

## Networking for the European Forest Risk Facility initiative – NET RISK WORK

# 1<sup>ST</sup> NATURAL HAZARDS RISK MANAGEMENT WORKSHOP

Managing forest risks towards disaster reduction: the  
case of wildfires, storms, floods and avalanches

Solsona (Catalonia, Spain), 4-6th October 2017

Deliverable nº 8 - Proceeds of the Discussions Sessions

**Project name:** Networking for the European Forest Risk Facility Initiative (NET RISK WORK)

**Financed by:** DG ECHO 2016 Call for projects on prevention and preparedness in civil protection and marine pollution

**Website:** <http://netriskwork.ctfc.cat/>

**Partnership:** Forest Science and Technology Centre of Catalonia - CTFC (Coord.), European Forest Institute - Central European Regional Office and the Observatory for European Forests - EFICENT, Pau Costa Foundation - PCF, Forest Research Institute Baden-Württemberg - FVA, Entente pour la forêt Méditerranéenne – EPLFM VALABRE, Civil Protection General Directorate of Autonomous Region of Sardinia - DGPCRAS

**Duration:** 2017-2018

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**Document reference suggested:** NET RISK WORK, 2018. Proceedings of 1<sup>st</sup> Natural hazards risk management workshop: Managing forest risks towards disaster reduction: the case of wildfires, storms, floods and avalanches (2017/10/4-6). Deliverable 8. Networking for the European Forest Risk Facility initiative. ECHO/SUB/2016/740171/PREV10 Project. 26pp

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## I. NET RISK WORK Project

**Networking for the European Forest Risk Facility Initiative** is a two-year Project (2017-2018) funded by the EU Civil Protection Mechanism, promoting the knowledge exchange and networking around four major European forest risks and their interactions; wildfires, storms, floods and avalanches.

NET RISK WORK wants to perform a best practices capitalization and knowledge exchange process on risk planning and management for a better comprehension on how these hazards are interacting in a changing climate context across Europe, and what can be used from lessons learned between regions and other risk experiences.

The Project is also giving continuity to the Risk Facility Initiative started in 2014 ([www.friksgo.org](http://www.friksgo.org)) encouraging networking under informal and permanent multi-actor platforms seeking for a better transfer of knowledge into practices and policy making.

Further information of the project is available at the website: <http://netriskwork.ctfc.cat/>

## II. Workshop objective and agenda

Under several climate change scenarios, all European countries seem to undergo increased risk of different natural disasters. This expected trend will affect areas that historically have not experienced significant impact from a specific natural hazard; a large proportion of damage is likely to be related not only with high-severity events but also with new hazards interactions (new risks coming up and influencing existing ones as wildfires affecting mountain forests increasing avalanche risk).

The workshop wants to provide a meeting and discussion space on expert knowledge about wildfires, floods, storms and avalanches risks, with the following specific objectives;

- Identify management and reduction strategy challenges of main risks in a climate change context.
- Explore how different risks are interacting and what can be used from lessons learned between regions and other risks' best practices and operational tools.
- Highlight the fundamentals for facing an inclusive risk cycle management under the Civil Protection objectives
- Promote networking and knowledge exchange on different natural hazards at European level

The workshop agenda includes sessions with key note conferences as well as discussion group sessions conducted by moderators. The aim is to deliver conclusions in a structured way, following common transverse components of the risk management cycle, referring to risk assessment and planning, cost-effectiveness, governance and communication. A final fieldtrip will serve to analyze the case of wildfire and flood risks in the region. An active participation of the invited attendants is expected.

**Wednesday, 4<sup>th</sup> October 2017 - Workshop Day 1: Assessing risks interactions and lessons learned**

- 09:00 **Welcome.** Eduard Plana, head of Forest Policy and Risk Governance, Forest Science and Technology Centre of Catalonia (CTFC), NET RISK WORK Project coordinator
- 09:15 **Opening session: Introducing European Forest Risk Facility initiative; Towards enhancing the resilience and adaptive capacity of European forests landscapes by promoting knowledge exchange and networking.** Alex Held, European Forest Institute Resilience Program & Marcus Lindner EFI– SURE project
- 09:35 **Workshop agenda and functioning.** Marc Font & Marta Serra, NET RISK WORK officers - CTFC
- Risks' key note conferences**  
Risk management review on main gaps and achievements, challenges in a climate change context and potential interactions with other risks
- 09:45 **Wildfires, dealing with complexity.** Eduard Plana, CTFC & Marc Castellnou, UT-GRAF Fire Service Generalitat de Catalunya
- 10:10 **Storm disasters: too seldom – too often.** Christoph Hartebrodt, Forest Research Institute of Baden-Württemberg FVA
- 10:35 *Coffee break*
- 11:00 **Flood risk management: opening opportunities.** Bertram de Rooij, Wageningen Environmental Research (Alterra)
- 11:25 **Avalanches: forest interactions and risk management.** Frank Krumm, Institute for Snow and Avalanche Research SLF – WSL
- 11:50 Questions & answers
- 13:15 *Lunch*
- Discussion groups sessions** (audience is split in parallel 3-4 groups)
- Discussion groups 1: How are risks affecting society? How are they interacting in a climate change context?**  
15:00 Description on main forest risks' impacts on people, goods and forest services and their evolution across EU under the climate change context will be discussed. Potential risk interactions should be identified.
- 16:00 Report to the plenary
- 16:30 *Coffee-break*
- Discussion groups 2: How being effective mitigating risks? Achievements towards risk assessment, mapping and cost-effectiveness**  
17:00 In discussions groups 2 and 3, exchange of knowledge on lessons learned, tools and best practices managing risks will be undertaken across common cross-sectoral topics of disaster reduction strategies, in consonance with the Sendai Framework for Disaster Risk Reduction 2015-2030.  
In this session, specific emphasis in Risk assessment tools for an effective integration into land Planning, and to support Decision Making at end-users level (as cost-effectiveness assessment) will be considered.
- 18:00 Report to the plenary

**Thursday, 5<sup>th</sup> October 2017 - Workshop Day 2: Towards integrative risk planning and management**

- 09:00 **Key note conference 5: Awareness-raising on risk in theory and practice.** Yvonne Hengst, Forest Research Institute of Baden-Württemberg FVA
- 09:35 **Multi-risk R+D Projects and Operational tools for effective Risk Reduction Strategies mainstreaming at regional policies**

- **PLAtform for Climate Adaptation and Risk reDuction (PLACARD Project)** - Bertram de Rooij, Wageningen Environmental Research (Alterra)
- **Transnational Plans for the management of forest risks (PLURIFOR project)** - Eduard Mauri, Atlantic European Regional Office of the European Forest Institute
- **Fire and Rescue Innovation Network (FIRE-IN Project)** - Jean Michel Dumaz, SAFE Cluster
- **Flood risks planning in Sardinia** - Roberto Silvano , Secretary-General of Basin Authority of Sardinia

10:30 *Coffee Break*

**NET RISK WORK project outcomes**

- **Best practices compilation.** Alice Clemenceau, Entente pour la forêt Méditerranéenne VALABRE
- 11:00 - **Risk interaction matrix.** Yvonne Hengst, FVA
- **RISKPlatform.** Alex Held, EFI & Christoph Suter, GEOTEST
- **Wildfire Regional Node.** Núria Prat, Pau Costa Foundation (PCF)

**Discussion groups 3: How being effective mitigating risks? Achievements towards risk planning, governance and communication to build up a resilient society**

11:30 Following the DG#2, in this session, knowledge exchange and gap analysis on successful risk planning process, governance and risk perception and communication towards involving citizens and communities in the disaster risk reduction strategies will be considered.

