MULTI-HAZARD RISK ASSESSMENT AND DECISION MAKING

Co-funded by the Erasmus+ Programme of the European Union

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CONTENT:

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Introduction

Earth is shaped by:

ENDOGENIC Processes

caused by forces from within the earth

EXOGENIC Processes

caused by forces related to the earth's atmosphere, hydrosphere, geosphere, biosphere and their interactions

Anthropogenic activities

for instance through the increase of greenhouse gasses, leading to global warming, OR through dramatic changes in the land cover and land use

…may lead to potentially catastrophic events, even in locations that may be far away…

HAZARDS

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HAZARDS

- Pose a level of threat to life, health, property, or environment
- Characteristics:

➢ **Magnitude:** indicate the size of the event, or the energy released

➢ **Intensity:** refers to the spatially varying effects

Example: *Earthquake magnitude refers to the energy released by the ruptured fault (e.g. measured on the Richter scale) whereas the intensity refers to the amount of ground shaking which varies with the distance to the epicenter (e.g. measured on Modified Mercalli scale)*

➢ **Magnitude-Frequency relationship:** it is generally necessary to collect historical data and carry out statistical analysis

Example: *small events may occur often, and large events seldom*

ELEMENT at RISK

- Hazards may be potentially harmful to *people*, *property*, *infrastructure*, *economy* and *activities*, but also to the *environment*, which are all grouped together under the term **Elements-at-risk** or assets

- **Exposure**- indicate those elements-at-risk that are subject to potential losses

- **Important elements-at-risk** that should be considered in analyzing potential damage of hazards are <u>population</u>, <u>building stock</u>, <u>essential facilities</u> and <u>critical infrastructure</u>

VULNERABILITY

- **Vulnerability** describes the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

- **Vulnerability aspects** may be related to physical, social, economic, and environmental conditions

Example: *When considering physical vulnerability only, it can be defined as the degree of damage to an object (e.g. building) exposed to a given level of hazard intensity (e.g. water height, ground shaking, and impact pressure)*

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RISK

Risk = The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between (natural, human-induced or man-made) hazards and vulnerable conditions in a given area and time period.

Risk = Hazard × Vulnerability × Amount of elements-at-risk

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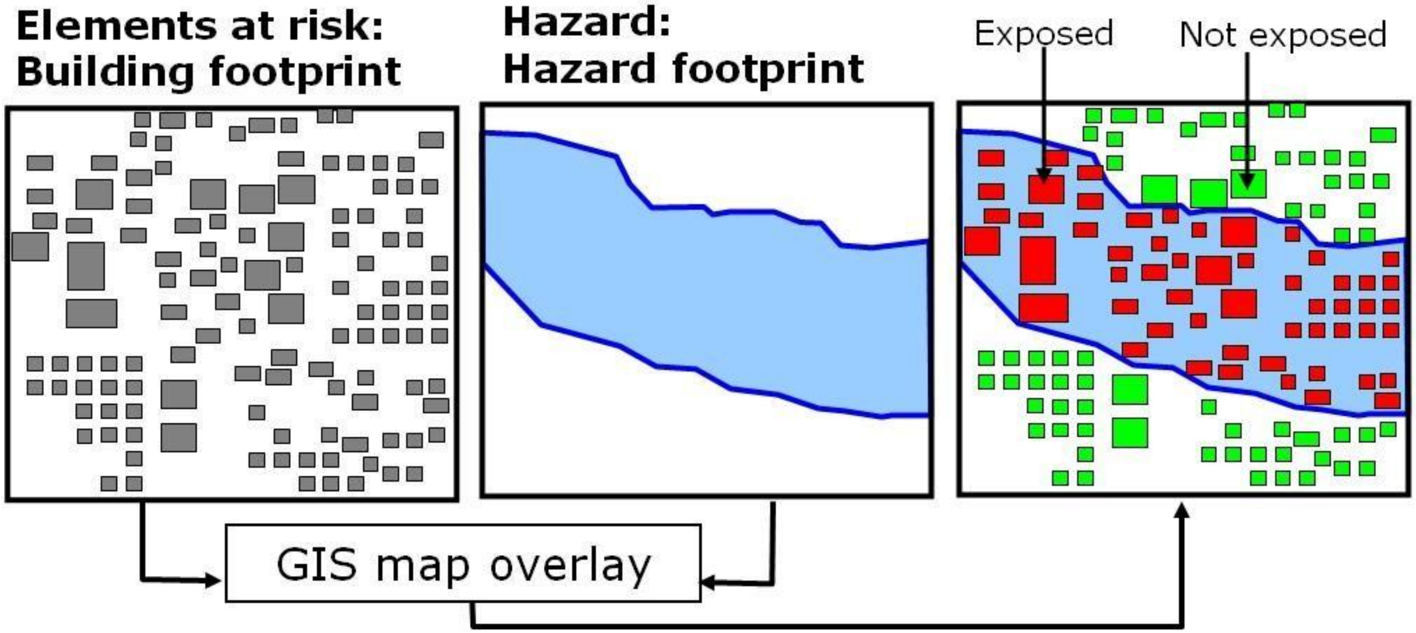
Most simple: risk = exposure

Spatial overlay of:

- a hazard footprint of a particular event;
- and elements at risk.

Gives the number of elements at risk affected.
Vulnerability is not used in this simple context.

Useful first approach Also a step in advanced risk assessment



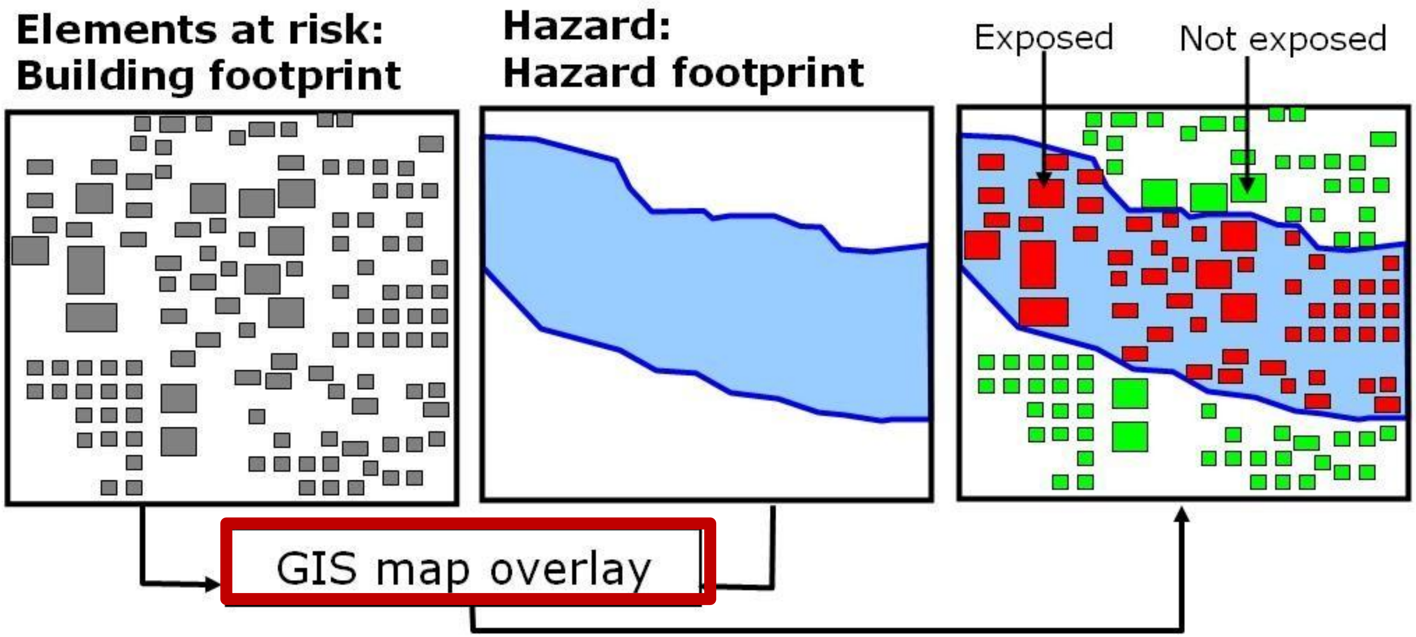
Most simple: risk = exposure

Spatial overlay of:

- a hazard footprint of a particular event;
- and elements at risk.

Gives the number of elements at risk affected.
Vulnerability is not used in this simple context.

- **All components of the risk equation are spatially varying**
- **There is a need to have spatially distributed info.**



TYPES OF RISKS

RISK

Absolute terms & Relative Terms

Direct & Indirect Terms

Examples:

- The annual probability of a single exposed person to be killed (individual risk)
- The relation between the annual probability and the number of people that could be killed (societal risk)
- Destruction of physical objects (e.g. buildings, transportation infrastructure)
- Disruption of transportation networks leading to longer travel time etc

MULTI- HAZARD RISKS

- Independent Events
- Coupled Events
- One hazard changes conditions for the next
- Domino or cascading hazards

MULTI- HAZARD RISKS

- **Independent Events**: the hazards are independent and caused by different triggers

Example: earthquake hazard and flood hazard

- the expected losses from one hazard type are independent from the losses expected from the other hazard type.

- If that is the case, the risk can be calculated by adding the average annual losses for the different types of hazard.

MULTI- HAZARD RISKS

- Independent Events

- **Coupled Events:** different hazard types that are triggered by the same triggering event

<u>Example</u>: the effect of an earthquake on a snow-covered building and the triggering of landslides by earthquakes occurring simultaneously with ground shaking and liquefaction

  - The temporal probability of occurrence of such coupled events is the same, = to the probability of occurrence of the triggering mechanism.

  - For analyzing, when coupled events occur in the same area -- the hazard footprints overlap -- the processes will interact, and therefore the hazard modeling for these events should be done simultaneously, which is still very complicated.
  - The best way to treat coupled risk is to take the maximum of the risks that are coupled

MULTI- HAZARD RISKS

- Independent Events
- Coupled Events:
- **One hazard changes conditions for the next:** the influence one hazard exerts on the disposition of a second hazard, though without triggering it

Example: *fire-flood cycle: forest fires alter the susceptibility to debris flows and flash floods due to their effect on the vegetation and soil properties.*

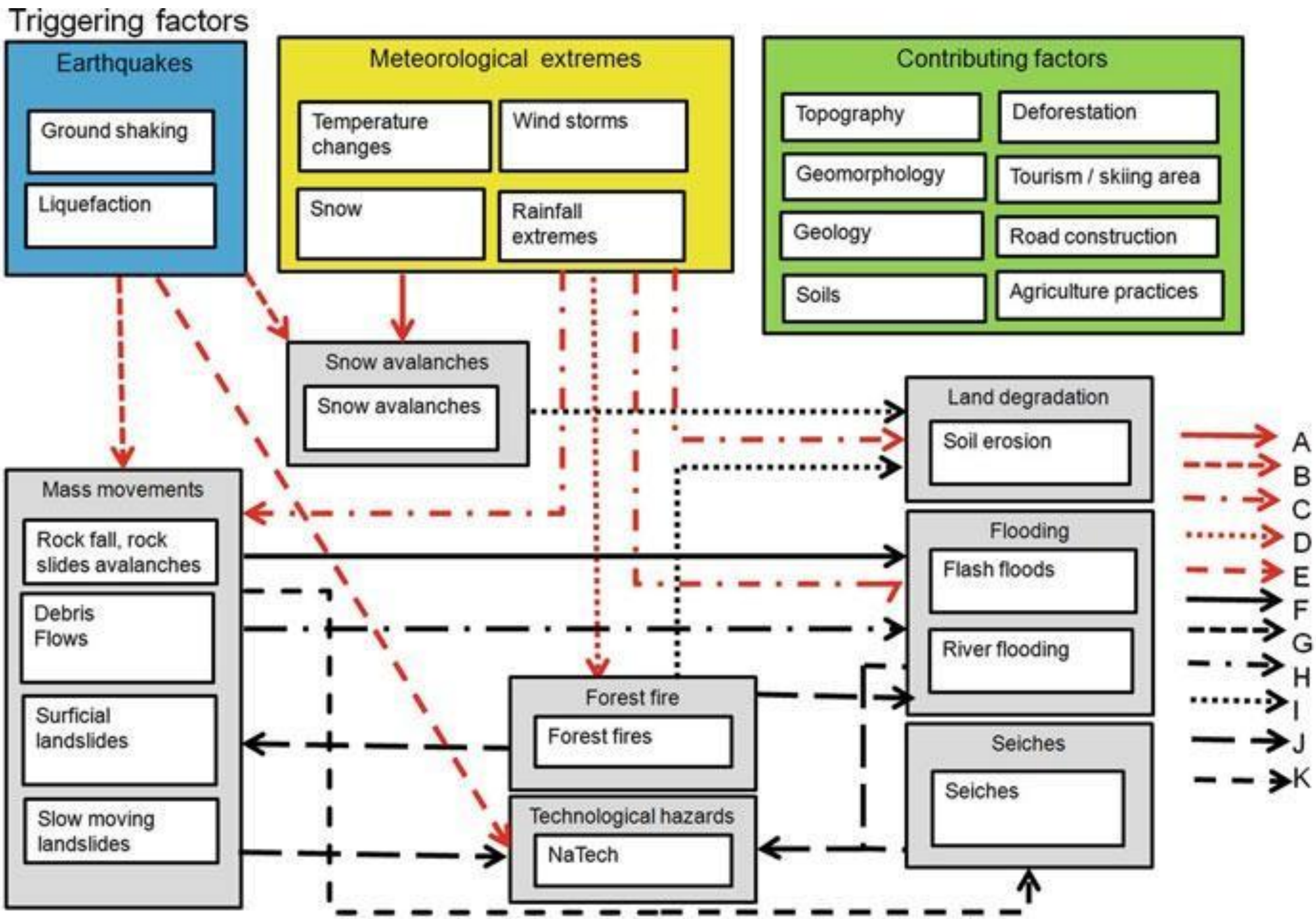
- very difficult to take this type of relationship into account
- The practice is to update a multi-hazard risk assessment each time after the occurrence of a major hazard event (like a volcanic eruption, major earthquake or hurricane)

