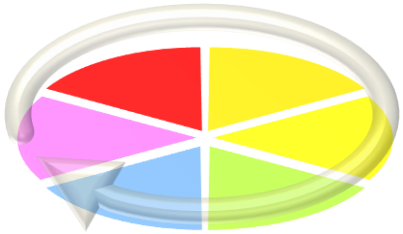
USA: Federal Emergency Management Agency (FEMA) supports citizens and first responders to build, sustain, and improve capability to prepare for, protect against, respond to, recover from, and mitigate all hazards" http://www.fema.gov/

ITALY: Civil Protection Department is a "National Service", a complex system that includes all the structures and activities to protect the integrity of life, property, settlements and the environment from damage resulting from natural disasters, catastrophes and other disasters http://www.protezionecivile.gov.it

EUROPE: EU Civil Protection Mechanism (CPM) "is made up of 32 states which cooperate in the field of civil protection to better protect people, their environment, property and cultural heritage in the event of major natural or man-made disasters occurring both inside and outside the EU" http://ec.europa.eu/echo

National Organizations

Risk Management **case studies**



Good examples of the entire Risk Management process can be found at the website of Italian Civil Protection :

http://www.protezionecivile.gov.it

risk section

specific risks:

- earthquakes
- volcanic eruptions
- floods
- landslides
- fires
- health
- nuclear
- pollution
- industrial

Risk Management case study: **earthquake**

risk management:
PREVISION

Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

The Civil Protection | Risks | Acts and Documents | Communication and Media

- Seismic Risk
  - Description of the Risk
  - Earthquakes
  - Activities
  - Emergencies
  - What to do
- Volcanic Risk
- Hydro-meteorological Risk
- Fire Risk
- Health Risk
- Nuclear Risk
- Environmental Risk
- Industrial Risk

Home > Risks > Seismic Risk > Activities

Technical Files

Seismic risk activity

The Civil Protection Department carries out activity to assess, prevent and mitigate seismic risk in Italy, Centres of Competence or operating units.

Prevision | Prevention | Emergency management | Post-emergency

Science today is not yet able to forecast the exact time and place for future earthquakes. The only forecast possible is of a statistical kind, based on knowledge of past seismicity in Italy therefore on the recurrence of earthquakes. We know which areas in the country run a high seismic risk, for earthquake frequency and intensity and therefore where it is most likely that a big seismic event will happen, but it is not possible to exactly determine when it will happen.

Probabilistic forecasting allows hazardous areas to be identified and classified according to the probability of strong earthquakes and their expected frequency. For greater accuracy when calculating the interval of time in which a given location will most probably be hit by an earthquake, we would need to know how much energy is accumulated in the seismogenic structure, which may trigger off an earthquake in that place and the way in which the energy is released, in other words, a little at a time with many low magnitude shakes or with a few very strong events. But even in-depth study of seismogenic structures will not enable us to establish the exact moment the next earthquake will strike.

Over recent years science has made considerable progress in the study of seismic precursors, in other words the chemical and physical parameters of the ground and underground subject to the variations that can be observed before an earthquake happens. In the future, systematic study of these precursors could allow the initial moment of the earthquake to be fixed, even if false alarms must be avoided, which could prove to be even more harmful.

Research into earthquake precursors has concentrated on:

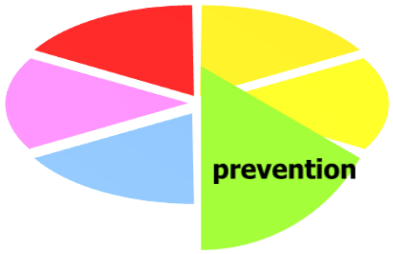
- Seismological precursors: before a big seismic event a series of microtremors may occur, only detectable by instruments.
- Geophysical precursors: anomalies in the P and S wave speeds, variations in magnetic and electric characteristics of rocks.
- Geochemical precursors: variation in underground waters of the concentration of some chemical elements, in particular of radon, a radioactive gas.
- Geodetic precursors: alterations in the level and slope of ground surface.