13:00 Report to the plenary

13:30 *Lunch*

**Deliberations into the wild; from theory to practice**

15:45 Short excursion (2km walk) into a forest land with examples of managed and unmanaged woodlands and operational tools for enhancing forest resilience

17:30 Conclusions

**Friday, 6<sup>th</sup> October 2017 - Workshop Day 3: Field trip; wildfire and flood risks**

08:00 Departure from Solsona

**Wildfire risk: Strategic large wildfire assessment and planning, fuel treatments for resilient landscapes, risk management in wildland urban interface**

09:30 Jordi Vendrell, PCF, Asier Larrañaga, UT-GRAF, Ricard Farriol, Forest Ownership Centre (CPF), David Sáez Catalunya La Pedrera Foundation, Jaume Muntada, Diputació de Barcelona

13:30 *Lunch*

**Flood risk: Mapping and regulation for land use planning, civil protection measures and protocols**

15:30 Eva Crego, Catalan Water Agency (ACA), Rosa Mata & Rafael Prades, Civil Protection Directorate, Generalitat de Catalunya

### III. Presentations

This chapter summarizes the oral presentations of the workshop. Titles are linked with the complete content of the presentations hosted on the NET RISK WORK website.

#### Workshop Day 1: Assessing risk interactions and lessons learned

**Opening session. Introducing European Forest Risk Facility initiative; Towards enhancing the resilience and adaptive capacity of European forests landscapes by promoting knowledge exchange and networking.** *Alex Held, European Forest Institute (EFI) Resilience Program & Marcus Lindner, EFI– SURE project.*

The countless efforts by organisations to work together to tackle the most complex challenges facing our world today (climate change, resource depletion and ecosystem loss) have failed because of competitive self-interest, a lack of fully shared purposes, and a shortage of trust. The project European Forest Risk Facility aims to increase capacity, promote cooperation and exchange, focus on people and their expertise, provide knowledge and options for decisions, in order to enhance the resilience and adaptive capacity of European forest landscapes by promoting intelligent handling of natural disturbance related risks as an integral part of sustainable management.

#### Risks' key note conferences

**Wildfires, dealing with complexity.** *Eduard Plana, Forest Science and Technology Centre of Catalonia & Marc Castellnou, UT-GRAF Fire Service Generalitat de Catalunya.*

Wildfire risk is evolving together with societal relationship changes with the environment and landscape. Fuel load is a main driver of fire behavior and intensity which may be reinforced by climate change scenarios. New changing risk contexts are jeopardizing stated paradigms and current regional planning when fires are impacting inhabitants and infrastructure. Forest functionality cannot be ensured under fire regimes out of their cycle as a natural perturbation, commonly present in most ecosystems of the world. At the end, overwhelmed by the suppression of wildfires, agencies are required to think out of the box. Firefighting agencies need to build more trust and credibility, based on science and experience, to convince society about the ecological fundamentals of fire and fuel management as main tools that will help avoiding catastrophic situations. Society needs to understand the risk they are exposed to, and trust the experts when assuming suppression capacity and emergency management limits to face high intensity wildfire situations. This way, potential losses of assets and structures can be recognised.

**Storms disaster: too seldom – too often.** *Christoph Hartebrodt, Forest Research Institute of Baden-Württemberg.*

Climate change is increasing the large storms events across Europe, with severe past examples of high relevance in the central parts. Storms have economic and social impacts in the field of forests and related activities. The presentation focuses on the state of the art in storms hazards affecting forest, identifying the main gaps and challenges that forest managers have to deal with. At the same time the key points to improve forest resilience through new operational approaches of risk assessment are highlighted.

**Flood risk management: opening opportunities.** *Bertram de Rooij, Wageningen Environmental Research.*

Forests play an important role in flood risk mitigation, acting as a defense infrastructure of huge importance for both, social and economic dimensions. The presentation figures out the opening opportunities on new flood risk mitigation approaches through the involvement of forest management looking forward to the upcoming challenges posed by climate change context.

**Avalanches: forest interactions and risk management.** *Frank Krumm, Institute for Snow and Avalanches Research*

Avalanches are one of the main natural hazards in mountain areas, having occurred several times with catastrophic results in recent history. Afforestation of avalanche release areas is the most cost-efficient defense structure to mitigate this hazard and to ensure the development of settlements in the exposed area. The presentation focuses on the protective function of forest to minimize avalanche formation, and how climate change will entail new vulnerabilities for forest resilience.

## Workshop Day 2: Towards integrating risk planning and management

**Awareness-raising on risk in theory and practice.** *Yvonne Hengst, Forest Research Institute of Baden-Württemberg.*

The presentation focuses on risk perception and risk awareness from theory to practice in a broad sense, summarizing the state of the art and key points. It addresses the following topics: “What affects our risk perception?”, “What is awareness?” and “Raising risk awareness in practice” illustrated by everyday examples that allowed us to understand the multiple dimensions of the concepts.

**Multi-risk R+D Projects and Operational tools for effective Risk Reduction Strategies mainstreaming at regional policies.**

**PLAtform for Climate Adaptation and Risk reDuction “PLACARD Project”.** *Bertram de Rooij, Wageningen Environmental Research.*

The PLACARD project aims to establish a coordination and knowledge exchange platform for multi-stakeholder dialogue and consultation. The main topics are Climate Change Adaption (CCA) and Disaster Risk Reduction (DRR). In this context, it tries to combine common actors, methodologies, and policies frameworks. Therefore, PLACARD is constituted as a common space where the different communities (CCA and DRR) can meet, share experiences and create opportunities for collaboration.

**Transnational Plans for the management of forest risks “PLURIFOR Project”.** *Eduard Mauri, Atlantic European Regional Office of the European Forest Institute.*

The PLURIFOR project helps with the development of regional and transnational risk management plans for forest areas susceptible to biotic and abiotic hazards. The project is focused on storms, fire, soil degradation, pinewood nematode, chestnut gall wasp, Eucalyptus weevil, *Fusarium circinatum*, and emerging pests and pathogens. The aim is to incorporate the latest scientific understanding of hazards to forests in the south-west of Europe into the civil planning mechanisms dealing with these hazards and their impacts. The project counts with the lessons learnt of Forrisk project (previous project) also coordinated by EFI Atlantic.

**Fire and Rescue Innovation Network “FIRE-IN Project”.** *Jean Michel Dumaz, SAFE Cluster.*

The FIRE-IN project is designed to raise the security level of EU citizens by improving the national and European Fire & Rescue (F&R) capability development process. The overarching result of the project will be a proven process for organising F&R capability-driven research based on a wide practitioner, research, and innovation network. The network will be linked at cross-domain and cross-border level and will feed harmonised operational requirements (or challenges) into national and EU capability development, i.e. research, innovation, procurement, and standardisation programmes.