MULTI- HAZARD RISKS

- Independent Events
- Coupled Events
- One hazard changes conditions for the next
- **Domino or cascading hazards:** consists of those that occur in chains- one hazard causes the next

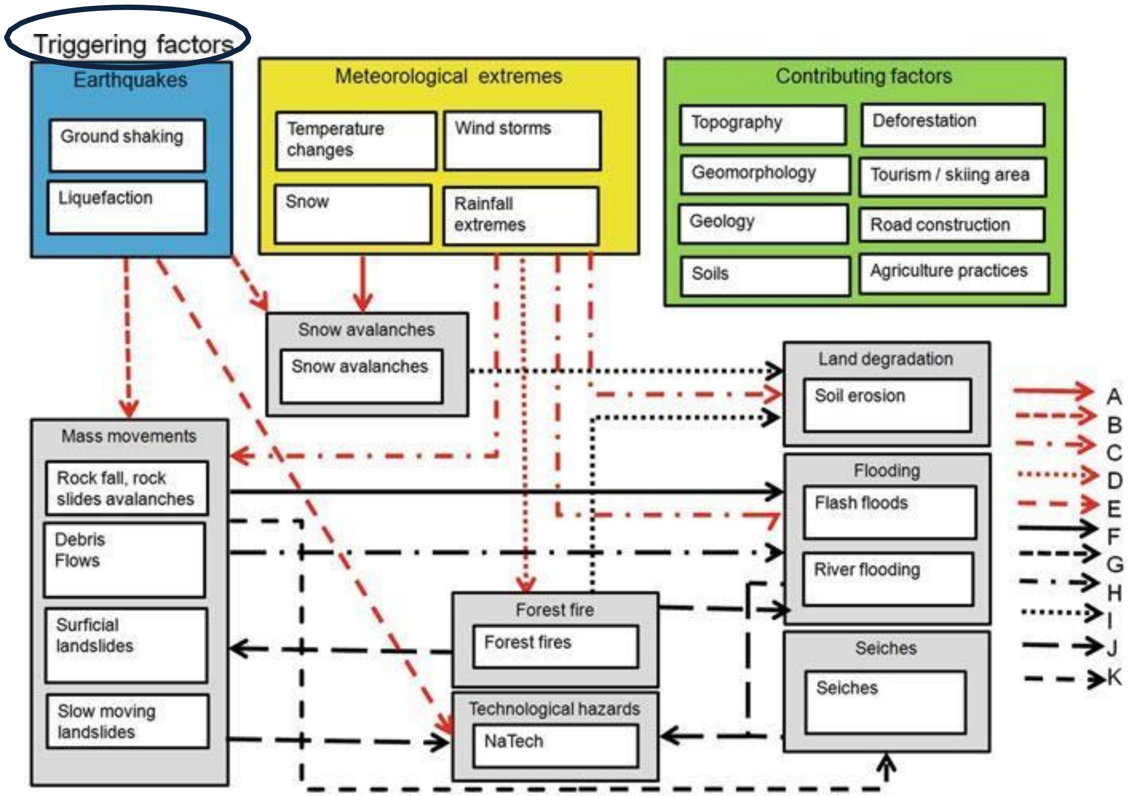
Example: landslide might block a river, leading to the formation of a lake, which might subsequently result in a dam break flood or debris flow

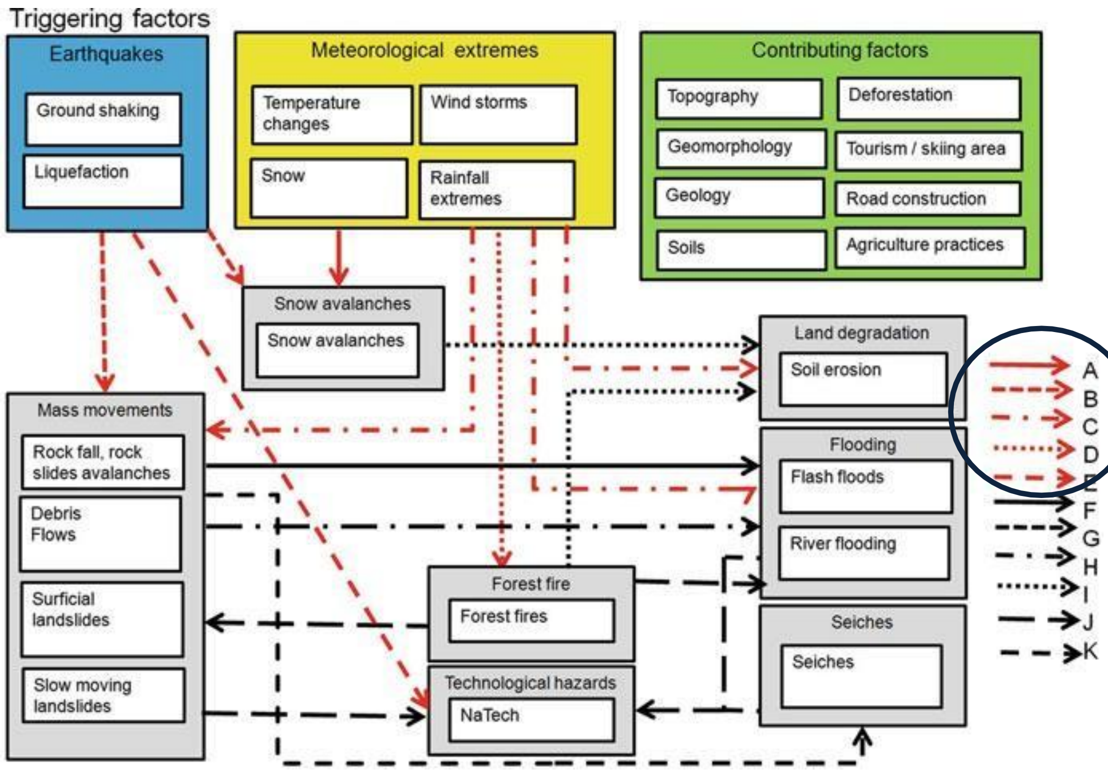
- extremely difficult to quantify over certain areas
- Good practice: the use so-called event-trees



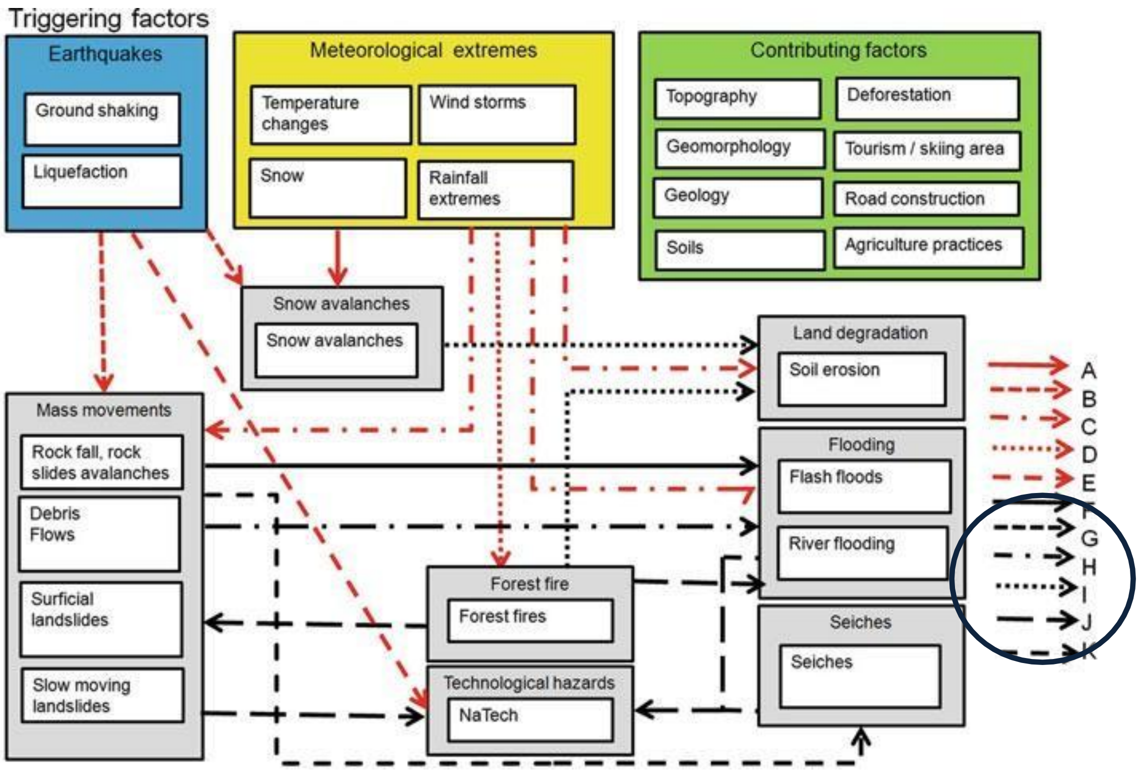
Multi-hazard in a mountainous environment, and their interrelationships

The triggering factors are indicated: **earthquakes**, **meteorological extremes**, and the **contributing factors**



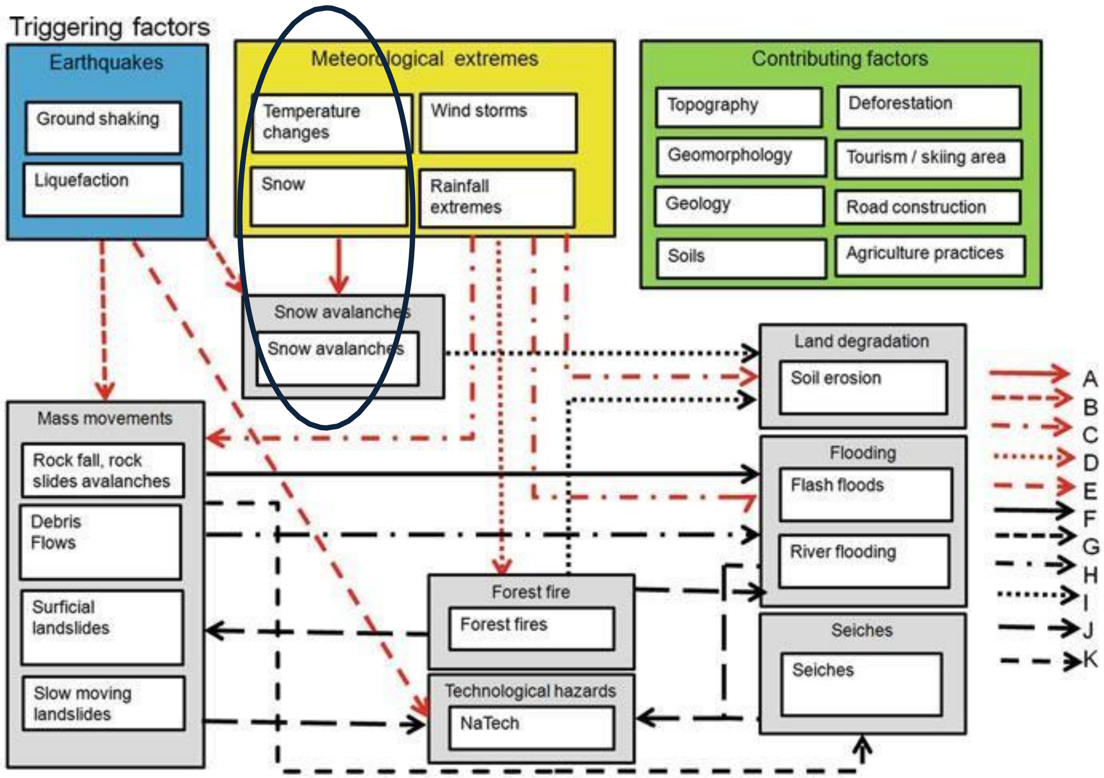


The red arrows indicate the hazards triggered simultaneously (coupled hazards

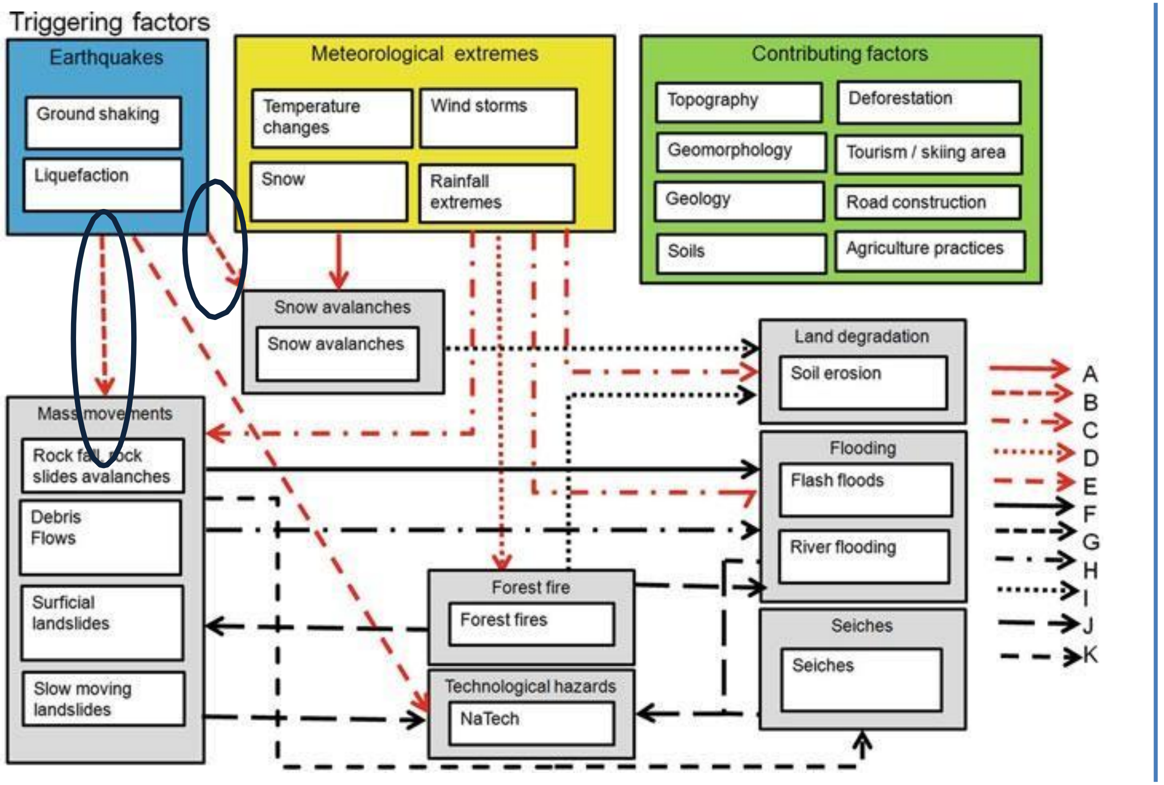


The **black** arrows indicate the concatenated hazards: one hazard causing another hazard over time