Despite comprehension of the phenomenon and confirmation of the validity of the genetic model for earthquakes advanced by seismologists, forecasting of earthquakes based on precursors has so far brought disappointing contradictory results. No precursor happens regularly before each important earthquake, for this reason research is moving towards simultaneous observation of different phenomena. For example, while it is true that animals behave unusually before a seismic event, it is not always true that an earthquake will occur when cats or dogs behave in a certain way. To prevent the effects of a seismic shake, the risk factors must be reduced, acting in particular on the quality of building. Prevention in the form of building well is therefore still the only effective way of reducing the consequences of an earthquake.

Emergency planning and damage scenarios

ICEF- International Commission on Earthquake Forecasting for Civil Protection

Risk Management case study: **earthquake**



risk management:
PREVENTION

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Seismic risk activity

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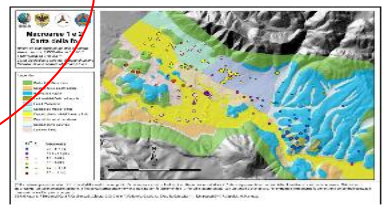
Prevision | **Prevention** | Emergency management | Post-emergency



Office III– "Seismic and volcanic risk" of the Department establishes criteria and methodologies for the assessment and mitigation of seismic risk, develops technical and scientific skills for predicting the impact of the earthquake on the territory
and works for the optimization of operations in emergency and post-earthquake reconstruction.
In addition, provides guidance on the seismic classification and regulations for buildings in seismic zones, g
peripheral of the State and r
characteristics and effects
initiatives to raise aware
(Earthquakes of Italy)

These tasks are carried out with the support of scientific and operation
Institute of Geophysics and Volcanology, for seismological aspects; ReLUIS - Net
Engineering and Eucentre - European Centre for Training and Re search in Earthq
effective strategy for mitigation of the seismic risk requires a co stant effort to imp
phenomenon, deepen studies on the behaviour of structures subjected to seismi
The seismic risk, in fact, in addition to the occurrence of the physical phenomenon
Since it is not possible to predict the occurrence of earthquakes, the only applicabl
on the man-made environment by implementing appropriate policies for preventio

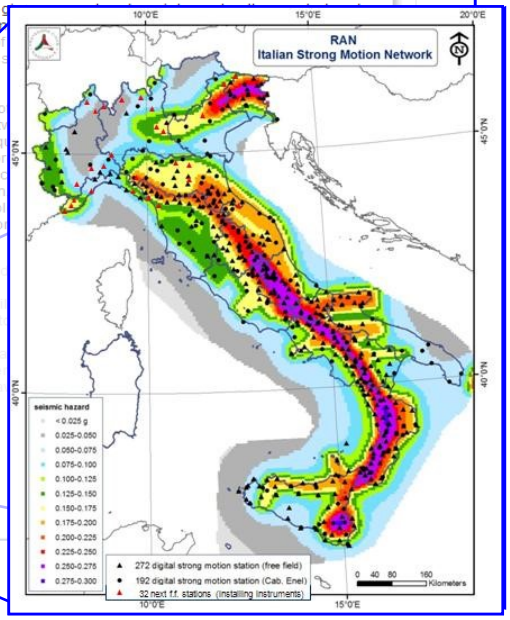
In particular:
- Improving knowledge of the phenomenon, th ough the monitoring of the area an
areas, population and infrastructure system are exposed;
- Implementing policies to reduce the vuln rability of older buildings, "relevant" bu
(hospitals, emergency management fa ilities), by optimizing the resources used f
- Upgrading the seismic classificatio and regulati
- Developing seismic micro-zonin studies fo correct use of ordinary tools of pl
that takes into account the seis ic risk and to improve the operation and manage
- Acting on the population with a constant and vigorous action of information and a

Seismic Classification

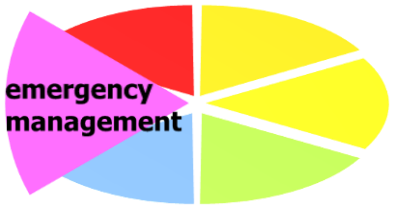
Anti-seismic regulation

Ran - National Accelerometric Network

Oss - Seismic Observatory of Structures



Risk Management case study: **earthquake**



risk management:
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The Civil Protection Department carries out activity to assess, prevent and mitigate seismic risk in Italy, Centres of Competence or operating units.