**The flood risk management plan of Sardinia “Directive 2007/60/EC”.** *Roberto Silvano, Former Secretary General of Basin Authority of Sardinia.*

According to the European Directive 2007/60/EC of evaluation and management of flood risk, the autonomous region of Sardinia (Italy) has a special management plan for mitigating flood risk in the region. The aim of this regional plan is to increase the safety of the people at risk, stabilize the cost of damage in short term (and reduce it in medium term), and increase resilience of the special affected territories of the region. Therefore, this plan includes all aspects related to flood management, especially prevention measures, and prevention and protection in relation to flood events. All of these measures have special considerations for each hydrological zone of Sardinia. The plan contains all knowledge and information about flood risk in Sardinia, and is also useful for urban planning. All information and procedures are provided by the General Direction of Hydrological Regional District Agency.

### NET RISK WORK project outcomes

**Best practices compilation.** *Alice Clemenceau, Entente pour la forêt Méditerranéenne VALABRE.*

The best practices compilations are formed by a common template to describe the identified tools and best practices. The objectives are (1) the collection of tools, best practices, methodologies, guidelines, and cases studies related to wildfires, storms, floods, and avalanches and are based on a partners’ expertise; (2) to share knowledge and experience about different types of risks among partners and beyond; (3) to foster adaptation for implementation of other risks and other regions. In this presentation you can find the process of capitalization of the best practices and tools on the project’s forest risks analyzed. Specifically, the method, results, examples and conclusions about it.

**Risk interaction matrix.** *Yvonne Hengst, Forest Research Institute of Baden-Württemberg.*

This tool capitalizes and shares the knowledge and possibilities in respect to risk interaction and single risks (storms, flood, avalanche and wildfire), always thinking in risk formula concepts (vulnerability, exposure and hazard) as well as natural and human influences. Starting from these elements, this tool is a new thinking approach to natural risk and their interactions in a climate change context.

**RISKPlatform.** *Christoph Suter, GEOTEST.*

The Riskplatform is a social media platform to share experiences, events, knowledge, documents, feelings, etc., about risk. The users are academics, practitioners, and public in general. In this case, the platform does not classify the users in “target audience” (the experts and the people). The role of users is defined by themselves. All of them have a rating and users can rate other users, comments, etc. Through this rating, the platform “assigns” the role of “expert” to users with the highest ratings. Observations with high ratings are more important and will be shown on top.

**Wildfire Regional Node.** *Jordi Vendrell, Pau Costa Foundation.*

To connect all existing networks and knowledge about wildfire risk at European level, the Regional Node is the spatial or virtual location where knowledge domains, networks and repositories intersect. In this case, the objective is to establish a central point to be used as a link for existing networks, individual practitioners and communities that possess expert knowledge on fire risk. Wildfire regional node in Europe has different scales: Mediterranean fires, Atlantic fires, Central European fires and Northern fires.

## IV. Results of the Discussion groups

### IV.1 Introduction

During the workshop, a total of 3 group discussions sessions were conducted in order to promote exchange of knowledge and information around the main four risks: avalanches, forest fires, storms, and floods. Specifically, the sessions focused on: (i) the present forests' risk affectation, and how these risks could interact in a climate change context, (ii) efficient risk mitigation measures through existing risk assessment methodologies and (iii) efficient risk mitigation measures through risk planning, governance and risk communication. Discussion sessions seek to capitalize the updated knowledge regarding each risk across Europe, and to promote the exchange of lessons learned from different EU contexts and expertise.

The diversity of participating nationalities and professional backgrounds ensured a wide variety and representation of cases and needs from around Europe contexts. Meanwhile this strengthened the consolidation of professional networks. In this sense, a total of 38 experts representing 11 different EU countries – Germany, the Netherlands, Switzerland, France, Italy, Lithuania, Bulgaria, Great Britany, North Ireland, Andorra, and Spain – participated in the discussions sessions. For each discussion session, 3 different groups have been created and were heterogeneously distributed according to individual fields of expertise and regional contexts.

This chapter summarizes the content of the discussions and highlights the main conclusions of each session.

The content of each discussion group is divided in different sections according to the topics treated. In that sense, discussion group 1 is divided first, in general remarks and then in natural risks (floods, wildfires, avalanches and storms). Discussion group 3 is divided in 2 cross-sectoral topics (integration of risk planning into the legal frame and, risk culture). Finally, discussion group 2, given the homogeneity of the ideas, does not have sections inside the content.

### IV.2. Discussion session 1: How are risks affecting societies? How are they interacting in a climate change context?

*This discussion group wanted to identify the impacts of main forest risks on people, goods and forest services as well as their evolution across EU countries under the context of climate change and potential risk interactions. Moderators followed a storyline that answered these and other questions: How are risks interacting? How is a climate change context affecting physical and social impacts and risks interactions?*

In this session the participants presented the main forests risks they face in their respective position and/or territory, highlighting the evolution of trends and dynamics, which affect the socio economic dimension of the impacts of risks in a climate change and land use change context.

#### General remarks

**Natural forests hazards are evolving together with global change** (which includes climate change and land use changes due to socioeconomic scenarios, such as rural depopulation). Consequently, the **natural regime of disturbances is affected with a potential increase of intensity and/or frequency**. For instance, in the Mediterranean, the combination of more intensive heat waves and drought together with an increase of fuel biomass from land abandonment is increasing the severity of wildfire events. In central Europe a more frequent and severe activity of storms is recorded in recent years. **These regime changes may affect the ecosystems resilience capacity**, potentially decreasing its recovery capacity. On the other hand, as natural hazards are

becoming far more severe, they have a higher capacity to interact with population and infrastructures **and civil protection becomes more of a priority.**

In this changing risk context, land use change seems at least as important as climate change in terms of consequences on the **modification of disturbance regimes and** natural hazards impacts. Beyond present effects, most of the consequences of global change are at mid- to long-term time scales, and not all impacts of climate change, for instance, are already visible (the stress of forests due to a drier weather decreases forest health and increases the vulnerability of trees to pest and diseases, which can appear years later). The **potential time lag of risk effects due to global change should be integrated into disaster risk reduction (DRR) strategies**, as so far commonly the social focus is more on what is happening now.

**Global change is** affecting forests risks and their impacts on society by **increasing the risk in already vulnerable areas** (events more severe, unseasonal, and unpredictable), **making risks appear in no usual areas** (i.e. increasing wind storm events in the Mediterranean or new vulnerable areas to wildfire risk in mountain areas and central north Europe in a drier and warmer weather). Beyond physical changes, social vulnerability is highly influenced by these changes in terms of culture of risk (see session 3). Consequently, **DRR should be locally developed according to the main increasing forest risk driver (land use change, climate change, or a combination of both) and effects both at physical and social level.**

In sum, more severe and/or frequent hazards events are threatening large amount of public values and communities. This includes the appearance of potential risks in areas that were traditionally considered safe or in face of a particular disturbance regime. This situation has been experienced especially during the wildfire seasons of 2017 across Mediterranean countries, with several fatalities in Portugal and Spain. The EU mission responding to the Chile wildfire event shows the global scale of the increase of natural hazards scenarios.