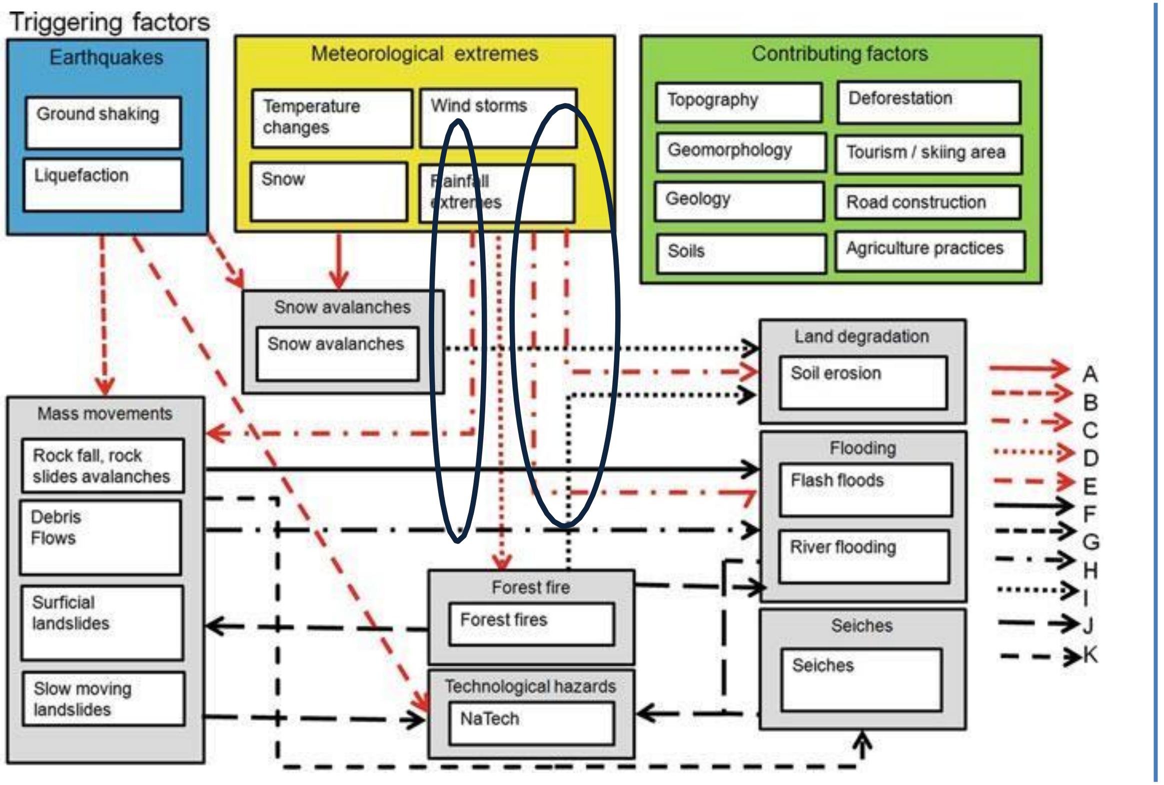
(a) Snow accumulation causing snow avalanches



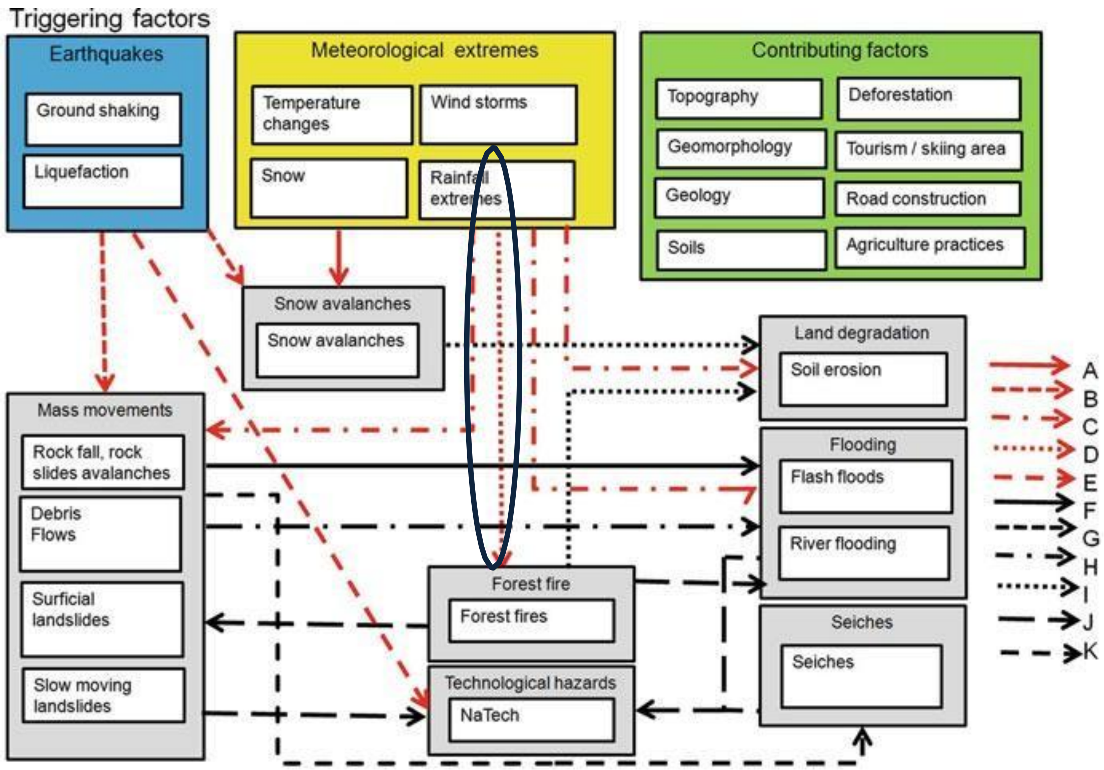
(b) Earthquakes triggering landslides and snow avalanches simultaneously



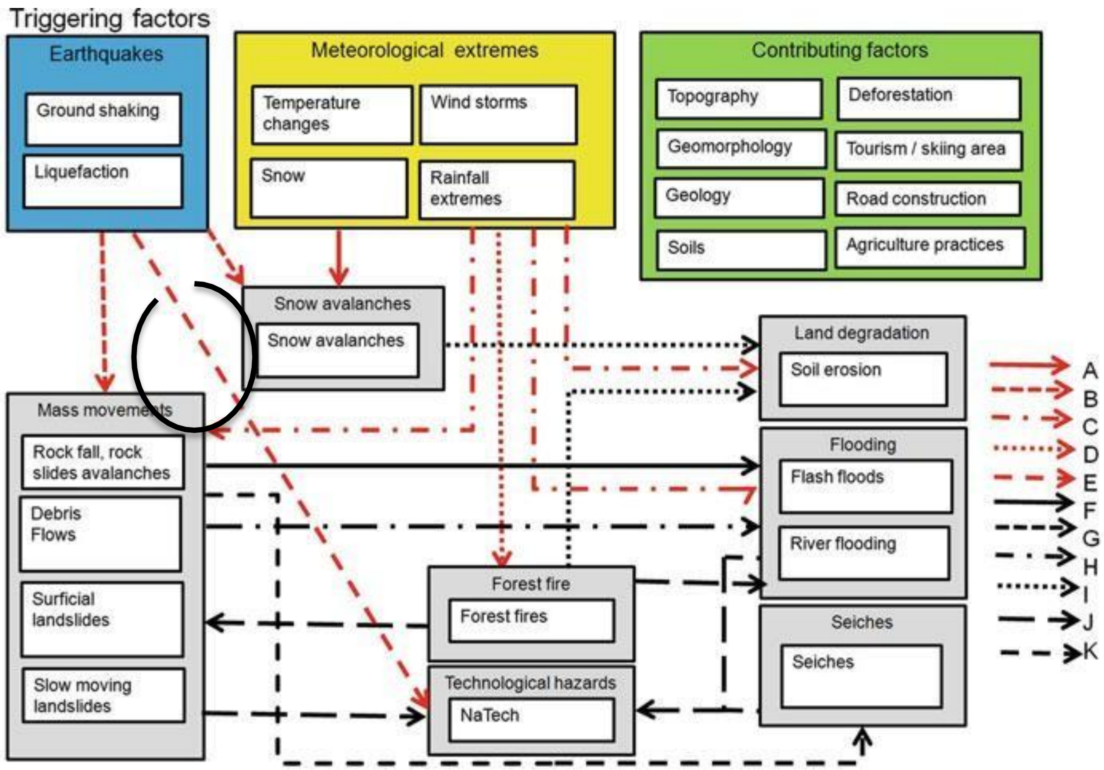
(c) extreme precipitation causing landslides, debris flows, flooding and soil erosion

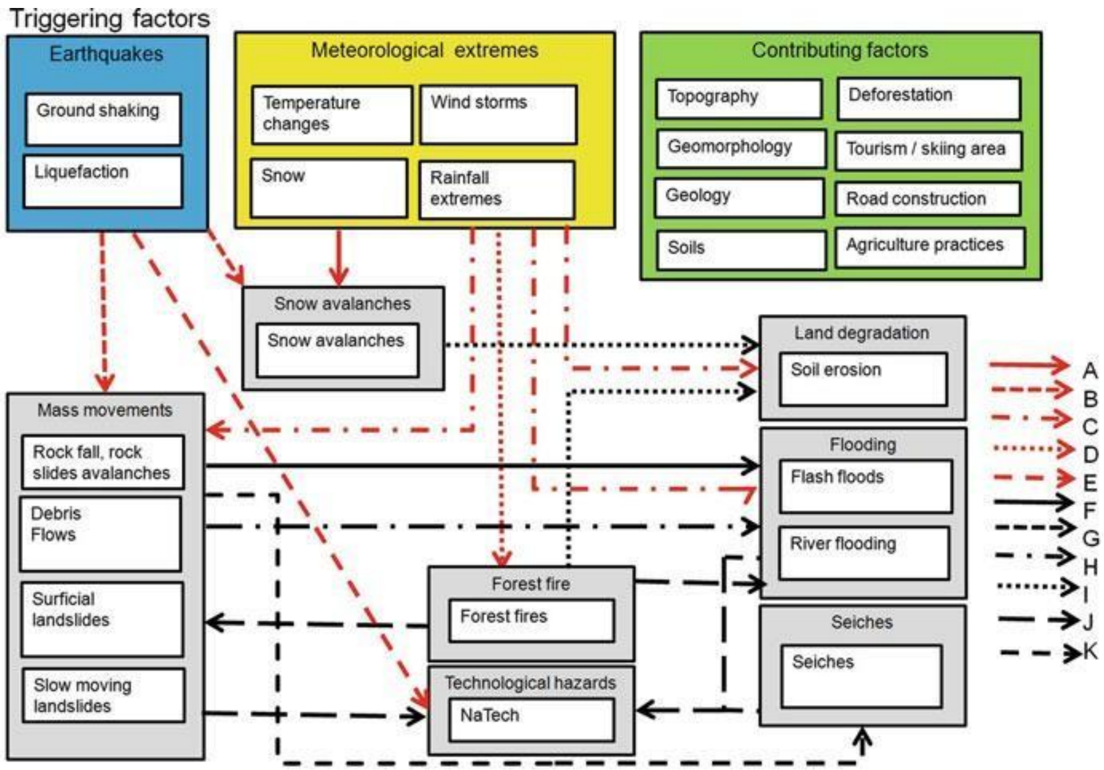


(d) drought and/or lightning causing forest fires



(e) earthquakes causing technological hazards





Following the same logic…

(f)landslides and debris flows damming rivers and causing dam break floods,
(g)large rapid landslides or rockfalls in reservoirs causing water floods,
(h)debris flows turning into floods in the downstream torrent section;
(i) snow avalanches or forest fires leading to soil erosion,
(j)forest fires leading to surficial landslides, debris flows and flash floods,
(k)landslides, debris flows or floods leading to technological hazards