Prevision | Prevention | **Emergency management** | Post-emergency

After a seismic event, the first information necessary for immediate aid are the size, extension and localisation of damage.

For this reason it is indispensable to have assessment tools based on damage scenario simulations that allow planning and management of emergency response in real time, even before inspections take place. These tools must be combined with activity to promptly assess the damage, to consolid
data rea
over the
the aim
stage. Th
distributi
intensity value expressed in degrees on the Mercalli Cancani S

During the first hours after an earthquake, it is fundamentally i
impact in the area and on the population in order to activate, si
experience following the Irpinia earthquake in 1980 was used
to generate a simulation scenario in semi-real time of the cons
large magnitude, the National Institute for Geophysics and Vol
and coordinates) of the event. An automatic procedure automa
minutes after the event. The report contains data, maps and in
km from the epicentre with reference to:

- description of the territory (man-made, physical and administ
monitoring networks)
- hazard (seismogenic zones, past earthquakes, isoseismal li
- vulnerability (building assets, schools, hospitals, road and ra
- exposure (characteristics and distribution of the population li
- preliminary assessment of damage and losses (damaged h
of economic damage).

Seismic risk emergencies

Emergencies in Italy | International interventions | Historial

Abruzzo earthquake - 2009
Date: 6 April 2009, h. 3:32
Magnitude: 6.3 (Maw)
Intensity at the epicentre: IX-X grade (MCS)
Victims: 308

Molise earthquake - 2002
Date: 31 October 2002, h. 11:32
Magnitude: 5.8 (Maw)
Intensity at the epicentre: VII-VIII grade (MCS)
Victims: 30

Umbria and Marche earthquake- 1997
Date: 26 September 1997, h. 11:40
Magnitude: 6.0 (Maw)
Intensity at the epicentre: VIII-IX grade (MCS)
Victims: 11

Emergencies in Italy | **International interventions**

Chile earthquake - 2010
Date: 27 February 2010,
Magnitude: 8.8
Victims: 507

Haiti earthquake - 2010
Datae: 12 January 2010
Magnitude: 7.0
Victims: 222,570

China earthquake- 2008
Date: 12 May 2008
Magnitude: 7.9
Victims: 87.587

Pakistan earthquake- 2005
Date: 8 October 2005
Magnitude: 7.6
Victims: 80,361

South-East Asia earth and seaquake - 2004
Date: 26 December 2004
Magnitude: 9.0
Victims: about 300,000

Iran earthquake- 2003
Date: 26 December 2003
Magnitude: 6.6
Victims: 31.000

Risk Management case study: **earthquake**

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Technical Files

Seismic risk activity

The Civil Protection Department carries out activity to assess, prevent and mitigate seismic risk in Italy, Centres of Competence or operating units.

Prevision | Prevention | Emergency management | **Post-emergency**

One of the fundamental activities carried out mainly by specialists in order to return people to their houses is inspection to decide whether buildings are suitable for use and organisation and management of all activity in the post-earthquake stage.

These activities call for a considerable level of standardisation in procedures and meticulous quality control, which over recent years has seen considerable involvement of the Civil Protection Department in management and organisation of measurement taking and inspections.