Since interaction of forest and society is increasing (urbanisation close to forests areas, infrastructure, recreational uses, etc.), **the necessary role of urban and spatial planning to reduce exposure and vulnerability becomes more and more crucial.** Risk planning should integrate not only the existing risks but **considering the upcoming ones under climate and land use change scenarios.** In that sense, **new disturbance regimes can overlap existing prevention measures giving a false sense of security, or let new areas become exposed to previously non-existent and unknown risks.** Once again, **efforts dealing with physical vulnerability should run together with initiatives promoting an updated risk culture.**

All in all, healthy **forests with natural hazards protection function become a crucial infrastructure to guarantee sustainable development and human safety.** Protection forest are increasingly reaching societal recognition and value due to their direct role on human settlements and infrastructures, but also due to their high cost-efficiency ratio as defence element, compared to artificial measures. A clear example for the role of protection forest against snow avalanches is found in the Alpine region, where governments have invested large amounts of resources during the last decades, in order to better understand forest dynamics and to ensure their maintenance and proper management.

Consequently, **a coherent legal status and a management oriented at conserving the functionality of protection forest should be guaranteed in wooded lands**, understanding them as a fundamental infrastructure in DRR strategies. For long, traditional sustainable forest management has assumed indirectly the maintenance of protective functions. The economic feasibility of forest management is determined by the global market, especially in the Mediterranean or mountain areas, wood mobilisation is more expensive. **From a financial point of view, a cash-flow between the protection forest function and the avoided costs of risk prevention should be established.**

Natural disturbances are part of the ecosystem’s dynamics, and risk management should focus in reducing undesired impacts on civilians and goods and values, as its occurrence cannot be suppressed at all. With all, own particularities among forests risks make it possible to limit potential hazard at different stages of the risk management cycle (see figure 1). In case of wildfires, for instance, after the ignition (natural or human cause), the amount of fuel biomass (modifiable by human factor) influences fire severity; a landscape with low density and well-managed forests prevent high intense wildfires. In this case, hazard development is highly influenced by the landscape pattern, beyond weather conditions. Storm severity cannot be influenced but its impacts can be mitigated by forest management as there exist forest structures that are more resistant to the effects of heavy winds. The same situation happens with the amount of snow and rain precipitation. In the first case, barriers can avoid the danger of starting (snow mass movement). By contrast, once the avalanche is running, protection measures to address the flow course as well as guarding the bottom of the valley are the only feasible interventions. Torrential floods in mountainous areas show similar behaviours. Instead, the effects of flooding in plains can be modified, if prevention measures are developed (flood-pools) along the river course at long distance before the impact area.

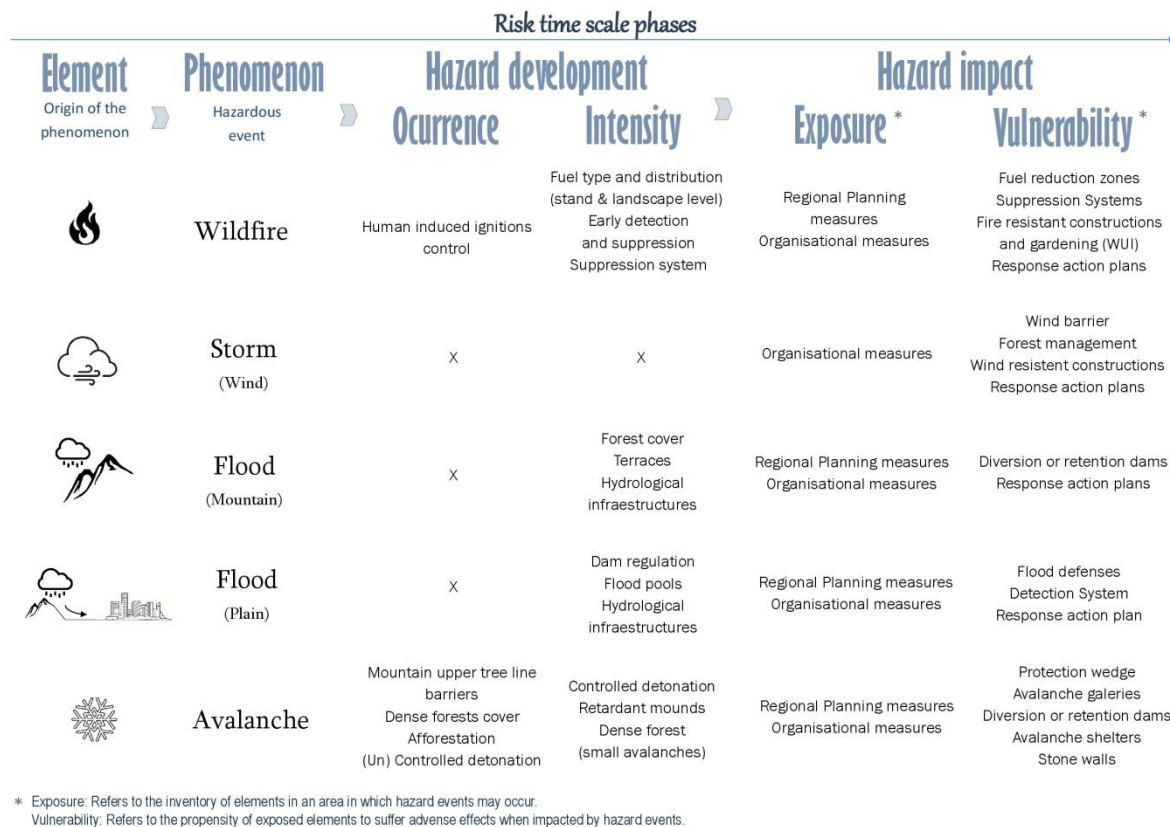


Figure 1: Hazard/Risk phases development and impacts mitigations measures

All in all, once the hazard has hit, prevention and preparedness actions are crucial for limiting the impacts and reducing the risk. In such an interconnected system, in case more efforts are done during the prevention stage, less efforts are necessary during the response phase, and if needed can be complemented by an intermediate preparedness stage. Therefore, risk mitigation measures must be based on a good understanding of the functioning of forest risks, putting more attention to the underlying factors of the “hazard build-up process”. Technological solutions at response level are necessary, however, operate within high levels of vulnerability or exposure. Nevertheless, in highly severe events, they are normally overlapped and do not always reduce the

latent existing risk which remains in the land. One clear example of this is the named “wildfire paradox”. It refers to the global risk increase beyond and effective suppression policy, as more fuel is accumulated in the landscape permitting the generation of high severe fire in the future that overlap definitely all suppression systems (these “megafires” events are more and more frequent all around the world; Chile 2017, Portugal 2017, Canada 2016, etc.).

Therefore, **complementary to technological solutions in the response phase, more attention should be paid on the structural cause of a hazard and on learning how to coexist with forest risks**, reducing vulnerability and exposure through prevention and preparedness measures, such as land planning, implementation of self-protection actions, or risk awareness behaviour.

There is a common **need to increase the social risk culture around natural hazards**, in order to improve the understanding and applicability of the individual and collective roles and actions, which allow to deal with hazards in risk exposed zones.

Socio-environmental services of forests are intrinsic and naturally, maintaining forest functionality has a cost. Thus, **a paradigm shift will be necessary, which sets priorities according to social values and implies socialization of risks (from “protecting everything” towards “protect the crucial”)**. For instance, all forest fires used to be approached in the same way. Meanwhile the guiding question could be “what value does society place on this landscape, what is it to preserve and why”? More and more, civil protection issues seem to be a strong criterion for forest risk planning at spatial/urban level.

