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# Improve information provision for disaster management: MONITOR II, EU project

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## Abstract

Management of natural hazards constitutes a common challenge in all country of the world. In Europe several projects have been dealing with this topics in the last decades. This significant effort has led to the development of generally accepted schemes for analyzing hazard, vulnerability and risk (European Commission 2010).

However, no real standardization of hazard and risk assessment has been achieved. Moreover, static hazard and risk maps are not sufficient to effectively support contingency planning. For example, they do not provide a clear and simple vision of expected evolution, in space and time, of the event and damage scenarios.

Improving information provision for disaster management by bridging the gap between hazard maps and contingency plans, is one of the goals of **MonitorII project (MII)**. It is a **European Project (www.monitor2.org) funded by the South East Transnational Cooperation Program – SEE** (Fig. 1).

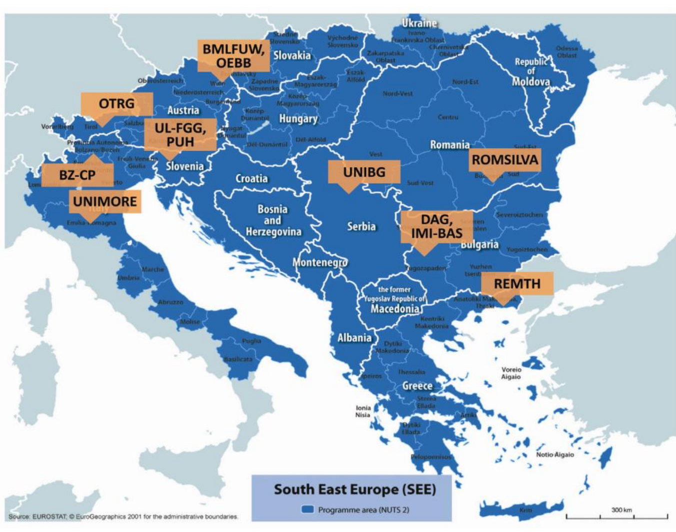

*Figure 1: Map of the SEE programme area with the abbreviations of the project partner names.*

***The vision of MII is that a closer link can be created between hazard assessment and risk management by:***

- complementing hazard and risk maps with simplified **scenario models** regarding the expected course of the natural event itself and of the expected damages;
- developing a modular software suite, the **CSA (Continuous Situation Awareness),** that can guide risk analysis and contingency management through conceptually and practically consistent procedures based on shared ontology rules.

Within the broad range of hazards, MII specifically deals with **floods and landslides** and it is presently just beyond its midterm. The first results are published at the follow link.

**www.monitor2.org/downloads/Outputs&Resultes/MonitorII_WP3_Brochure_Final_NEW**

## Hazard mapping and contingency planning: state of art

Hazard and risk mapping are "pseudo-static" documents updated with an interval of 1 – 10 years (or even longer). In the public sector they are produced for land-use planning purposes and are not intended for contingency planning. Land-use planning requires maps to be used and interpreted by non experts and that can incorporate a dose of political-decisional subjectivity.

The analysis of practice among Project Partners has highlighted a number of common points between these maps and the methods used to combine risk variables: **frequency** of hazard (defined by using return periods); **intensity** of hazard (determined by physical variable); **hazard potential** is derived by a heuristic matrix-based combination of frequency and intensity; **vulnerability** of elements at risk is usually only defined on the basis of the function of structures (with some regard to their sociopolitic-strategic importance).

There is **no "true" information on vulnerability** of single structures concerning hazardous events. This means that the capacity of structures to resist the impact of an event is not taken into account. But vulnerability should not be restricted to the "resistance capacity", but must include "anticipation capacity", "coping capacity" and "recovery capacity" as well.

The general similarities described above contrast with great differences in details of approaches, that lead top difficulties in adopting transnational approaches. No common standard exist in the hazard and risk assessment for floods (Fig. 2)

| FREQUENCY CLASS | AUSTRIA (PP1) | SLOVENIA (PP3 & PP4) | AUSTRIA (Hora maps) | SOUTH TYROL (PP5) | SOUTH TYROL (PP7) |
|---|---|---|---|---|---|
| High | < = 10 years | 10 years | 30 years | < = 30 years | < = 50 years |
| Medium | 150 years | 100 years | 100 years | 100 years | 200 years |
| Low | n.d | 500 years | 300 years | 300 years | 500 years |
| Very Low | n.d | n.d | n.d | > 300 years | n.d. |