Over 120,000 inspections in Umbria and Marche after the earthquake in 1997, more than 20,000 after the one in Pollino in 1998, more than 6000 in the area of Etna, over 10,000 following the earthquake in Molise and approximately 80,000

after the earthquake in L'Aquila in 2009.

risk management:
POST-EMERGENCY

Risk Management case study: **flood & landslide**

risk management:
PREVISION

Prevision

The civil protection department, established for emergency relief, has developed systems over the years for forecasting and preventing phenomena for protecting the life of the citizens and the heritage of the communities. Thanks to collaboration with research bodies, institutes and groups, the Civil Protection Department has promoted studies and research to improve the knowledge of the territory, assess the extent of the phenomena and develop innovative strategies for damage co

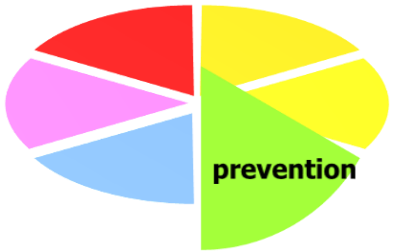
The monitoring networks. A systen
the territory 24 hours a day for colle
meteorological, hydrogeological an
networks to detect volcanic, seismi
the Civil Protection Department the
the job of collecting, checking and passing the information to the components and to the
level. The monitoring system is made up of:
• national centres of scientific research;
• technological systems of collecting and processing information on different types of ris
possibility of danger for the community;
• data processing centres capable of indicating the probability of catastrophic events as

As regards this, a monitoring centre is active in the Civil Protection Department, operati
checking and passing the information to the components and to the operative structure

The technical-scientific activity ranges from collecting information on the territory to pro
according to models and simulations of events. This data makes it possible for the civ
of possible risk, to alert the intervention system in useful time and to provide the autho
reasoned and timely decisions.
The use of technologically advanced networks – like radar networks for weather foreca
sophisticated systems of monitoring the activity of the volcanoes – puts the Italian Civ
intervening with timely alerts and when possible with preventive measures like evacu

> Functional centres network
> Centres of competence

Risk Management case study: **flood & landslide**



risk management:
PREVENTION

Home > Risks > Hydro-meteorological Risk > Activities

Hydrogeological risk activities

Hydrogeological risk is one of the major risks afflicting Italy.
Calamities hitting the domestic territory have taught us that, to effectively protect the life of the people and keep the infrastructures in good condition, we must be able to foresee possible events in an area, identify possible damages and the actions to take before, during and after an emergency: this is precisely the reason why prediction and prevention have taken on increasing importance as compared to what happened in a not too distant past.

Prediction and prevention is based on increasingly close contacts between civil protection and the world of scientific research, with new technological systems for collecting and processing information and data processing centres capable of warning about the probability of a catastrophic event occurring with maximum possible notice, by preparing sophisticated and efficient risk maps, and promotion of normative and technical measures to prevent and mitigate damages.

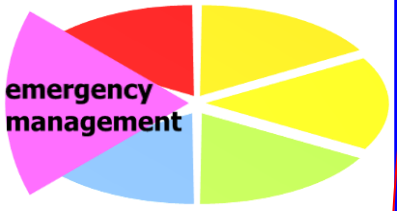
Prediction and Prevention

In the hydrogeologycal risk, prevision activities help to understand expected phenomena, especially extreme meteorological events. To achieve this goal, we use tools and sophisticated techniques are used together: applied meteorology, satellite images, weather radars, hydraulic models, etc..

Prevention activities help to avoid or minimize the possible occurrence of damage due to a flood, a landslide etc. Prevention activities are thus designed to take measures designed to eliminate or mitigate the effects on the ground.

Prevention measures may be structural or non-structural. Structural interventions consist of active or passive arranging works, which aim to reduce the danger of the event, lowering the probability of occurrence or mitigating its impact. Examples of structural

Risk Management case study: **flood & landslide**



risk management:
EMERGENCY

Home > Risks > Hydro-meteorological Risk > Emergencies

Emergencies

Today, over two thirds of our peninsula are prone to hydrogeological instability, with risk of landslides and floods.
Prediction and prevention have been strategic for dealing with the hydrogeological risk for some time now. Contact with the world of scientific research is increasingly closely knit as well as the use of new technological systems to estimate the foreseen damages and to monitor vulnerable zones in the event of extreme weather conditions such as floods or drought.
The Department's major operations in hydrogeological emergencies are given hereunder.