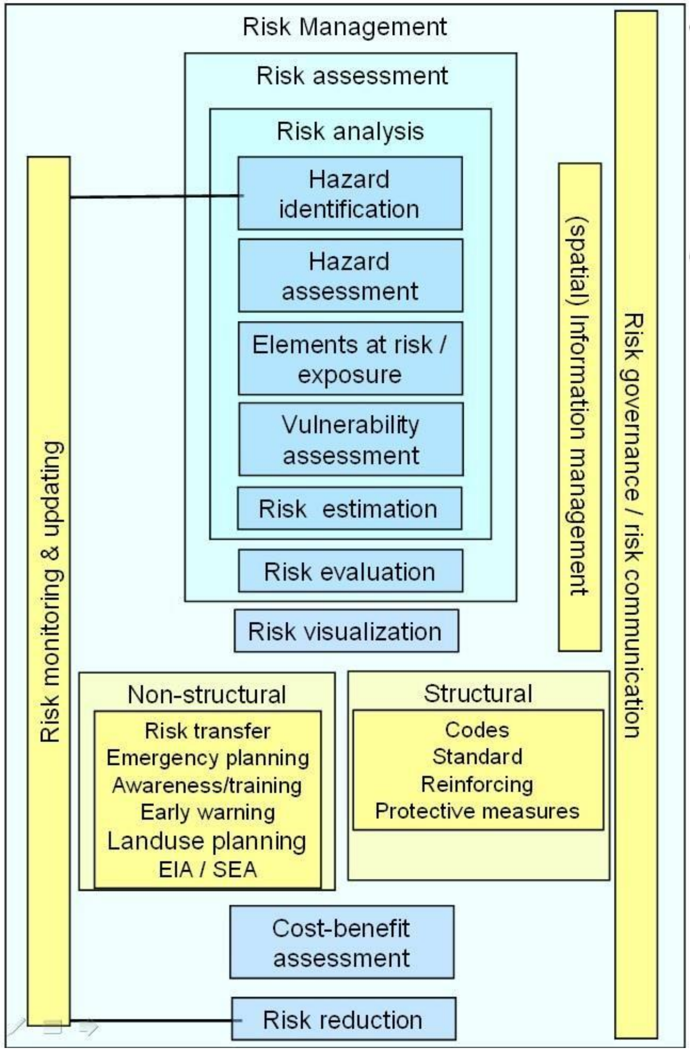
DEFINITION

Risk Assessment is a process to determine the probability of losses by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a threat or harm to property, people, livelihoods and the environment on which they depend

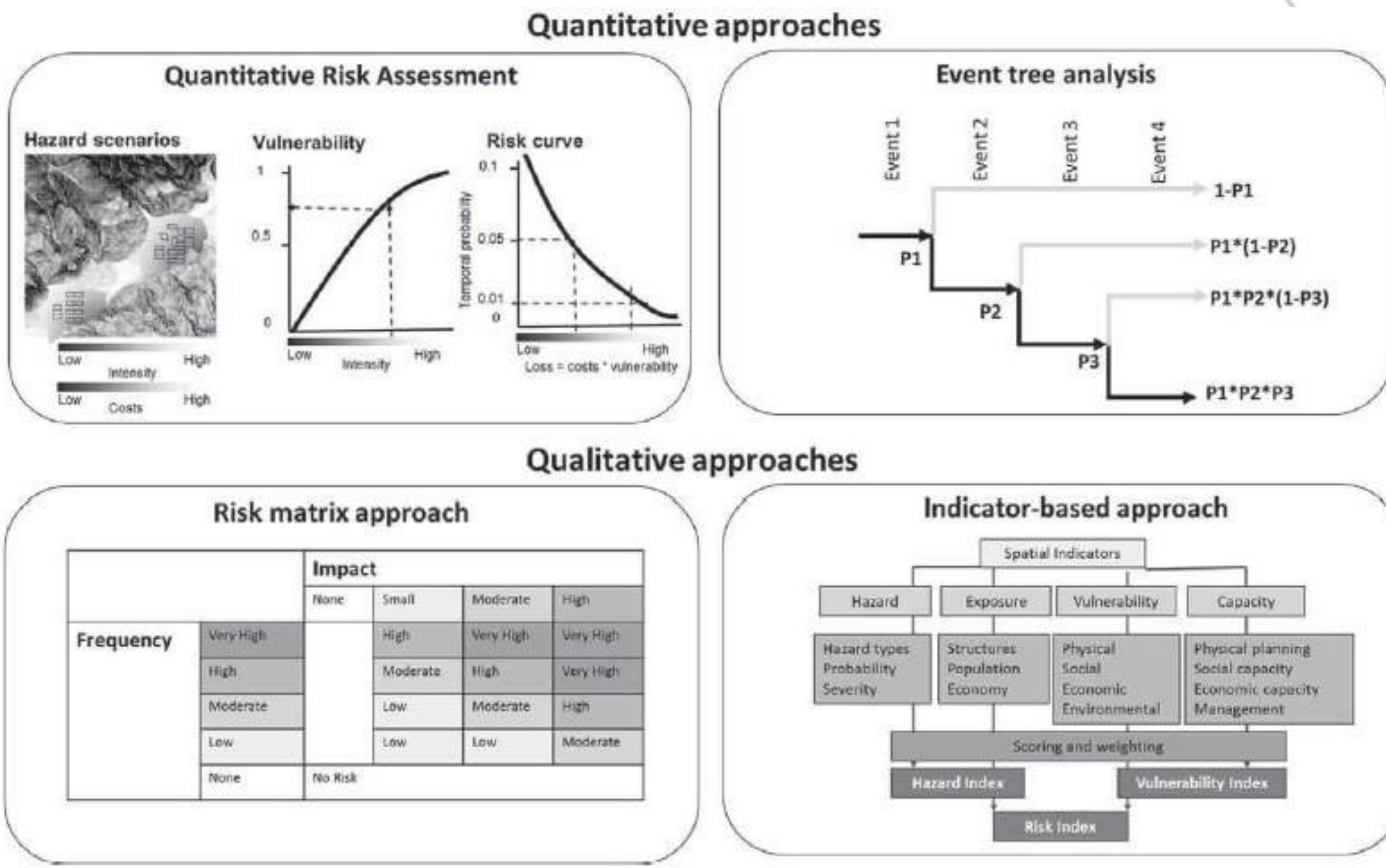
Risk assessment incorporates the risk analysis and risk evaluation phases

Risk Analysis is the process that is used to understand the nature, sources, and causes of the risks that have been identified and to estimate the level of risk

Risk evaluation is the process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable



Multi-Hazard Risk Assessment



Quantitative Risk Assessment

$$R_S = P_T * P_L * V * A$$

P_T is the temporal (e.g. annual) probability of occurrence of a specific hazard scenario (Hs) with a given return period in an area;

P_L is the locational or spatial probability of occurrence of a specific hazard scenario with a given return period in an area impacting the elements-at-risk;

V is the physical vulnerability, specified as the degree of damage to a specific element-at-risk E_s given the local intensity caused due to the occurrence of hazard scenario Hs

A is the quantification (value) of the specific type of element at risk evaluated. If the value is expressed in monetary terms, the risk may also be expressed as potential damage.

Quantitative Multi-Hazard Risk Assessment

$$\text{Risk} = \sum_{\text{All hazards}} \left(\int_{P_T=0}^{P_T=1} P_{(T|\text{HS})} \times \left(\sum_{\text{All EaR}} \left(P_{(S|\text{HS})} \times \left(A_{(\text{ER}|\text{HS})} \times V_{(\text{ER}|\text{HS})} \right)\right)\right)\right)$$

P(T/HS) = the temporal probability of a certain hazard scenario (HS). A hazard scenario is a hazard event of a certain type (e.g. flooding) with a certain magnitude and frequency;

P(S/HS) = the spatial probability that a particular location is affected given a certain hazard scenario;

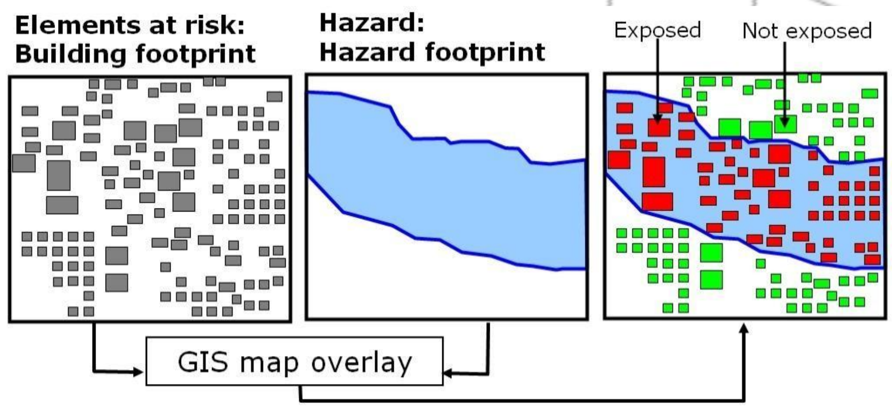
A(ER/HS) = the quantification of the amount of exposed elements-at-risk, given a certain hazard scenario (e.g. number of people, number of buildings, monetary values, hectares of land) and

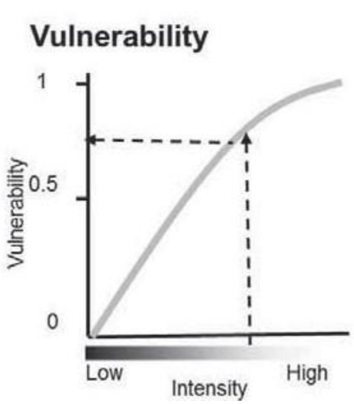
V(ER/HS) = the vulnerability of elements at risk given the hazard intensity under the specific hazard scenario (as a value between 0 and 1)

Quantitative Multi-Hazard Risk Assessment

$$\text{Risk} = \sum_{\text{All hazards}} \left(\int_{P_T=0}^{P_T=1} P_{(T|HS)} \times \left(\sum_{\text{All EaR}} \left(P_{(S|HS)} \times \left(A_{(ER|HS)} \times V_{(ER|HS)} \right) \right) \right) \right)$$

- GIS operations are used to analyze the exposure as the intersection between the elements-at-risk and the hazard footprint area for each hazard scenario
- For each element-at-risk also the level of intensity is recorded through a GIS-overlay operation
- These intensity values are used in combination with the element-at-risk type to find the corresponding vulnerability curve, which is then used as a lookup table to find the vulnerability value





Quantitative Multi-Hazard Risk Assessment

$$\text{Risk} = \sum_{\text{All hazards}} \left(\int_{P_T=0}^{P_T=1} P_{(T|HS)} \times \left(\sum_{\text{All EaR}} \left(P_{(S|HS)} \times \left(A_{(ER|HS)} \times V_{(ER|HS)} \right) \right) \right) \right)$$

- The way in which the amount of elements-at-risk are characterized (e.g. as number of buildings, number of people, economic value) also defines the way in which the risk is calculated

- The multiplication of exposed amounts and vulnerability should be done for all elements-at-risk for the same hazard scenario.

Quantitative Multi-Hazard Risk Assessment

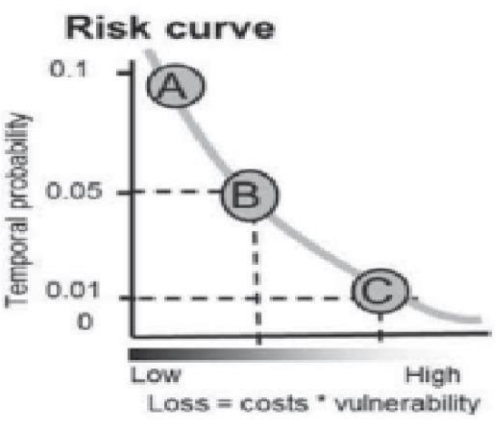
$$\text{Risk} = \sum_{\text{All hazards}} \left(\int_{P_T=0}^{P_T=1} P_{(T|HS)} \times \left(\sum_{\text{All EaR}} \left(P_{(S|HS)} \times \left(A_{(ER|HS)} \times V_{(ER|HS)} \right) \right) \right) \right)$$

- The results are multiplied with the spatial probability that the hazard footprint actually intersects with the element-at-risk for the given hazard scenario P(S/HS)

- The resulting value represents the losses, which are plotted against the temporal probability of occurrence for the same hazard scenario in a so-called risk curve

- The area under the curve is then calculated by integrating all losses with their respective annual probabilities

- This is repeated for all available hazard scenarios

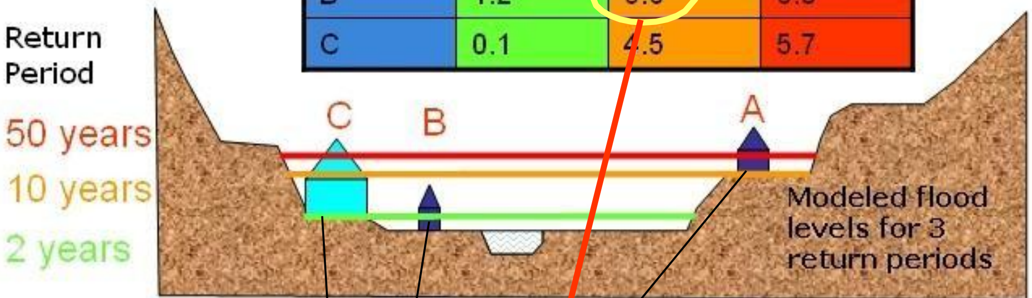


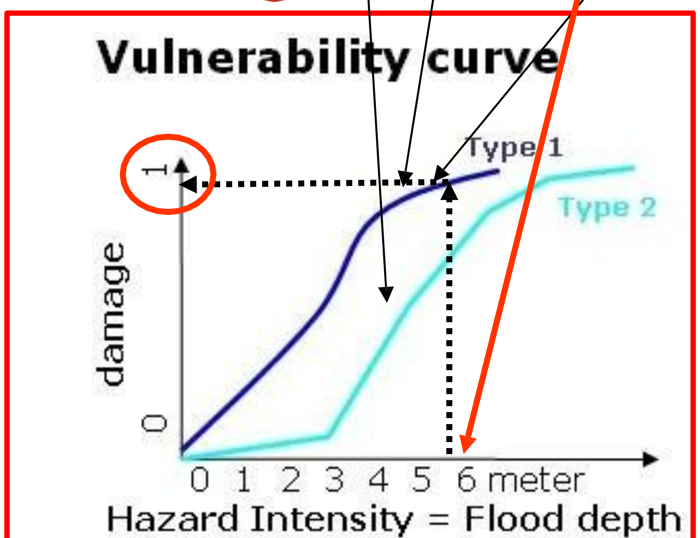
Example:

Exposure results

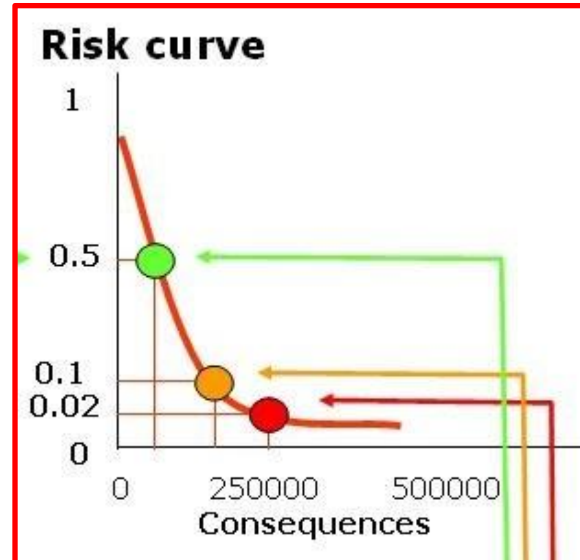
Water depth per return period

House	2 years	10 years	50 years
A	0	0.8	2.0
B	1.2	5.6	6.8
C	0.1	4.5	5.7





	RP	PT	A	V	V*A	ΣV*A
A	2	0.5	100000	0	0	20000
B	2	0.5	50000	0.2	10000	
C	2	0.5	200000	0.05	10000	
A	10	0.1	100000	0.1	10000	160000
B	10	0.1	50000	1	50000	
C	10	0.1	200000	0.5	100000	
A	50	0.02	100000	0.4	40000	250000
B	50	0.02	50000	1	50000	
C	50	0.02	200000	0.8	160000	

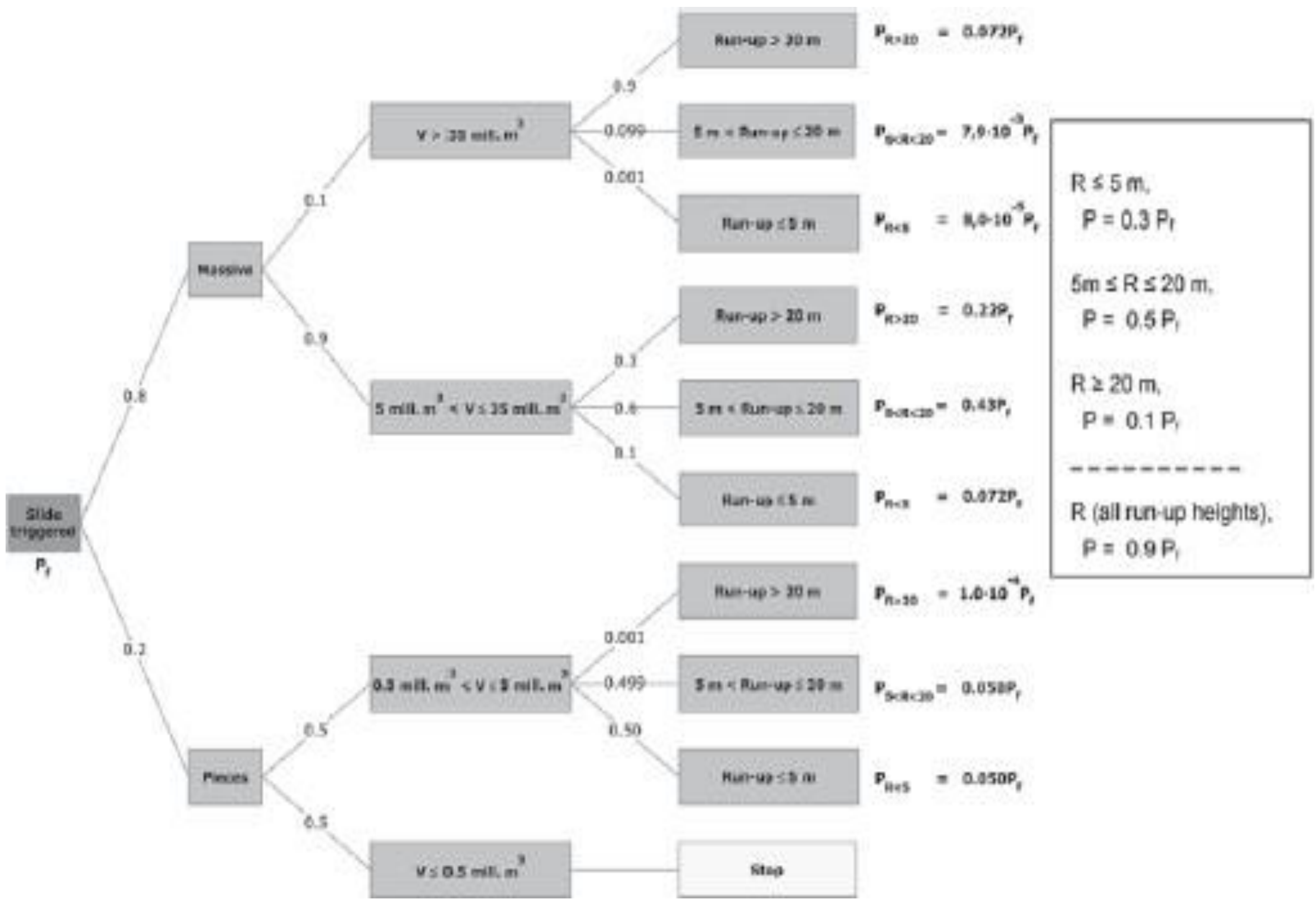


Event tree Approach

- Is the best approach for analyzing hazard chains/domino or concatenated
- An event tree is a system, which is applied <u>to analyze all the combinations</u> (and the associated probability of occurrence) of the parameters that affect the system under analysis.
- All the analyzed events are linked to each other by means of nodes
- All possible states of the system are considered at each node
- Each state (branch of the event tree) is characterized by a defined value of probability of occurrence

Event tree Approach- EXAMPLE

- Situation: a rockfall in a lake may trigger a flood wave that would impact a village



Risk Matrix Approach

- Quantitative Assessment- difficult and complex:
  - *many aspects are not fully quantifiable*
  - *have a very large degree of uncertainty*
  - *difficulty to define hazard scenarios, map and characterize the EaR*
  - *define the vulnerability using vulnerability curves*

- In order to overcome these problems, the risk is often assessed using the so-called risk matrices or consequences-frequency matrices

- **CFM are diagrams with consequence and frequency classes on the axes**

Risk Matrix Approach

A risk matrix

PROBABILITY \ POTENTIAL LOSS	Low	Medium	High	Very High
High	C	B	A	A
Medium	C	B	B	A
Low	D	C	B	B
Very low	D	D	C	C

Loss

Based on the potential by taking into account elements at risk

- Fatalities
- Injuries
- Impact on facilities, critical services and infrastructure
- Property damage
- Business interruption
- Environmental/ Economic impact

Risk levels

A: Very high. Frequent events causing very high losses, or moderate frequent events causing very high losses

B: High. Frequent events with moderate losses/ moderate & low frequent events causing (very) high losses

C: Moderate. Frequent events with low losses or very low frequent events causing (very) high losses

D: Low. Low frequency events with low losses

Probability

High	Events that occur more frequently than once in 10 years
Moderate	Events that occur from once in 10 years to once in 100 years
Low	Events that occur from once in 100 years to once in 1000 years
Very Low	Events that occur less frequently than once in 1000 years

classes of consequences (or expected losses) of the hazardous events on one axis

classes of frequency of the hazardous events on the other axis

Which one to use?

Method	Advantages	Disadvantages	Suitability for Specific Spatial Scales
Quantitative risk assessment (QRA)	Provides quantitative risk information that can be used in Cost-benefit analysis of risk reduction measures.	Very data demanding. Difficult to quantify temporal probability, hazard intensity and vulnerability.	Normally used as basis for investments in structural mitigation measures on project level
Event-tree analysis	Allow modelling of a sequence of events, and works well for domino effects	The probabilities for the different nodes are difficult to assess, and spatial implementation is very difficult due to lack of data.	Normally used as basis for plan approval procedures of dangerous facilities (e.g. nuclear power plants, chemical establishments) on project level
Risk matrix approach	Allows to express risk using classes instead of exact values, and is a good basis for discussing risk reduction measures.	The method doesn't give quantitative values that can be used in cost-benefit analysis of risk reduction measures. The assessment of impacts and frequencies is difficult, and one area might have different combinations of impacts and frequencies.	Basis for hazard zoning in many countries like Austria France, Italy and Switzerland. Good fit for regional and local spatial planning as basis for keeping hazard prone areas free of further development

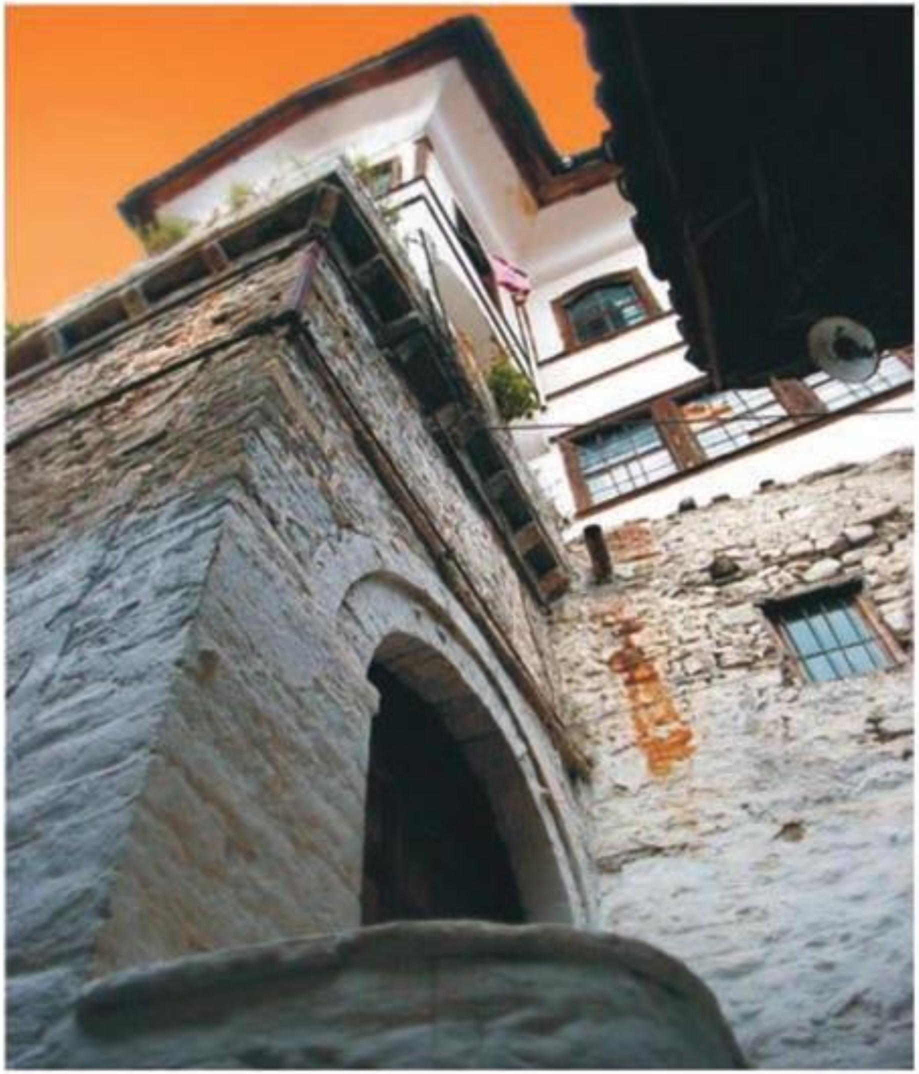
CASE STUDY:
Disaster Risk Preparedness and Management of Berat

➢ Brief history of Berat

Berat is inscribed as a rare example of an architectural character typical of the Ottoman period
Attributes and Values:
1. **Architecture: a)** Byzantine Churches (architectural, artistic, Christian and spiritual tradition preserved, historic, education value); **b)** Mosques build under the Ottoman era (architectural, spiritual tradition, historic); **c)** Fortifications (archaeological, architectural, historic); **d)** Vernacular buildings (ottoman architecture, social, functional values, continuously inhabited, economic)
2.Coexistence (combination of various religious and cultural traditions)
3. Artisan tradition (artistic, craft values)
4.Urban heritage (diversity of urban societies, landscape, lifestyle)
5. Landscape (environment values, geological value).

Stakeholders involved in the DRM Plan

- Municipality of Berat
- Regional Directorate of National Culture
- Institute of Culture Monuments
- CEZ
- Ministry of Tourism, Culture, Youth and Sports
- Police of Fire Protection and Rescue
- Ministry of Interior Affairs
- Directorate of Museums
- Directorate of Water Supply
- Prefecture of Berat (Emergency Unit)
- Regional District of Berat
- Drainage Board
- Directorate of Forests
- Red Cross
- Citizen Forum
- Chamber of Commerce
- Directorate of Public Health
- Military Division of Berat
- Police Station
- ASHA
- Agency of Environment
- UNESCO office



ANALYSIS
Hazards and Vulnerabilities

IMMEDIATE HAZARDS:

1. FIRE
2. ROCK FALL
3. LANDSLIDE
4. FLOODS
5. EARTHQUAKE

OTHER HAZARDS:

1. PROGRESSIVE DETERIORATION
2. ABANDONMENT
3. IMPROPER RESTAURATIONS
4. LITTLE CONTROL ON THE BUFFER ZONE

FIRE
(VULNERABILITIES)

Vulnerabilities to cope immediately

- Lack or improper functioning of the existing hydrants.
- On air electric lines and worn out electric installations inside the houses.
- Narrow streets and alleys that make it difficult for fire suppression vehicles to pass through.
- Lack of 24 hours water supply.
- Lack of electric and fire projects for the houses.
- Lack of fire suppression equipment installed in the neighborhood.
- Abandonment and lack of maintenance.
- Lack of awareness.