**Global change is also affecting risk interactions, as climate change and land use changes are generating new manifestations of natural hazards through new or more severe events.** Once the natural disturbance regime changes, new risk interaction effects could appear and results in new social values and exposure levels. **This interaction** between hazards **could in one hand, magnify the intensity of a specific risk when acting simultaneously** – e.g. on October 2017, high wind speeds of Ophelia’s storm have interacted with a wildfire event in the North-East of Spain (Galicia), exacerbating the fire behaviour with extreme spread ratios, which made its control and suppression more difficult. On the other hand, risk interaction **could generate additional or unexpected damage and raise concerns when acting as cascade effects** (one after another). For instance, the loss of protection forest cover due to severe events (wildfires, storms, pests, etc.) can trigger the appearance of other underlying hazards, such as snow avalanches, mudslides, rock fall, etc. In both cases, **changes on the intensity of already existing natural hazards or cascade effects based on unusual natural hazards**, such as high intensive fires in Alpine areas, **can affect and collapse the resilience of an ecosystem and functionality of a protection forest**. Together with the spread of “extraordinary” “unusual” or “new” events, **best practices and lessons learned exchange appears to be a powerful tool to accelerate the learning process and the development of adaptive plans.**

Globally, most of these potential risk interactions under global change scenarios are not fully considered within the national/regional risk prevention and emergencies management plans. **Integrative and multidisciplinary approaches within the public bodies** (commonly segmented on different administrative competences), **complemented with participatory approaches, should help to deal with increasing risk complexity and uncertainties.**

As far as natural hazards dynamics follow physical boundaries, administrative boundaries should not be constraint to risk planning and management. When facing natural hazards in a globalized and interconnected Europe, the hazard cannot have a country’s borders. The influence of a local event could reach and affect the entire rest of EU territory. On that sense, successful emergency **collaboration protocols at local-regional-national and cross-border levels should be extended to the risk analysis and planning phases, especially looking at the root causes of the risk up to the prevention stage.**

High rates of uncertainty and complexity posed by climate change combined with land uses changes is a main concern for efficient risk planning and forest management, and complicate the implementation of proactive prevention measures. In principle, there is more capacity on reducing unknown effects of land use change, than improving ecosystem resilience towards climate change consequences. Including these **high rates of complexity and uncertainty into decision support tools through different scenarios and establishing a dialog between risk managers and society can help to increase the robustness of decision making processes.**

### Remarks by forests risks

#### Wildfires

**Wildfire risk has increase across EU**, both in fire prone areas (Mediterranean) and also in wet northern and central European regions (Sweden, UK, Norway, Germany, etc.) In particular, a common trend across EU landscapes is experienced: fire behaviour is reaching anomalous values, regarding its historical records.

**Climate change seems to increase the presence of specific weather conditions favouring wildfire generation**, especially in those regions traditionally with a low fire risk, or increasing wildfire severity in typically fire prone areas.

**As forest fires are increasingly impacting communities and infrastructure, they become** not only an issue for landscape and forest services, but **a local/regional issue for civil protection, spatial and urban planning and socio-economic development.** Therefore, **new actors have to be involved into the risk planning and management phases** (see discussion group 3).

**The occurrence of large and severe wildfires is fundamentally exacerbated for two main factors; the current state of the forests**, with overload of available fuel due to lack of forest management and land-use changes, **and extreme drought periods.** The combination of these two factors **make large forest fires become the main "management" factor of wooded lands in the Mediterranean** at landscape level, **conditioning regional/national forest policies and resource availability out of fire prevention and suppression.**

**Efforts done in controlling ignitions are being more and more complemented by shifting the attention from less vulnerable forest to a fire's spread as a main strategy to reduce wildfire risk.** However, many challenges and gaps are still present when designing and planning forest management towards fire prevention, such as financial (specially in no profitable forests), ecological (as high diameters even aged mature stands resilient forests structures not always fit with local market wood of medium diameters), and even social (using prescribed burning or even managing natural fires) constraints.

**More and more large fires are present in central and northern parts of the EU.** In the case of Alpine fires, they are characterized by their small to medium size (100ha) and with medium to high severity. Even though the fire itself is usually not a problem, **it represents a major driver of social vulnerability, by its cascading consequences.** **In case protection forests**, dominated by non-fire adapted species (beech, spruce, or fir), are affected by wildfire, an increase of avalanche risk may be the result.

More concretely, **in Alpine or Pyrenees areas**, a warmer climate combined with an increase of biomass due to lack of wood mobilization, grazing or pastures abandonment, **will increase fire risk.** The steep terrain makes topographic fires very severe when wind, slope and exposition is aligned. Reduction of snow on the top of the ridges and hills allows fire to spreading from one valley to another. Normally, steep terrain complicated the accessibility and adds limitations for controlling fire propagation.

**In dry Mediterranean regions** (for instance Spain and Sardinia) **many cases of cascading effects of risks, notably between forest fires and floods / flash floods are recorded**, which affects the tap water quality and increases erosion dynamics.

One of the **most significant problems in Northern Europe** in relation to the existing situation, and more importantly the future increase in the potential size and intensity of future fires, **is the lack of knowledge**. This is manifested by the lack of experience in dealing with high impact wildfire events, and this problem is compounded by little professional understanding of fire behavior or of effective and efficient methods of suppression.

**This critical situation can only be solved through effective interaction between Northern European agencies with their more experienced Southern European counterparts** who can provide the expertise, knowledge and skills necessary to address this issue. This could be facilitated through an exchange of practical and theoretical capabilities.

A **potential solution** could be the **exchange of wildfire information and expertise** in a European context **through existing agencies that have established an extensive knowledge of wildfire**, the wildfire environment and suppression techniques that will allow them to effectively prepare and respond to the growing threat. Other agencies, many in Northern Europe, have little capability and will be much more vulnerable to the same (or even less) threat.

## Storms

Compared with other natural hazards (for instance forest fires, avalanches or pests), **storms are unavoidable and their occurrence cannot be prevented**. There is no way to influence their spatial distribution and intensity. Therefore, **efforts have to be focused on the preparedness and prevention phases by means of increasing both, forest resistance and resilience capacity** to mitigate potential impacts and damage.

**In terms of forest resistance to storms**, no short technical prevention is possible or feasible, **only long-term silvicultural measures have proved useful**.

**Storm hazards are also characterized to appear too seldom at a single location**, which makes it difficult to consolidate a social risk culture among forest owners and citizens.

Fast progress in salvage logging activities instead of proper planning and professional management is a major obstacle. External experts are needed to increase professionalism.

Once a forest is affected by storm with a breakdown of thousands of trees, restoration management should focus on avoiding secondary direct effects, such as bark beetle exposure. **Forest recovery after a storm normally will need a planned management strategy, far from premature actions aiming at overcoming the most visible effects** as soon as possible.

A relevant **example for cascade effects of risks** was highlighted in Bulgaria. In a region near the Greek border, which suffered from a large wind throw in 2003 (60 hectares impacted), the timber was not harvested and bark beetles affected an even larger area (250 hectares). Two years later the region had to face massive forest fires, which caused soil erosion and finally episodes of flash floods.