| INTENSITY CLASS | SLOVENIA (PP3 & PP4) | | AUSTRIA (PP1) | | SOUTH TYROL (PP5) |
|---|---|---|---|---|---|
| | Height of Water | Momentum | Height of Energy Line | | Height of Water |
| | | If velocity >1 m/s) | Recurrent events | Frequent events | |
| High | > 1.5 m | > 1,5 $m^2/s$ | > = 1,5 m | > = 0,5 m | >2 m |
| Medium | 0.5–1.5 m | 0.5–1,5 $m^2/s$ | < 1,5 m | < 0,25 m | 0.5–2 m |
| Low | < 0.5 m | < 0,5 $m^2/s$ | n.d. | n.d. | < 0.5 m |

| | | SLOVENIA (PP3 & PP4) | | | SOUTH TYROL (PP5) | | | | AUSTRIA (PP1) | |
|---|---|---|---|---|---|---|---|---|---|---|
| HAZARD CLASS | | FREQUENCY CLASS | | | FREQUENCY CLASS | | | | FREQUENCY CLASS | |
| | | High | Medium | Low | High | Medium | Low | Very Low | High | Medium |
| Intensity class | High | High | High | residual | Very High | Very High | Very High | residual | High | High |
| | Medium | High | Medium | residual | Very High | High | Medium | residual | Low | Low |
| | Low | High | Low | residual | High | Medium | Medium | residual | | |

*Figure 2 Example of no common standard in the hazard assessment; Concerning floods in Slovenia, Italy, Austria.*

## Hazard mapping and contingency planning: open issue

The review of hazard, risk mapping and contingency planning among Project Partners has highlighted a number of open issues:

- Being **Hazard** generally defined by a combination of Return Period and Intensity parameters, should these parameters be ranked in descriptive "qualitative" or "pseudo-quantitative" classes or should they rather be ranked on a continuous "quantitative" 0 to 1 basis (as in insurance practice)?
- Is it preferable to define **Hazard** levels combining Intensity and Return Period classes or values by using an heuristic "matrix-based" approach – so to include some "political" decisions – or by using an objective "math-based" combination approach?
- Should **Vulnerability** of elements at risk be ranked in descriptive "qualitative" or "pseudo-quantitative" classes based on its "strategic" or "social" worth or should it rather be ranked on a continuous "quantitative" 0 to 1 basis considering it's constructional characteristics with respect to the occurring hazard (as in insurance practice)?
- **Contingency plans** are often not available in a harmonized form (if available at all);
- **Contingency plans** are usually not available in a structured digital form; links to GIS or hazard maps are not possible;
- **Contingency plans** are being prepared on different levels of competences, different hazard types, different organizations, and more often than, not integrated into common work-flows;
- **Contingency plans** need update in the event of any change relating to hazards or the availability of protection, rescue and relief forces. Standardized procedures for this important task are not available; How can residual risk be dealt with in contingency plans?; How can the public be integrated in a risk dialogue.

| | PREPAREDNESS | RESPONSE | |
|---|---|---|---|
| INFORMATION NEEDS | P) PREVENTION Planning – Technical measures (non-real-time information) | F) WARNING Alert – Pre-Alaram – Alarm (real-time information) | R) INTERVENTION Rescue – Damage mitigation (real-time information) |
| | InfoNeeds: to Assess – Define | InfoNeeds: to Forecast – Identify | InfoNeeds: to Appraise – Control |
| H) HAZARD | P.H.1) Hazard processes spatial distibution and extent<br>P.H.2) Hazard processes long-term evolution-dynamic<br>P.H.3) Triggering Conditions<br>P.H.4) Predicted Event Scenarios<br>P.H.5) Hazard Mitigation Alternatives | F.H.1) Hazard processes on going evolution-dynamic<br>F.H.2) Hazard processes expected evolution-dynamic<br>F.H.3) Triggering causes situation<br>F.H.4) Triggering causes expected trends<br>F.H.5) Expected Event scenarios<br>F.H.6) Urgent – Contingent hazard mitigation measures | R.H.1) Hazard processes on going evolution-dynamic<br>R.H.2) Status-efficacy of ongoing hazard mitigation measures<br>R.H.3) Ongoing Event scenarios |
| V) VULNERABILITY | P.V.1) Exposure<br>P.V.2) Vulnerability<br>P.V.3) Value or Worth<br>P.V.4) Vulnerability and/or Cost-worth Reduction Alternatives | F.V.1) Urgent-Contingent Vulnerability and/or cost reduction measures | R.V.1) Status-Efficacy of ongoing vulnerability and/or cost reduction measures |
| R) RISK | P.R.1) Predicted Damage Scenarios<br>P.R.2) Predicted Loss Scenarios | F.R.1) Expected Damage Scenarios<br>F.R.2) Expected Loss Scenarios | R.R.1) Ongoing Damage Scenarios<br>R.R.2) Ongoing Loss Scenarios |
| Main information flow direction During an Emergency Event | | Update | Update |
| Main information flow direction After an Emergency Event | Update | | |