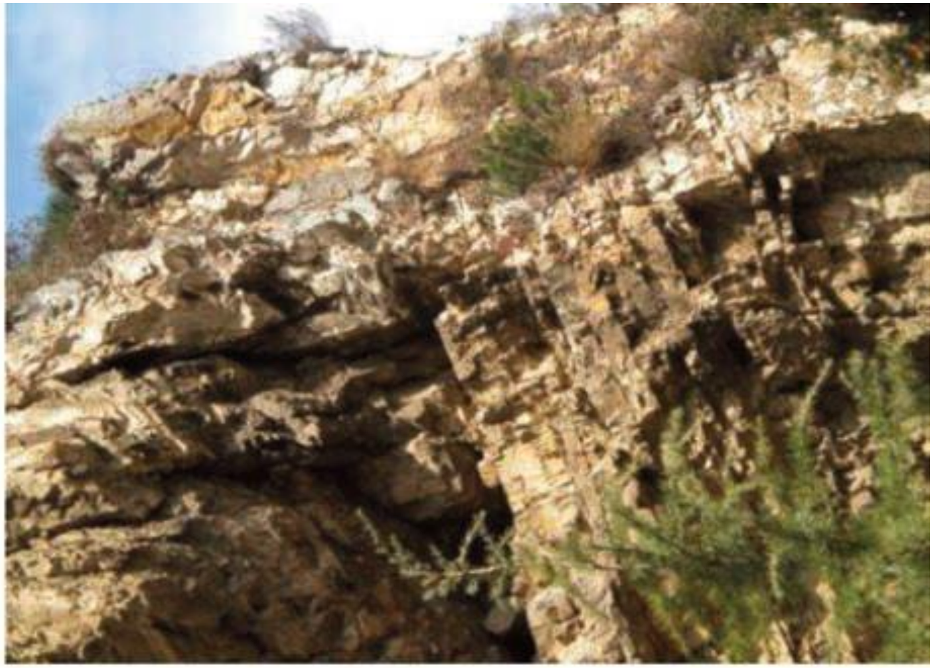
Other Vulnerabilities

- Lack of smoke detectors, manual and automatic fire suppression equipment inside the houses
- Materials; wood constructions, carpets, (Combustible material)
- Vegetation growth
- Scattered garbage
- Nearness of Trees
- Nearness of houses
- Lack of water collecting areas

- Lack of evacuation exits
- Alarms not connected to the fire department
- Lack of awareness
- Lack of fire management plans during restoration
- Lack of signage
- Lack of drills
- Lack of citizen training
- Water cisterns inside traditional houses not in use
- Abandoned houses
- Lack of Space for immediate interventions
- Lack of Storage for works of art etc
- Improper measures for visitors
- Poor security

ROCK FALL

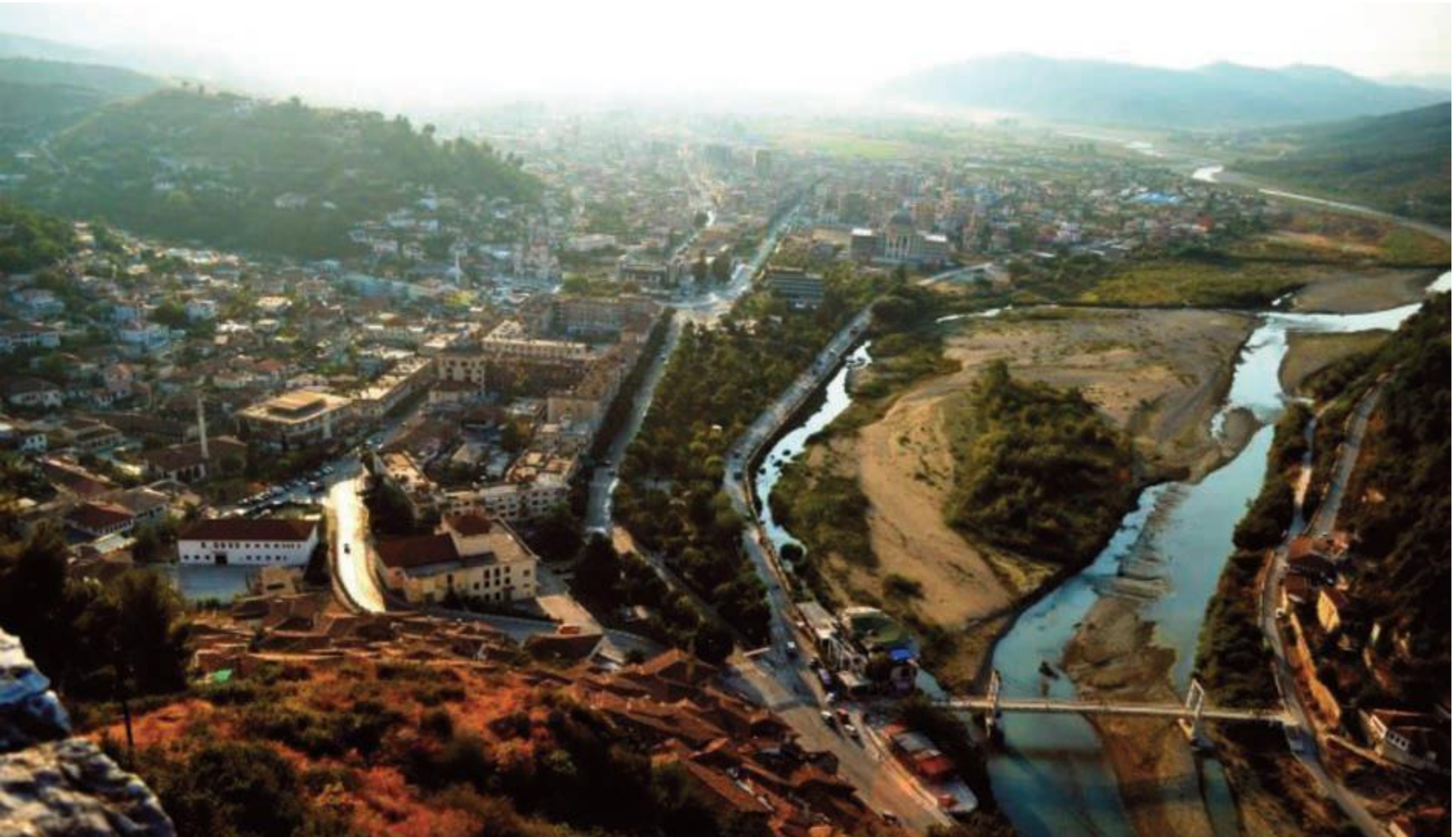
- Poor drainage system
- Unstable hilly rocks
- Unconsolidated hilly slopes
- No protection against the falling rocks
- Soft composition of rocks
- Not a thorough seismic and geological research
- Lack of funds
- Civilian houses are near
- The site overlooks the main road
- Scarceness of trees spread on the hill



LANDSLIDE

- Lack of Drainage system
- Poor wall construction
- Unstable hilly rocks
- Unconsolidated hilly slopes
- Nearness of Houses, people living near or on the slopes.
- Scarceness of trees spread on the hill
- Lack of sewage system for the houses built recently

FLOODS/RAINFALL



FLOODS

- Level of discharging pipes is not high enough in the river
- Lack of a collector
- Poor Drainage system
- Poor condition of the houses
- Lack of river embankments
- Lack of dams
- Lack of maintenance for the river bed
- Lack of maintenance for heritage assets such as buildings
- Lack of training
- Exposed electric cables
- Nearness of Houses
- Difficult terrain

EARTHQUAKE

- Lack of a Seismic Microzonation
- Unconsolidated buildings and fortification walls
- Materials (for example different phases of restorations)
- Lack of Storage for works of art etc
- Nearness of houses
- Electrical and telephonic lines are exposed
- Unstable hilly rocks
- Lack of Space for immediate interventions
- Abandoned houses
- Location related to mountain (geographic positioning)
- Lack of signage for evacuation
- Lack of river embankments
- Illegal buildings and interventions
- Nearness of trees to the walls

SCENARIO

Gorica Quarter; a monument house of category II near the church of Saint Church of Saint Spiridon which is Category I This house is divided between two owners, one belongs to Scott Logan and One belongs to Vali Prifti. Vali Prifti doesn't live in the building for years, while Scott Logan does live.

Vali Prifti's part has undergone these damages because of abandonment :

- Roof has fallen in
- Moisture
- Damaged wall structure (Cracks)
- Weakened foundations
- Floor has given in.
- These have damaged the other part of the house:
- Damaged roof
- Moisture
- Damaged walls
- Foundations weakened.

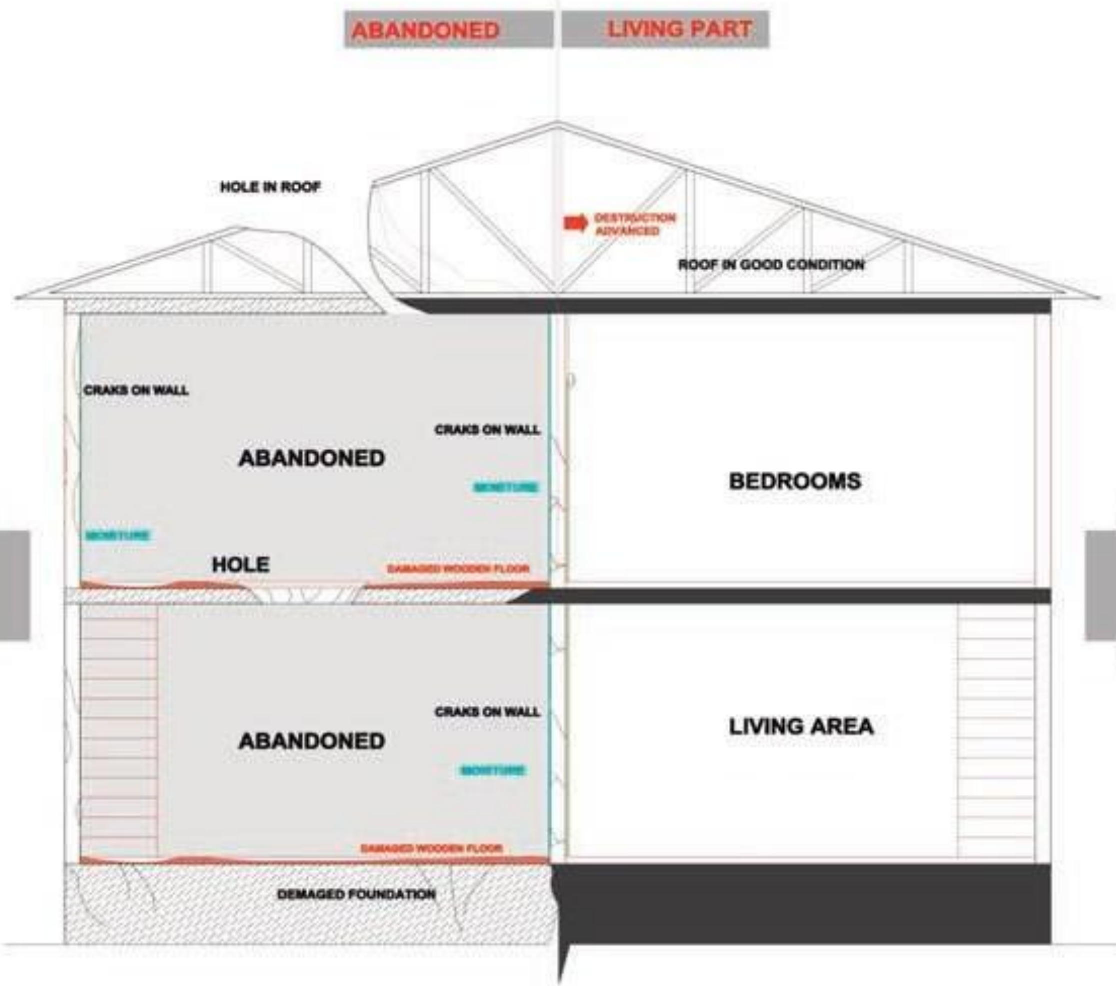
This situation makes the house vulnerable to hazards. The house is vulnerable to fires, earthquake and heavy rain. There is a whole in the roof of the abandoned house through which water flows in freely. There is heavy rain and large amount of water gets through the wall. The water penetrates in the other house and reaches the electric spine causing immediate fire. There are no fire detection and fire suppression equipment. The inhabitants notice the fire late because the disaster is taking place in the bedrooms. The fire spreads rapidly through the wooden structures of the second floor and spreads in the source house as well as in the surrounding area which has high vegetation. The house is a hostel and tourists might be endangered with a high economic impact. The houses have little compartimentation and the fire has little chance of being suppressed. There is a high possibility that the fire might reach the power pole and the other houses which are very close.
Firefighter Department is notified late and there is already some damage done when they arrive. The terrain makes it difficult for fire officials to arrive with a vehicle at the place. Because the houses are very close to one another the fire fighters have difficulty in limiting the fire within the already damaged area. There are no hydrants near.

Location:

Gorica Quarter. A monument house of Category II.