## Floods

**Climate change contribute to an increase in likelihood and adverse impacts of flood events.** Pluvial floods and flash floods, which are triggered by intense local precipitation events, are likely to become more frequent throughout Europe. However, **quantitative projections of changes in flood frequency and magnitude remain highly uncertain.**

**In terms of social and economic impact, flood risk is probably the most important natural hazard at EU level,** as the distribution of floods is normally situated in areas with more human activity (urbanisation, industry, agriculture or strategic infrastructures).

**Forest plays a crucial role in the regulation and mitigation of flood risk in flood plains and upstream regions.** Among the major ecosystem types, forests have a large potential for water retention. Forests retain excess rainwater and help to moderate run-off patterns, preventing extreme run-offs. This in turn reduces damage from flooding and also helps to mitigate the effects of droughts.

Water retention capacity, runoff reduction, and magnitude of stream flows highly depend on pre-event groundwater levels, site conditions, and also, forest type. In this sense, as **climate change will have important effects on the composition and development of forest communities, this will also change the water retention capacity of forests with all its consequences.**

## Avalanches

**Forest play a crucial role in terms of avalanche protection. This green infrastructure is the most cost-efficient measure to mitigate and prevent avalanche risk.** For this reason, all mountainous countries have recognized and ensured the conservation and maintenance of this forest function through specific legal regulations (see discussion group 3).

**All in all, large avalanches initiated from above the timberline can generally not be stopped by the forest belt.** In fact, broken tree trunks become part of the running snow mass, which aggravates the destructive potential of the avalanche run out.

**Alpine/mountain forests are very sensitive to environmental conditions,** as normally trees are growing in adverse conditions. Therefore, changes in the climate could threat current forest communities and health. The expected warmer conditions could lead to an increase of timberline in altitude, favored by a decrease of grazing on alpine pastures. The increase of forest density may lead to a further increase of avalanche protection. Instead, **drier conditions may adversely affect forest health, and thus, jeopardizing its protection function.**

Switzerland has strongly done research and development on **decisions support tools for managing protection forests and for prioritizing public resource allocation according to the damage avoided by protection forests** in each Canton.

**Avalanche risk prevention and management is of crucial importance for the wellbeing of national economies, but also for the rest of Europe. A relevant example** is the ripple effect that Switzerland's avalanche risk had on Central European **train mobility.**

**There have been reported cascade effects between wildfire, storms and pests, as primary disturbance agents, reducing the forest cover and** facilitating the subsequent avalanche release. In another sense, avalanche can intensify **floods due to the remaining wood along torrents,** mobilized by large avalanche.



In case of the interaction between forest fires and avalanches risks, tree species selection plays a crucial role. **As wildfire will become more frequent in alpine areas, the promotion of fire adapted species and a change in forest structures should increase ecosystem resilience.** Nevertheless, sometime this means changing the traditional management or local preferences of species, and some cultural resistance can be found. Overall, forest structures adapted to low intensity fires, preventing large intense wildfires, should provide enough tree density for ensuring avalanche protection.

In some way, **avalanche run out areas create natural lateral fire-breaks, which can support suppression efforts in case of fire. In a climate change scenario** with warmer and drier weather, avalanches will decrease in importance compared to other natural hazards, but **wet snow problems and interactions with other disturbances become more important.** All in all, there is a great uncertainty, as modifications in rainfall patterns with extraordinary precipitation events can overlap existing preventive measures for instance.

### IV.3 Discussion session 2: How to be effective in mitigating risks? Achievements towards risk assessment, mapping, and cost-effectiveness.

*This discussion group considered the exchange of knowledge on lessons learned, tools and best practices managing risks across common cross-sectoral topics of disaster reduction strategies, in consonance with the Sendai Framework for Disaster Risk Reduction 2015-2030. This session set a specific emphasis in Risk assessment tools for an effective integration into land planning, and to support decision making at end-user's level (as cost-effectiveness assessment). Moderators followed a storyline that answered these and other questions: What information should be included in risk mapping? And consequences? How to deal with uncertainties related with climate change in risk assessment? How to justify the benefits of prevention and preparedness?*

Participants briefly presented tools and methods used in terms of risk assessment and mapping, notably forecast bulletins and prevision plans. Meteorological data collection, using remote sensors and satellite images was discussed. The scale of such tools (from local to regional, with consistency issues), actors involved (public or private), update frequency were some issues tackled in the groups.

#### General remarks

**There is a need to define common standards to build up risk mapping on different hazards across EU.** There is the example of floods, where common standards across Europe are based on experiences and data from past incidents, geography/morphology of the terrain, and the frequency of an event. One of these common standards is the definition of "flood return period". Nevertheless, **more and more risk management has to deal with uncertainties posed by a climate change context.**

In general, **risk assessments are often done by insurances companies**, just focusing and covering the physical, but not the social damages caused by disturbances. All in all, **there is still work to do in integrating vulnerability assessments into insurance accountability as a means of motivating social awareness** and own responsibility in managing risk. For instance, at this stage, no difference exists within home insurance on fire-prone environments in urbanisation areas close to wooded lands.

**Independently of the event's magnitude, analysis and reflection afterwards can offer useful information for improving risk management.** Collecting data and lessons learned of low impact hazard experiences, could help to ensure a better analysis of high magnitude and impact events, as in such situations there is normally no capacity to collect and analyse the experience.

**Knowing the stochastic occurrence, distribution, and intensity of natural hazards offers significant advantages for risk mapping. Contrary, random distribution of perturbations due to human or natural factors, add**

**difficulties in connecting the benefits of prevention actions compared to avoided risk impacts.** Within forest risks, the presence of snow avalanches and floods are well covered by stochastic approaches. Nevertheless, normally storms and wildfire risks show difficulties in determining its return period (in terms of probability), its spatial definition/delimitation for each return period, and the initial position (starting point of the event) due to the variability of the occurrence causes.

Natural hazards development, done following according physical criteria (topography, fuel distribution, winds direction, slope exposition, etc.), **needs more cooperation at all administrative levels, nationally and internationally, for data sharing and homogeneous risk assessment, as well as mapping procedures based on geographic limits instead of administrative boundaries.**

**Planning of forest risks should be developed and linked to the main management objectives** (recreation use, biodiversity conservation, civilian and strategic infrastructure protection, income source, etc.), **as no unique solution preventing risk, nor a threshold of perturbation tolerance exists.** As soon as society expectations are clear, it is easier for incident commanders to decide on the course of action.

**Established forecasting protocols are being affected by new climate change scenarios and should be consequently updated and adapted to new seasonal patterns.** For instance, in forest fire risk forecasting, the fire weather index is automatically available only during the fire season, even though it would be more and more useful also outside this season (fire season getting longer). Likewise, in some areas, huge late snow patterns happen at the end of the season, when the public avalanche forecast service is already closed.

**Although climatologist look at climate change at a macro scale, high difficulties exist for downscaling such studies using data for local risk assessments.** Risk prevention actions can affect and even limit economic activities. However, misunderstandings, such as the popular confusion between weather and climate does not help on giving more robustness to risk planning decisions within a changing climate scenario.