Emergencies in Italy

This section contains the main hydrogeological emergencies for which the Head of Department has been apppointed as Commissioner or that involved the Department during the post-emergency reconstruction.

Montaguto landslide

In March 2010 incessant rainfall reactivated the landslide at Montaguto, in the province of Avellino, which blocked the railway line from the capital and Naples to Puglia. The Civil Protection Department coordinates all activities for safety checks in the area and for the landslide restraint.

Cerzeto landslide

In March 2005, the hystorical centre of Cavallerizzo, fraction of Cerzeto, was hit by a landslide. The area of the municipality of Cosenza (Calabria Region) was already in a serious condition of hydrogeological instability. The Department carried out studies on the area and a decision to move the village of Cavallerizzo was eventually taken. Reconstruction works for the new settlement of Pianette began in 2007. In February 2011 new allotments started to be assigned to the population.

Tiber flooding

Violent rainfalls hit Rome during December 2008 causing the flood of the river Tiber. After the first phase of the emergency, a plan for the 'new Tiber' was studied, with cleaning and reclamation interventions and works aimed at the safety of the portion of the river flowing in the city of Rome.

Risk Management case study: **flood & ...**

risk management:
POST-
EMERGENCY

Home > Risks > Hydro-meteorological Risk > Emergencies > Esondazione del Tevere > bonifica

Safety and reclamation interventions

A marzo 2009 cominciano i primi interventi di pulizia, bonifica e funzionalità idraulica del fiume Tevere, nel tratto compreso tra Castel Giubileo e la foce. La violenta ondata di maltempo ha causato numerosi danni idraulici e ambientali, con accumulo di rifiuti, detriti e legname contro le colonne dei ponti, smottamenti sulle sponde e incaglio di relitti sulle banchine. Le attività di sistemazione del bacino del Tevere sono previste dall'ordinanza 3734 del 16 gennaio 2009 e definite con il decreto di attuazione firmato dal Capo della Protezione Civile, Guido Bertolaso.

Le operazioni vengono portate avanti da Regione Lazio, Comuni di Roma e Fiumicino, Autorità di bacino. Il coordinamento dei lavori è affidato al Capo Dipartimento della Protezione Civile, d'intesa con il Commissario Delegato per la Regione Lazio. Tutti gli interventi messi a punto dalle amministrazioni coinvolte sono in linea con quanto già previsto dalla pianificazione ordinaria. Tra le attività programmate, anche quelle inserite nel Piano Stralcio per Roma -P.S.5- Piano di Bacino del fiume Tevere, relativo al tratto metropolitano del fiume, come pure l'attuazione delle misure riguardanti il regolamento della navigazione e lo stazionamento di barconi e galleggianti. Sono previsti inoltre il censimento delle strutture galleggianti e la rimozione dei relitti abbandonati a seguito della piena.

Viene realizzato anche l'aggiornamento del rilievo batimetrico del Tevere, con la mappa dettagliata dei fondali che consentirà di programmare al meglio le attività di sistemazione del letto del fiume. Un'attenzione particolare viene dedicata al litorale di Ostia e Fiumicino, con la pulizia delle spiagge e il dragaggio del porto canale, significativamente insabbiato dopo la piena dello scorso dicembre, fino alla linea di costa. Il lavoro, oltre a consentire il regolare transito dei natanti, assicurerà i necessari criteri di sicurezza per eseguire eventuali interventi di soccorso a mare.