Scheme of Scenario

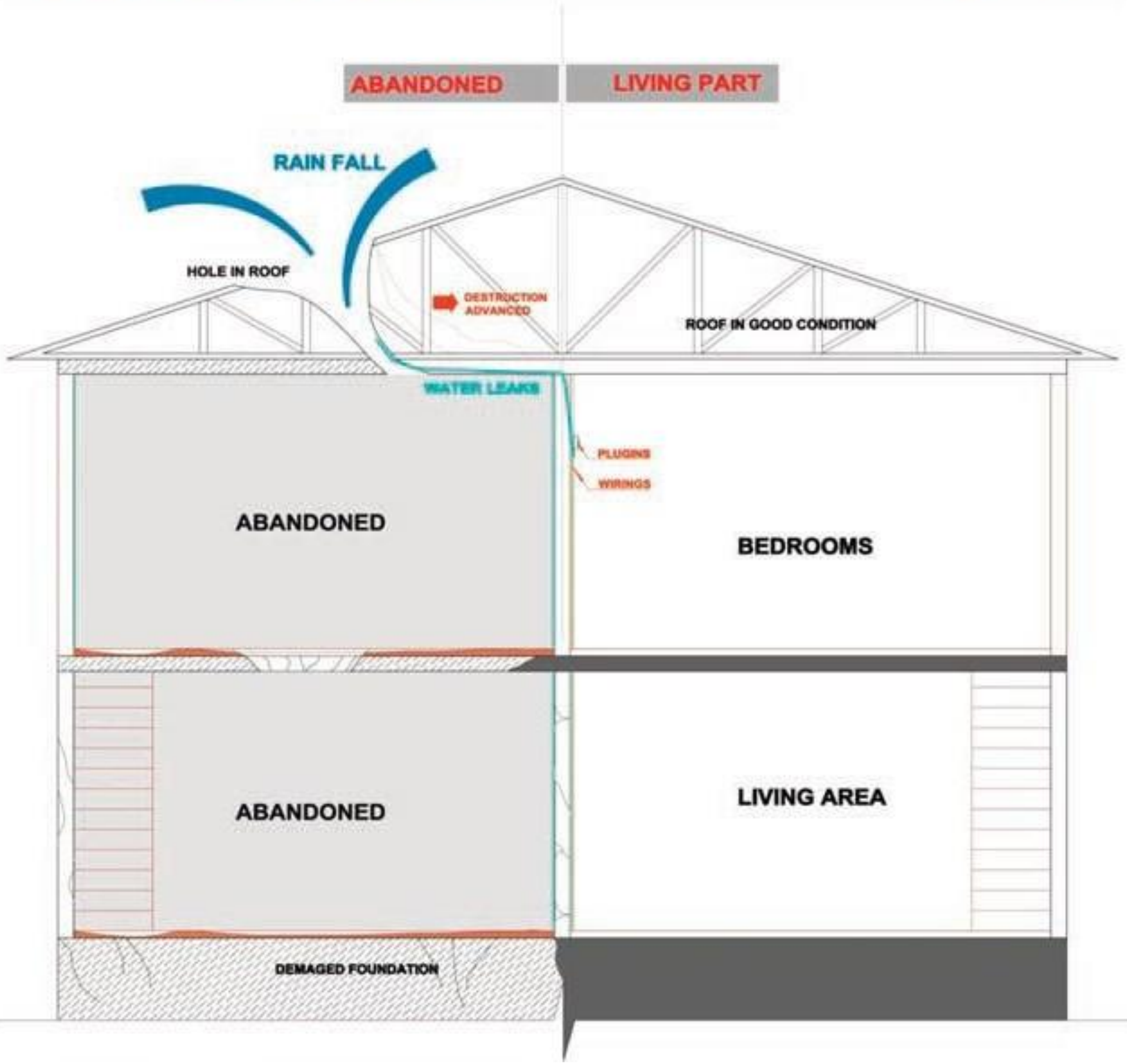
EXISTING CONDITION OF THE HOUSE

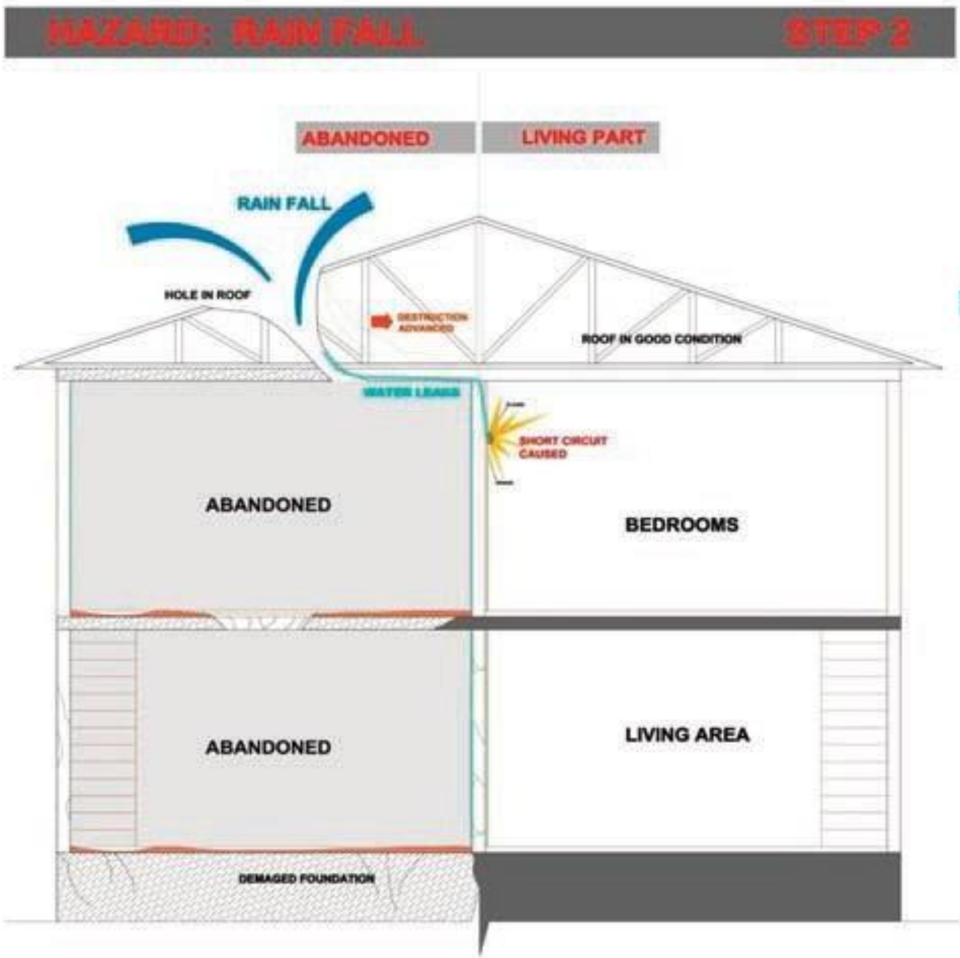


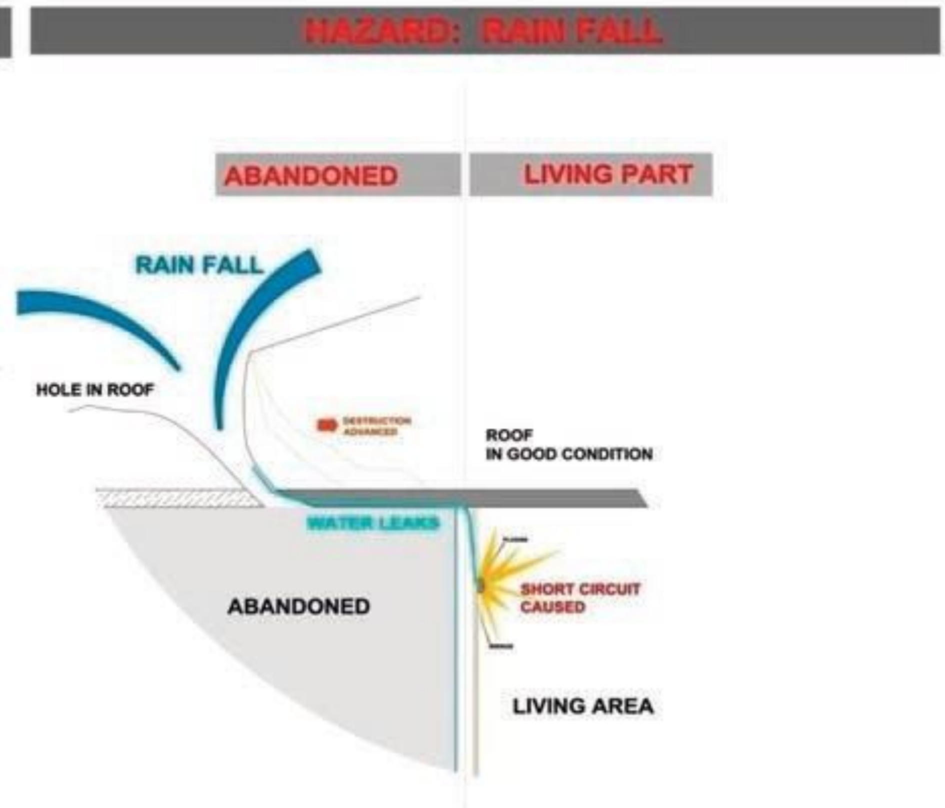
BAD CONDITIONS
- Roof has follen in
- Moisture
- Damaged wall structure
- Hole on the floor
- Damaged wooden floor
- Damaged foundation
- Damaged facade

GOOD CONDITIONS
- Restored roof
- Strengthened walls
- Repaired floor
- Consolidated foundation
- Restored facades

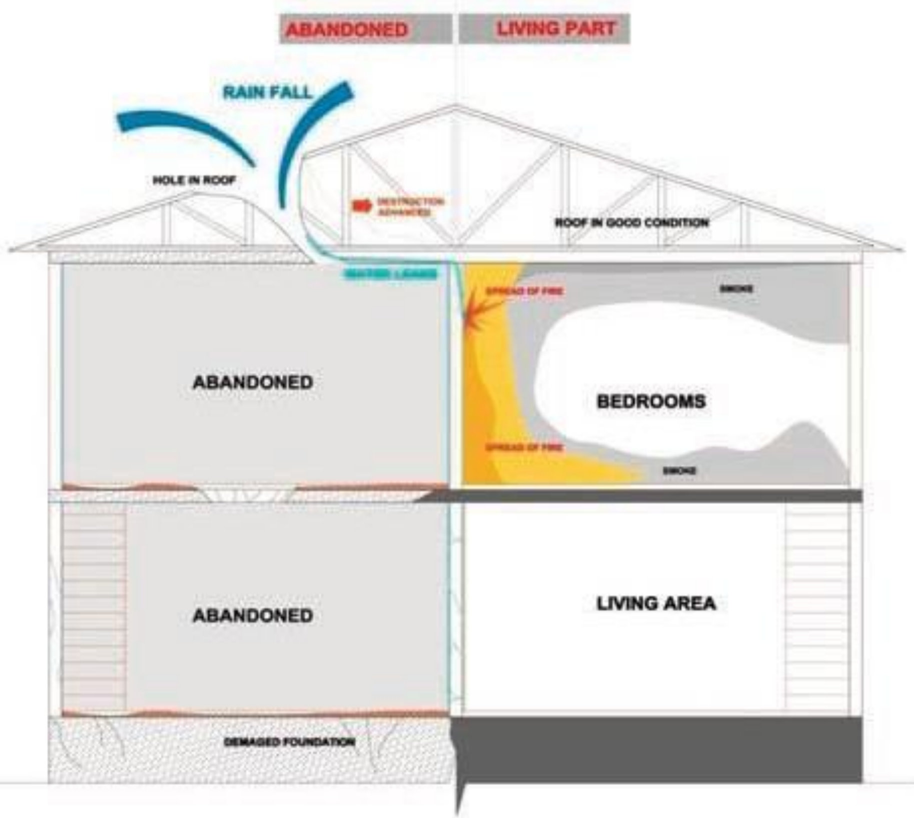
HAZARD: RAIN FALL STEP 1



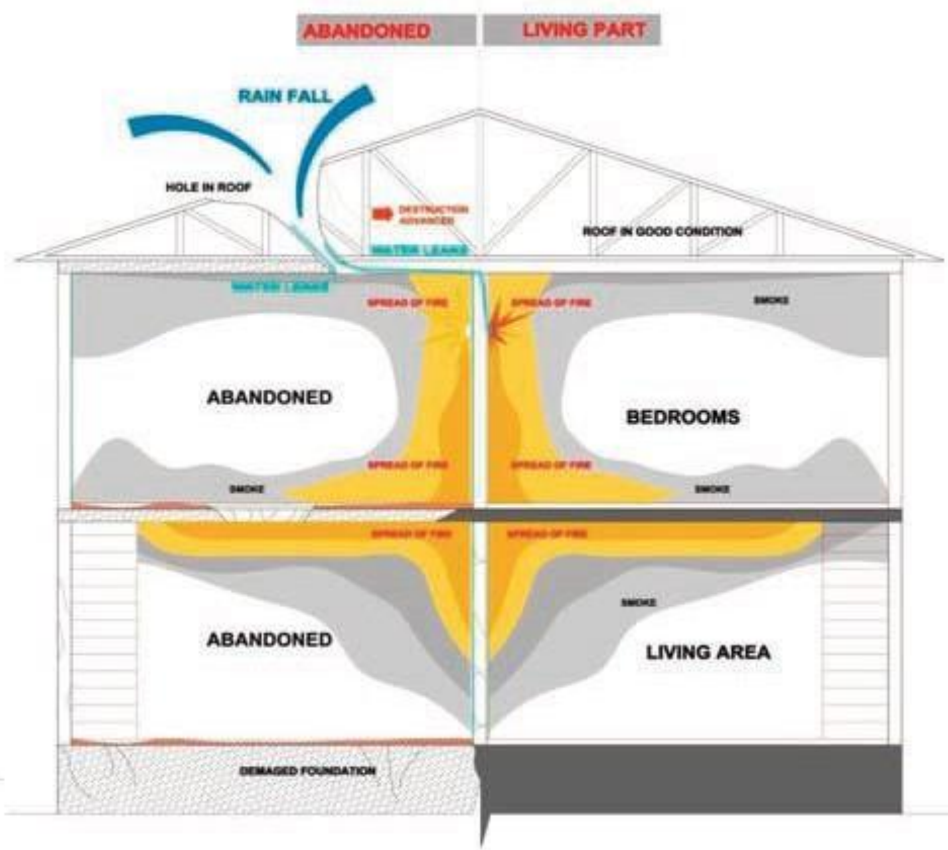

HAZARD: RAIN FALL
STEP 2
ABANDONED
LIVING PART
RAIN FALL
HOLE IN ROOF
DESTRUCTION ADVANCED
ROOF IN GOOD CONDITION
WATER LEAKS
SHORT CIRCUIT CAUSED
ABANDONED
BEDROOMS
ABANDONED
LIVING AREA
DEMAGED FOUNDATION