*Figure 3 Information needs by disaster management phase.*

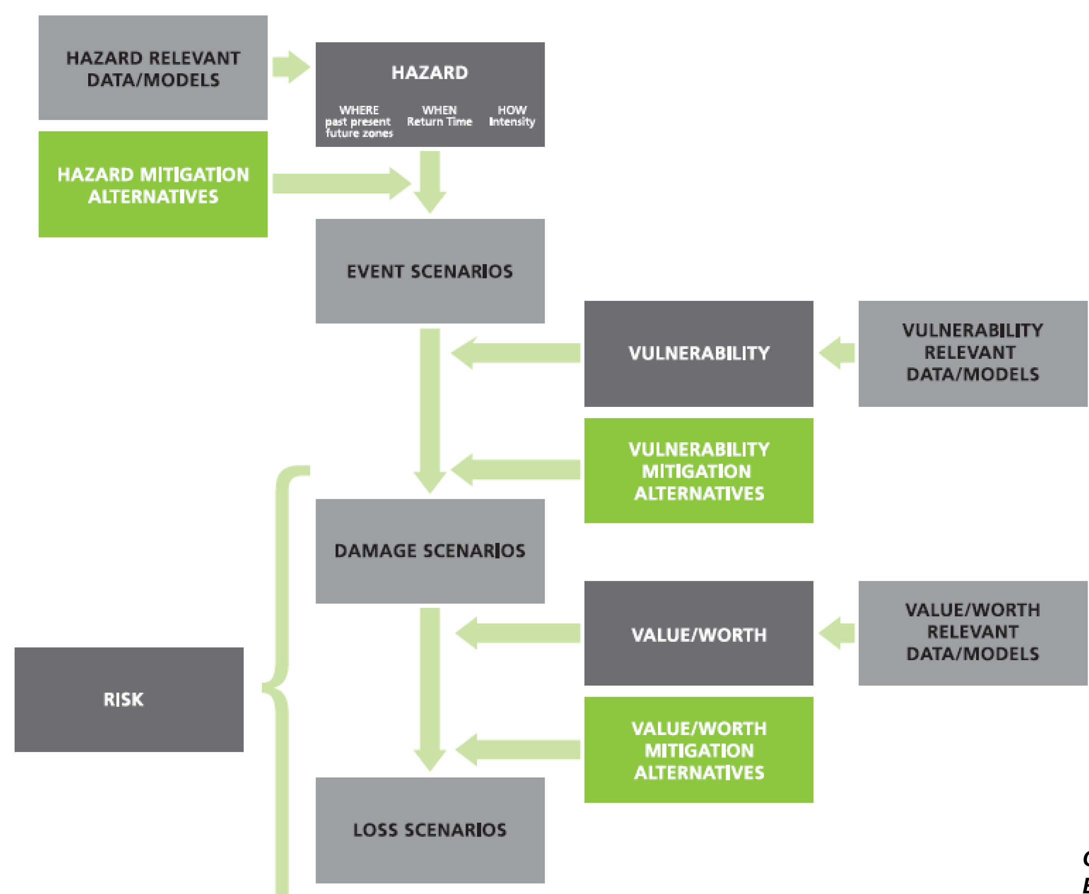


*Figure 4 Risk and emergency basics with relevant input*

## Information needs and information flows

Information collection are essential in all risk management phases (preparedness, response, recovery). They produce supporting dataset that are used to meet information needs in the different risk management tasks (prevention, warning and intervention) about hazard, vulnerability and risk. Information flows are defined by the way in which datasets are used in a harmonized integrated manner in order to meet information needs (Fig. 3). Information flows vary depending on the risk management task (Fig. 4).