Forests risk assessment and mapping are mostly based on the calculation of complex hazard indexes and require high quality levels of computation and accuracy of the risk modelling process. **Typical outputs on maps, indicating colours according to the danger level have to be strongly rigorous, as information must be credible and trustworthy for building up confidence with the risk managers.** At the end, risk prevention actions are often affecting societal/individual rights and duties.

The **three risk components (hazard, vulnerability, exposure) should be always taken into account in risk assessment and mapping and form an integrative approach.** Although it could be a long and expensive process that is not easily updatable, the **visualisation of trade-offs between prevention-preparedness-response and recovery efforts improves technical and social acceptability in decision making processes, while offering better cost-efficient solutions.**

Methods for quantifying the value of endangered resources are not always homogeneous enough, and depending on the assessment method used result might differ. **Incommensurability of most forest services outside of market prices (externalities) add difficulties in evaluating the benefits of prevention actions.** As a consequence, vulnerability mapping and assessment are often contested and revoked. In this sense, even for objects with known market values, such as houses, it is still difficult to assess their potential fire affectation, due to the high variability of construction materials, and depending on the radiation at the fire front. This leads to uncertainty and a non-definition of standards to assess or model fire risk, when houses are present in the forest.

Overall, **quantitative approaches assessing protected goods and values can be complemented with qualitative analysis and social appraisal methods to help decision making processes in risk planning.**

#### IV.4 Discussion session 3: How to be effective in mitigating risks? Achievements towards risk planning, governance and communication to build up a resilient society.

*This discussion group considered the exchange of knowledge on lessons learned, tools and best practices managing risks across common cross-sectoral topics of disaster reduction strategies, in consonance with the Sendai Framework for Disaster Risk Reduction 2015-2030. This session took specific emphasis on knowledge exchange and gap analysis in successful risk planning processes, governance and risk perception, and communication towards involving citizens and communities in disaster risk reduction strategies. Moderators followed a storyline that answered these and other questions: How to make compatible physical and administrative limits? What can be expected from land planning towards risk mitigation (urban and spatial level, land uses – settlements- infrastructures links, prevention, and response capacity link), How to manage pre-existence infrastructures? Is the individual the solution or is it the problem? How to achieve the first and avoid the second?*

##### Integration of risk planning into the legal framework

**Mainstreaming research outputs and integrating them into legislations/policies is not immediately possible, as timing might differ between both**, (and sometimes it is necessary to wait years before a new legislative cycle opens and a space for debate is created). Together with timing, **knowledge, networking, and awareness at social level are recognised as key points**. The “Transnational plans for the management of forest risk” (PLURIFOR) project was mentioned as a starting point and interesting example, as both the research side and the legislative side are involved.

Although the willingness of authorities is important, their **own awareness about the issue of decision making** (lack of knowledge, and lack of time) **is key** and needs to come first (before networking and developing contact and trust between researchers/experts and the authorities). A change of responsibilities due to rotations at high political levels can be compensated by interacting at the intermediate civil servant level, which can help to focus public policies.

**The inertia of the legislative process can be a constraint to develop risk management**, as by the time the law or regulation comes into force and is being implemented, **new solutions can arise and the addressed change might already be outdated**.

**Risk management in a climate change context and land use change context has to deal with high levels of uncertainties**. This makes it relevant to wonder **how to approach “what we don’t know” from a legal perspective and how flexible should the law be** to accommodate “what we don’t know”? For example, the European Commission has indeed published a list of invasive tree species, which are common to the whole European territory. However, they are migrating faster than both, research and legislative processes can keep up with. More adaptation and discussion would be necessary to accommodate a variety into the list and update it at the requested pace. The missing step here is a process to include “what we don’t know” into the legal process; a deeper risk culture would facilitate this paradigm shift.

**Windows of opportunity need to be created to put specific risk issues on top of the political and legislative agenda**. It is necessary to act on the 3 levels of awareness to create such momentum: cognition, affect, and behaviour. However, windows of opportunity appear most of the time after a catastrophe (“the big one”). To make the most of this momentum, proposals and advice need to come quickly after the event, and therefore, should be prepared before. In case of events with smaller magnitude and higher recurrence, it might get difficult to open a real window of opportunity, though the cumulated damage over time may be higher.

**Following large forest risks events, the focus tends to be on getting new plans and funding, but rarely on developing more integrative processes**. This can be related to the “political cycle”, which explains a preference of politicians for short-term actions with visible results, as well as structural measures being favoured instead of non-structural measures. However, this statement needs to be nuanced, as in some cases large amount of funding may also be dedicated to “invisible measures”.

**For an effective integration of forest risk into spatial/urban planning, it is necessary to adapt the risk assessment information to the requirements of land planners,** which is not necessarily the same as for answering a forest manager’s objectives. The more affectation is related to risk mitigation measures on public/private rights and duties, the more robust in legal and technical terms the risk information has to be.

Although land planning processes have their own tempos and administrative processes, **it is recommended to include the expertise on forest risks in the initial stages of the planning phases for an effective** (and more cost-effective) **integration of risk mitigation measures.** This way, it is easier to connect prevention – preparedness – response actions and to improve global system resilience. From a methodological point of view, protocols (cooperation among public bodies on data sharing etc.), extra time, and the corresponding additional resources should be properly planned to make this collaboration viable.

**Complementary to the quality of risk assessment information, a strong legal framework, where conditions of risk planning development are fully recognized is necessary,** normally through mandatory rules.

Since risk planning needs to restrict type and amount of urban development taking place on a property, **having measures and tools for putting the needs of risk management before private** (even other public departments) **interests** (as easements, voluntary or legal agreements, economic resources for expropriations, etc.) **is a necessary primary requirement** for facilitating the implementation of risk policies.

Most forest risks start on wooded/forestry lands and their main impacts are on population and infrastructures in urban areas. **The corresponding intermix between social and physical vulnerability managing risks needs a strong institutional coordination for being able to assume the transverse dimension of factors affecting the phases of the risk cycle and its domains.** For instance, since forest and landscape management decrease the risk of a potential wildfire impacting settlements, the urban and forest/agricultural policies/uses should be considered together in risk planning.

Complementary, **participatory processes should be integrated into risk planning as a core element for promoting the corresponding awareness and initiative based on the own risk mitigation responsibility** (see next risk culture chapter). **Uncertainties posed by a climate change context can also be tackled through participatory approaches along the risk planning process.** Societal participation offers also an opportunity to make the benefits of mitigation strategies in front of avoided costs of potential damages visible.

**The necessity for cross-sectoral coordination of managing risk, is even more necessary when dealing with several forest risk interactions.** Meeting experts on each field of risk should help to identify main drivers and more effective mitigation measures of short, medium, and long term effects of different management options.

### Risk culture

Due to social changes, people are less connected to the land and its dynamics (also natural hazards) than they used to be. **A deep social process is necessary to reconnect population to their natural environment and therefore develop consciousness, knowledge and concern,** and finally encourage accountability and responsibility. Social sciences are central in that respect.

**As risk will never disappear completely, the introduction of the “acceptable risk” concept, which indicates the risk that people collectively and individually are willing to accept, is needed.** Some technological solutions in the response phase can lead to the perception of a false sense of security based on the “technological myth”, which at the end, leads to an even higher exposition of people. **Risk culture and communication has to be precise on the threshold of mitigated risk, and the risk level, which are not able to be reduced even with all available resources.**

**To convince people about prevention measures, it is useful to show the results, notably by using comparisons.** A success factor is also to link risk discussion with opportunities at stake (economic, social, even political), as seen in the case of the Dutch polders.