HAZARD: RAIN FALL
ABANDONED
LIVING PART
RAIN FALL
HOLE IN ROOF
DESTRUCTION ADVANCED
ROOF
IN GOOD CONDITION
WATER LEAKS
SHORT CIRCUIT
CAUSED
ABANDONED
LIVING AREA

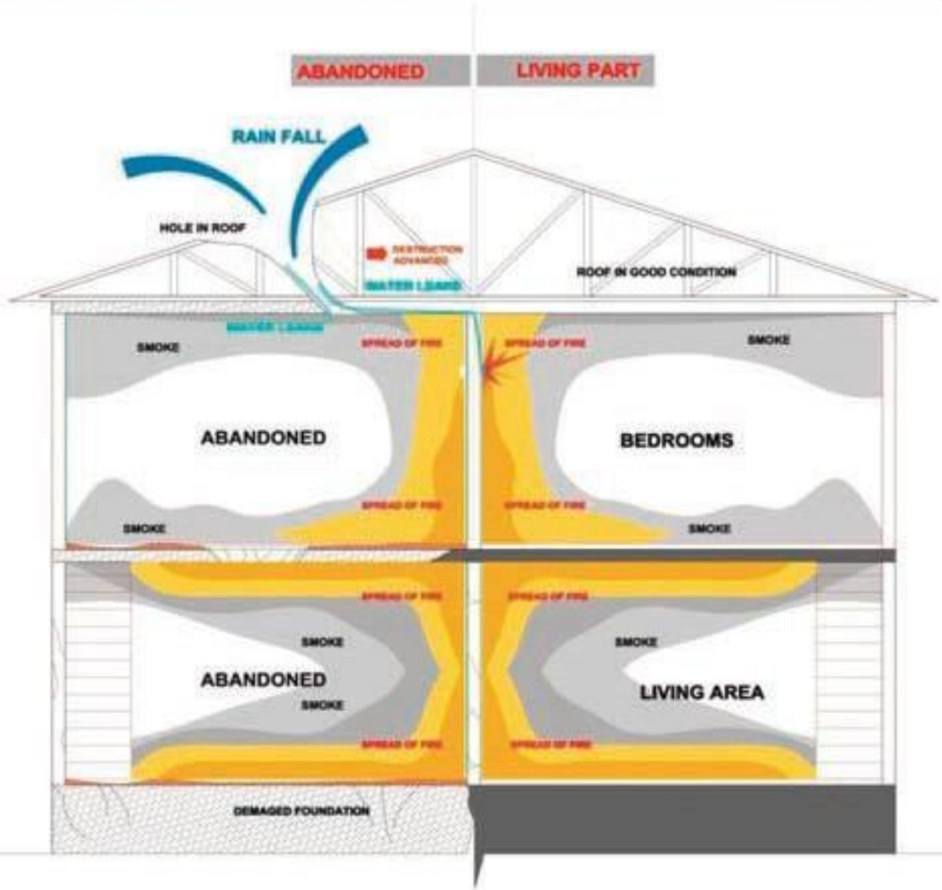
HAZARD: RAIN FALL STEP 3



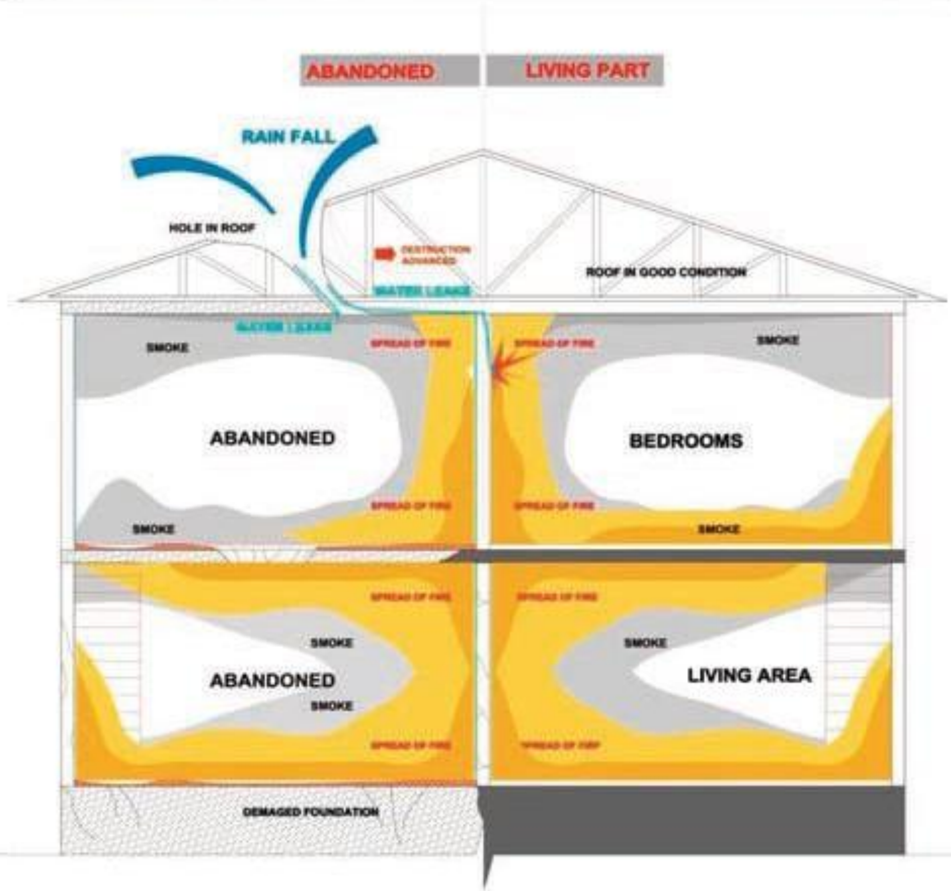
HAZARD: RAIN FALL STEP 4

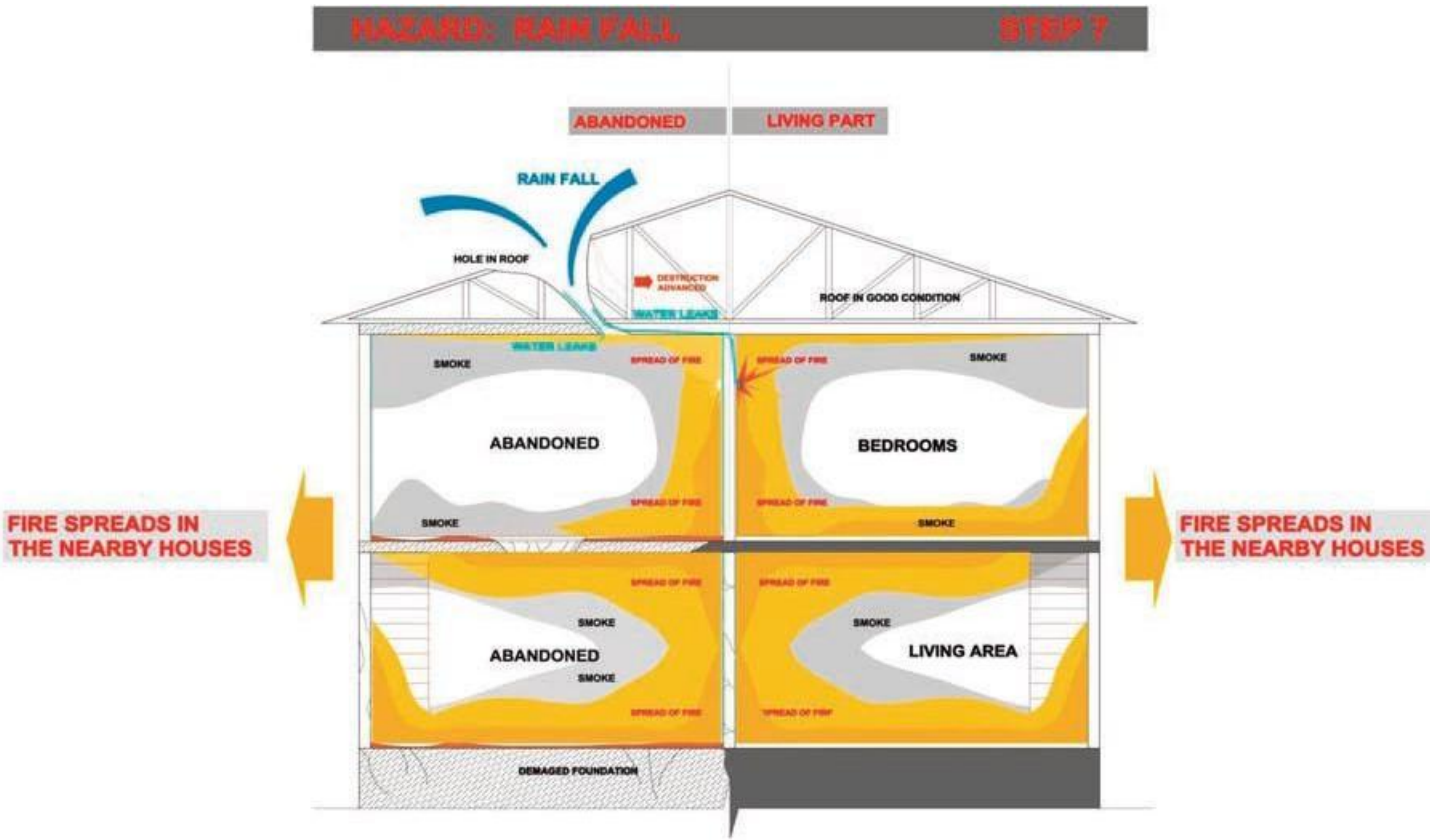


HAZARD: RAIN FALL STEP 5



HAZARD: RAIN FALL STEP 6





HAZARD: RAIN FALL
STEP 7
ABANDONED
LIVING PART
RAIN FALL
HOLE IN ROOF
DESTRUCTION ADVANCED
WATER LEAKS
ROOF IN GOOD CONDITION
WATER LEAKS
SMOKE
SPREAD OF FIRE
SPREAD OF FIRE
SMOKE
ABANDONED
BEDROOMS
SPREAD OF FIRE
SPREAD OF FIRE
SMOKE
SMOKE
FIRE SPREADS IN THE NEARBY HOUSES
FIRE SPREADS IN THE NEARBY HOUSES
SPREAD OF FIRE
SPREAD OF FIRE
SMOKE
SMOKE
ABANDONED
LIVING AREA
SMOKE
SPREAD OF FIRE
DEMAGED FOUNDATION

SPREAD OF FIRE


DECEMBER, 2011

PREVENTION AND MITIGATION

Mitigation and preparedness measures can help reducing disaster risk form hazards and vulnerability on the site

1. **Documentations and inventory** of each monument in the site in details will help in preparing the evacuation plan. Documentation should include:
   - the building structure of the building (the problems, where is damaged, how is build etc.)
   - The object with value and where are located
   - Prioritization of the significance of the monument
2. Improvement of the **Electrical system** in the site
3. **System of Hydrants**
4. **Alarm system** (installing equipment and proper signature, suitable vehicles of transportation in the historic center etc.)
5. **Strong and clear legislation** that protects from any improper intervention
6. **Maintenance of the green areas.** Vegetation
7. **The regular collection of the garbage**
8. **Evacuation plan**

EMERGENCY PREPAREDNES AND RESPONSE

Emergency Equipment

- Extinguishers will be placed near the areas that are dense with houses and that are easily accessed by people in case of emergency
- Smoke alarms will be placed inside the houses
- CCTV-s will be placed on the roof of the church and on Tabya tower (risk of theft)
- Water from the pipes will be in the form of rain and will not have high pressure so as to damage the least the heritage structures
- The hoses will be connected to hydrants positioned on the lower and upper roads

Evacuation Plan

- The house has two doors, and a garden that can be easily crossed. People will exit from the door on the back of the house and will be collected in the school on the southeast of the quarter
- The shortest way for pedestrians and transport of heritage assets is to the back of the house.
- The emergency vehicles will take the road on the west
- Team members will protect the three doors from theft and one guard will stay on the garden
- The firefighters will provide many barrels to transport the injured

RECOVERY AND REHABILITATION

Short Terms

- Damage Assessment: Buildings assessment, landscape assessment,
- Inspect the structural stability, material damage, loss of authenticity or integrity, environmental setting
- The tools include pictures, drawings, technical reports
- Institute of Cultural Monuments, Directorate of Monuments, Municipality of Berat will inspect the affected area
- Recovery activities in short term:
  - The area will be isolated
    - Transport will be prohibited
    - Electricity supply will be disconnected
    - The houses that are burned will be temporarily covered for not being further damaged by climate conditions
    - The walls in danger of falling will be temporarily supported with appropriate structures
    - People and heritage assets will be rescued to the school of the neighborhood

RECOVERY AND REHABILITATION

Long Terms

1. Restoration and reconstruction of the property in accordance with the integrity and authenticit
2. Rehabilitation of the environment
3. Review of cultural heritage legislation
4. Review of Disaster Management
5. Assessment of human and economic resources
6. Stakeholder involvement and community participation
7. Educational and Awareness raising activities
8. Introduction of a monitoring system

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- “Disaster Risk Management of Cultural Heritage Sites in Albania”, UN Albania

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Thank you
for your attention

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Knowledge FOr Resilient soCiEty


Season's Greetings