## Simplified scenarios as a missing link between hazard map and contingency plan

Although high quality information is available during hazard assessment procedure, this information on hazard processes, process development and possible event scenarios is generally summarized in reports hardly readable by contingency planners and "condensed" in more or less simple hazard maps.

**Simplified Scenario Models** and "**Hot Spot Information**" included in hazard maps sustains the contingency planner in preparedness and intervention phase to gain a fast overview about principle process information in a standardized form and thus helps to improve process understanding.

**Simplified scenarios models** (used for "event" or "damage"/"loss" scenarios) should comprise the following key elements:

- definition/description of possible "reference" scenarios (mainly process oriented);
- evaluation of the efficiency of existing countermeasures;
- definition of forecasting, observation, alert and intervention options;
- indication of the main elements and key situations regarding processes and countermeasures/interventions.

In order to fulfill these requirements, reference scenarios must be defined as a link between hazard mapping and contingency planning procedure.

Reference scenarios should be structured according to simplified scenario models. Within contingency planning, scenario models can be used to describe reference scenarios both in preparedness phase and response phase.

❖ **Reference Event Scenarios** refer exclusively to the evolution in space and time of the hazardous process.

❖ **Reference Risk Scenarios** (divided into Damage Scenarios and Loss Scenarios) refer to the evolution in space and time of the reference event and of its effects, also considering eventual mitigation or response actions.

The "hot spots" are indicators for information linking the hazard/process and the contingency/intervention fields by providing key process information or indications of required measures.

Hot spots can be defined in the process (p), damage/loss (d) and intervention (i) domains. These points have some standardized information linked about possible processes, monitoring instruments, expect time of impact, countermeasures etc.

The hot spots can be classified as follow:

- **p_info** process oriented information point, depending on the event scenario;
- **p_op** process oriented observation point (p_op), it indicates a location where the process can be observed or monitored;
- **p_ip** process oriented intervention point (p_ip), it is used during the preparedness phase indicate all technical and non technical prevention measures installed.

The concept of scenario models and "hot spots" shown for a landslide (earth-slide) is presented in Fig. 5.