**It is important to not over inform people. Risk communication has to be clear, precise and understandable.** Different narratives and frames are needed according to the target audience. Information need to fit people's priorities. **Being credible, inspiring and confident are core elements of risk communication and awareness.** Sometimes close institutions or local actors can help in making the message more effective in changing attitudes.

**Cost-benefit analysis is a good way of convincing people, since the risk culture is more developed when property comes into play.** However, it is more developed in the private sector than in the public. How to involve other types of people and raise their concern, especially people, which are not particularly related to a specific area, like tourists? They are not interested in the long term consequences, safety and security seems to be the easiest starting point for involving them.

**New climate and land uses changes are posing new challenges for risk management in the cultural sphere, since new hazard scenarios are arising faster than the necessary cultural processes to adapt social resilience.** Extreme events beyond the "normal" patterns are normally understood as extraordinary and with low probability to be repeated. Nevertheless, in case of an event, social demands in terms of security and protection are the same, adding high pressure to civil protection and emergency services, up to political levels.

**Individual responsibility managing risk should not be overshadowed by public prevention and emergency services, and rights and duties should be clarified according to each situation.** On the opposite, **new vulnerability situations posed by climate or land use change** (as urban areas under fire risk resulting from forest regrowth close to the cities) **should not be transferred only to individuals** (homeowners in this case). A **changing risk context makes it necessary to explore deeply the "risk property" concept** (which part of the risk is under my responsibility), and take advantage of the risk planning process for building up credibility, assuming the public one first before asking for promoting a better risk culture among individuals and private actors.

## V. Annex

### V.1. List of participants and representatives

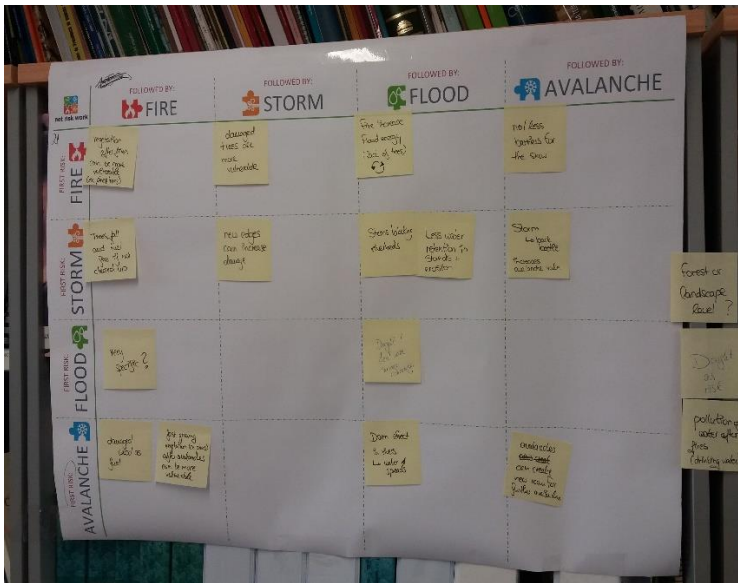
Surname	Name	Institution	Representative
Trapero	Laura	Snow and Research Centre of Andorra	Andorra
Dobrinkova	Nina	Institute of Information and Communication Technologies	Bulgaria
Castellnou	Marc	UT GRAF Fire Service Government of Catalonia	Catalonia
Crego	Eva	Catalan Water Agency	Catalonia
Alcasena	Fermin	Department of Agricultural and Forest Engineering of University of Lleida	Catalonia
Farriol	Ricard	Forest Ownership Centre of Catalonia	Catalonia
Domènech	Rut	Forest Science and Technology Centre of Catalonia	Catalonia
Font	Marc	Forest Science and Technology Centre of Catalonia	Catalonia
Plana	Eduard	Forest Science and Technology Centre of Catalonia	Catalonia
Serra	Marta	Forest Science and Technology Centre of Catalonia	Catalonia
Mata	Rosa	General Directorate for Civil Protection, Government of Catalonia	Catalonia
Prades	Rafael	General Directorate for Civil Protection, Government of Catalonia	Catalonia
Marti	Glòria	Cartographic and Geological Institute of Catalonia	Catalonia
Bach	Albert	Institute of Environmental Science and Technology	Catalonia
Fàbrega	Anna	Pau Costa Foundation	Catalonia
Vendrell	Jordi	Pau Costa Foundation	Catalonia
Furadada	Glòria	RISKMAT Group, University of Barcelona	Catalonia
Mauri	Eduard	Atlantic European Regional Office of the European Forest Institute	France
Dumaz	J.Michel	SAFE Competitiveness Cluster	France
Clemenceau	Alice	VALABRE	France
Giroud	Féréderique	VALABRE	France
Held	Alex	European Forest Institute	Germany
Lindner	Marcus	European Forest Institute	Germany
Hartebrodt	Christoph	Forest Research Institute Baden-Württemberg	Germany
Hengst	Yvonne	Forest Research Institute Baden-Württemberg	Germany
Gibson	Steve	Chief Fire Officers Association	Great Britain
Botti	Paolo	General Directorate of Civil protection of Sardinia	Italy
Capula	Teresa	General Directorate of Civil protection of Sardinia	Italy
Tola	Francesco	General Directorate of Civil protection of Sardinia	Italy
Visani	Caterina	General Directorate of Civil protection of Sardinia	Italy
Delogu	Giuseppe	Former Commander of Forestry Corp of Sardinia	Italy
Silvano	Roberto	Former Secretary-General of Basin Authority of Sardinia	Italy
Araminiene	Valda	Lithuanian Research Centre for Agriculture and Forestry	Lithuania
McDaid	Colum	Northern Ireland Environmental Agency	Northern Ireland
Suter	Christoph	GEOTEST LTD	Switzerland
Krumm	Frank	Institute for Snow and Avalanche Research of Swiss Federal Research Institute	Switzerland
De Rooij	Bertram	Soil Geography and Landscape Group of University of Wageningen	The Netherlands
Stoof	Cathelijne	Soil Geography and Landscape Group of University of Wageningen	The Netherlands



CTFC main hall sessions



Discussion groups sessions



Simplified matrix on risks interactions



NET RISK WORK project roll-up



Attendance family picture



First field trip about Mediterranean forests management challenges under climate change and land use changes contexts on Font Farrera site, Catalan Pre-Pyrenees



Discussing biodiversity, management and fire ecology fo *Pinus nigra* and *Pinus sylvestris* forests







2<sup>nd</sup> field visit on 2015 Òdena wildfire, which occurs in a prior strategically fuel reduction planned area according the knowledge of fire behavior patterns on the area. Thanks Catalan Fire Service for contributing!



Tools for promoting forest management towards resilient forests in non-productive private ownership. Thanks to Forest Ownership Centre and LIFE Montserrat for contributing!



Challenges on wildfire risk planning and civil protection on wildland urban interface. Thanks Diputació de Barcelona for contributing!



Visiting Llobregat river and Montserrat massive floods and torrential rains events and planning. Thanks Catalan Water Agency and Catalan Civil Protection Directorate for contributing!

Personal notes, comments, remarks

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