Due gommoni della polizia idraulica, coordinata dall'Ardis -Agenzia regionale difesa del suolo, vigileranno sulla sicurezza delle operazioni, insieme alle altre forze dell'ordine impegnate nei lavori. Le attività relative alla prima fase, il cui ammontare complessivo è pari a 6.680.00 Euro, impegnano oltre 60 persone tra operai, tecnici e addetti alla vigilanza dei cantieri. I lavori terminano il 31 maggio 2009, ad eccezione degli interventi di dragaggio di Porto Canale, della darsena di Fiumicino e della vasca di colmata, che vengono ultimati entro il 30 dicembre 2009.

Il programma per i lavori d'intervento, pianificato con la Regione, il Comune di Roma e l'Autorità di Bacino, è stato condiviso con i circoli sportivi attivi lungo il Tevere e con le principali associazioni ambientaliste, tra cui Legambiente, Marevivo, WWF, Amici della Terra, Italia Nostra. Per favorire il coinvolgimento degli enti interessati, viene attivata una mailing list dedicata alle associazioni, dove sono raccolti pareri, esigenze e proposte in merito alle problematiche legate al fiume e alle attività di ripristino.

Le operazioni di pulizia sono eseguite nel pieno rispetto della flora, della fauna e dell'ambiente fluviale in generale, in osservanza del divieto di uso di disinfestanti chimici. Il materiale risultante dalle operazioni, ove non sia vegetale ecocompatibile o trattabile come biomassa vegetale, è smaltito in luoghi autorizzati nel rispetto dei termini di legge.

Gli interventi del Commissario delegato per la Regione Lazio. Gli interventi affidati alla Regione riguardano entrambe le sponde del

Risk Management case study: … & landslide

Home > Risks > Hydro-meteorological Risk > Emergencies > Frana di Montaguto > Gli interventi

Interventions

The Commissioner Delegate had started up a series of operations, through the contra
the lakes and sources of water along the central part of the landslide, away from the la
The purpose of these operations was to guarantee safe conditions for the work sites a
destabilized slope.
The works were carried out with the assistance of the DST-UNIFI, CNR-IRPI Operation
11th Engineer Sapper Corps Regiment.

Job 1: altitude 500 m above sea level

At the altitude of 500 m above sea leve
basin flowed directly into the central pa
water in the central-terminal part of the
waters and channelling them valley-wa
comprised: construction of an intercep
stream waters, laying a water pipe (ab
Cervaro and interception works to dive
The typology of the works was established by the conditions of accessibility to the sites, time imposed by the events and above all by the necessity to avoid any interference between works at the work site and calamity in progress.
The works in fact served to mitigate the effects of the water circulating on the surface and just under the surface of the landslide to reduce the risk in the foot areas, where removal and profiling works were in progress to restore the communication network (railway and SS 90 main road).

Job 2: altitude 700 m above sea level
A drainage trench in gabions was dug to collect the waters from under the surface and those circulating on the surface and channel them towards the "Tre Confini" stream at a distance from the landslide.
The trench was positioned at an average depth of about 5 m from ground level and where the landslide canal has a reduced section, for geological reasons, and is at the right height for channelling the waters into the adjacent water basin. The water circulation above the landslide was partly restored and a considerable amount of the water flowing to feed the land on the move in the central-upper part of the slope was eliminated with these works.

Job 3: cleaning and repairing the "Laghetto delle rane" drainage canal
The works comprised deepening and re-profiling the canal, ablation of the pond and temporarily restoring the drainage canal to River Cervaro. The area also underwent forestry clearance works and dead vegetation was removed to allow the water to flow freely.
The waters coming from the water sources orographically to the left, which by running into a pond called "Laghetto delle rane" continually fed the land on the move, were deviated away from the landslide by these works

Job 4: Lake "Maggiore" siphon
To empty the landslide lake formed in a hollow (750 m above sea level) after the calamitous events, the Foggia 11th Engineer Sapper Corps Regiment built a system of siphons with light flyover pipes coming out in the "Tre confini" stream away from the landslide.

risk management:
POST-EMERGENCY