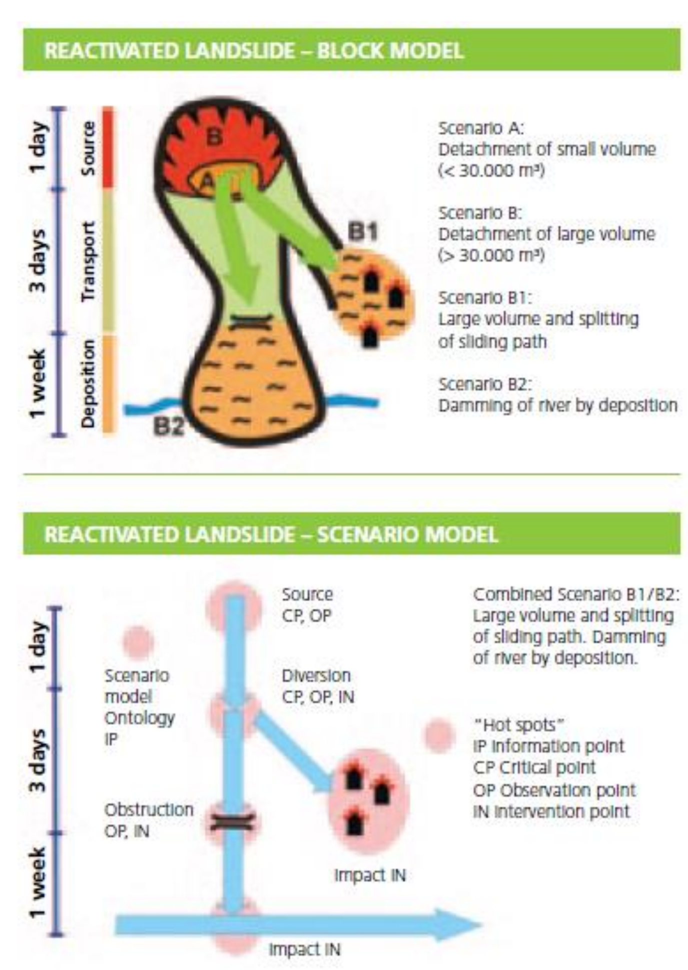


*Figure 5 Concept of scenario model and "hot spots" shown for a sliding event.*

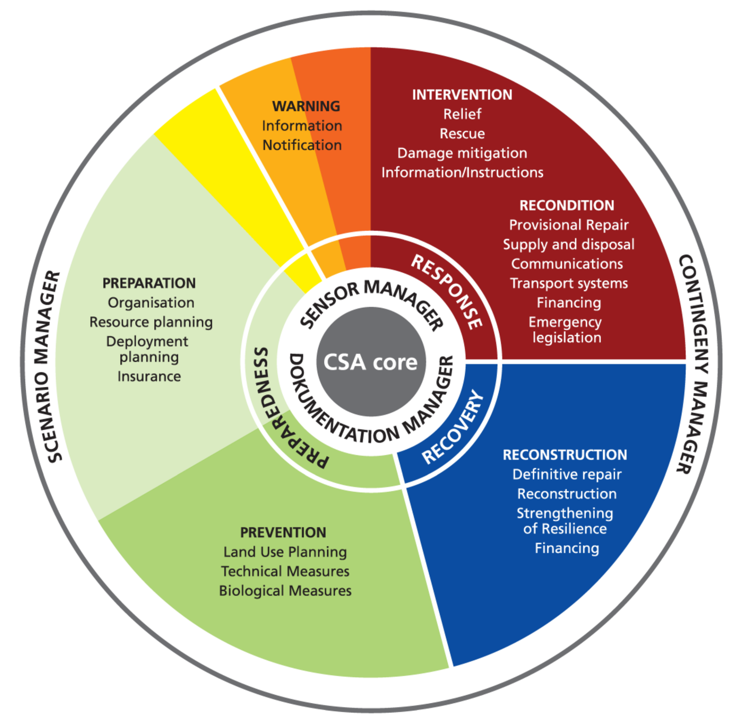


*Figure 6 Scheme of the MonitorII CSA modules within the risk management cycle.*

## Toward a CSA (Continuous Situation Awareness) software tool

The CSA is a tool that will be developed in the MII project composed by a series of software components, allowing the easy integration, presentation and use of the disaster management information (Kollarits et al. 2011).

Seen from the perspective of a disaster event, the CSA will be usable in different risk management phases and recurrent activities (Fig. 6). For MII the current definitions of ClimChAlp (Strategic Interreg III B Alpine Space Project) (2008) were taken as a starting point.

The CSA is designed to store event data in a special CSA database. Object data - like buildings or roads - are assumed to be stored in the local, regional or national GIS. It includes all basic administration functionality (user administration, authorization and security management, service configuration) and allows to interface to GIS integration services. Basic user interaction - like mapping, querying and filtering and searching is provided via a standard web client.

The sensor manager supports the integration of sensor information of various sources (by using standards like sensor web) and helps to configure and monitor sensors. Sensor generated information can be visualised (on maps, in charts) and analyzed – together with other information sources provided via CSA core module.

The scenario manager supports the definition of hazard scenarios and to link them to hazard maps. This shall help to communicate scenarios and to provide an information base for contingency plans.

The contingency manager supports the definition of contingency plans (conforming to contingency planning guidelines as defined in MII) in a digital, GIS based way.

In response phase these digital contingency plans support the monitoring and execution of contingency plans (the work-flow of measures) and after an event to evaluate the contingency plan and update the contingency plan.

The documentation manager provides mobile information viewing and mobile information. On platforms like smartphones or tablets the user is supported in mobile observation.

***ClimChAlp (2008).*** *Interreg III B Alpine Space. http://www.climchalp.org/index.php?option=com_docman&task=doc_download&gid=181&&Itemid=125.*
***European Commission (2010).*** *Risk Assessment and mapping guidelines for disaster management. EU Commission staff working paper. Brussels 21.12.2010 SEC(2010) 1626 final, http://ec.europa.eu/echo/civil_protection/civil/pdfdocs/prevention/COMM_PDF_SEC_2010_1626_F_staff_working_document_en.pdf*
***Kollarits S, Leber D, Schnetzer I (2011).*** *Linking hazard maps to contingency planning needs - the MONITOR II Continuous Situation Awareness System (CSA). Proceedings of EGU.*
***Leber D, Schnetzer I, Kollarits S (2012).*** *Scenario models as a link between hazard mapping and contingency planning. 12th Congress INTERPRAEVENT 2012 Grenobl*
***Monitor II (2011).*** *New methods for linking hazard mapping and contingency planning. http://www.monitor2.org/.*