FIREfficient
Operational tools for improving efficiency in wildfire risk reduction in EU landscapes

This project is co-funded by the European Union

Operational tools for improving efficiency in wildfire risk reduction in EU landscapes FIREfficient

Task 2. Reviewing key knowledge, tools and best practices to integrate wildfire patterns assessment into land planning

Report on challenges for wildfire risk integration into land planning

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***Authors*:**
Alexander Held, Tim Green

FOREST SCIENCES CENTRE OF CATALONIA
Generalitat de Catalunya
Departament d'Interior
PAU COSTA FOUNDATION
EFI
KING'S College LONDON
University of London

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1. Introduction and Motivation

Since the birth of forestry as a discipline (in Europe in the 18th and 19th centuries) and until fairly recently, forest management and forest policy have generally had a relatively narrow focus. Disturbances, such as fire or wind-throw, were mainly assessed in terms of the damage they caused rather than their role in succession, ecosystem functioning (Puettmann et al., 2012) or indeed as a part of fire prevention. There was a policy to try to exclude such disturbances across large areas of European forests in order to maximise the economic outputs of the forest (particularly timber). Fire-fighting methods have also become increasingly effective in the 20th century. A number of socio-economic changes in Europe are also relevant. In some areas the rural population who have tended the land are moving away and there has been a trend towards abandonment of agricultural land. This has led to re-colonization of the land by scrub and trees. With regard to the development of forests, nature conservation and preservation of biodiversity this development can be viewed as positive, but it does mean that fuel loads on land are increasing. In a review of farmland abandonment in Europe Keenleyside and Tucker (2010) suggested that a mid-range estimate for land abandonment by 2030 was 3-4% of the total land area (some 12.6-16.8 million ha) if current trends continue. There has also been a concentration of population in urban areas with an associated urban expansion. This has increased the wildland-urban interface and the risk to populations living in these areas of fire. As well as rural population moving to the city, there has also been a counter-migration of urban and suburban dwellers into rural areas – people who work in urban areas but live in the city. For whatever reason – lack of time, different expectations from the surrounding area – this new urban population views the rural area in a different way, and fuel loads on land that was previously managed for agriculture are growing.

The combination of a policy of fire exclusion, increasing efficiency of fire control and changing land use has led to an ever increasing fuel load in European forests. In turn has led to the occurrence of so called megafires – fires that burn at an intensity beyond the capacity of fire services and forest management to control the fire. This has particularly been the case in the dry fire-prone areas of the Mediterranean. If you add in the predicted effects of climate change, the situation is predicted to get even worse. However, 2014 was a relatively quiet year for forest fires in the Mediterranean area. The largest single forest fire event in 2014 occurred in Sweden starting on 31 July with the rescue operation finally ending on 11 September. The fire covered an area of 12 807 ha (JRC, 2015). This event shows that, although relatively rare in northern zones, these large wildfires are not just a problem for the Mediterranean zone; all countries need to be appropriately prepared for such events.

The use of prescribed burning has been shown to greatly reduce the importance of large fires in North America (Flannigan et al., 2013; Pyne, 2015), Australia (McCaw, 2013; Underwood et al., 2008) and in the Mediterranean area (Lazaro and Montiel, 2010; Piñol et al., 2005).

As the saying goes, the “proof of the pudding” is in the eating. There were a number of very large fires in Western Australian forests from 1900 to 1960, but after the 1961 Dwellingup fire disaster, the wide-scale fuel reduction program carried out by the then Forests Department, ensured that the fuel accumulation was well controlled. The graph below demonstrates this clearly.

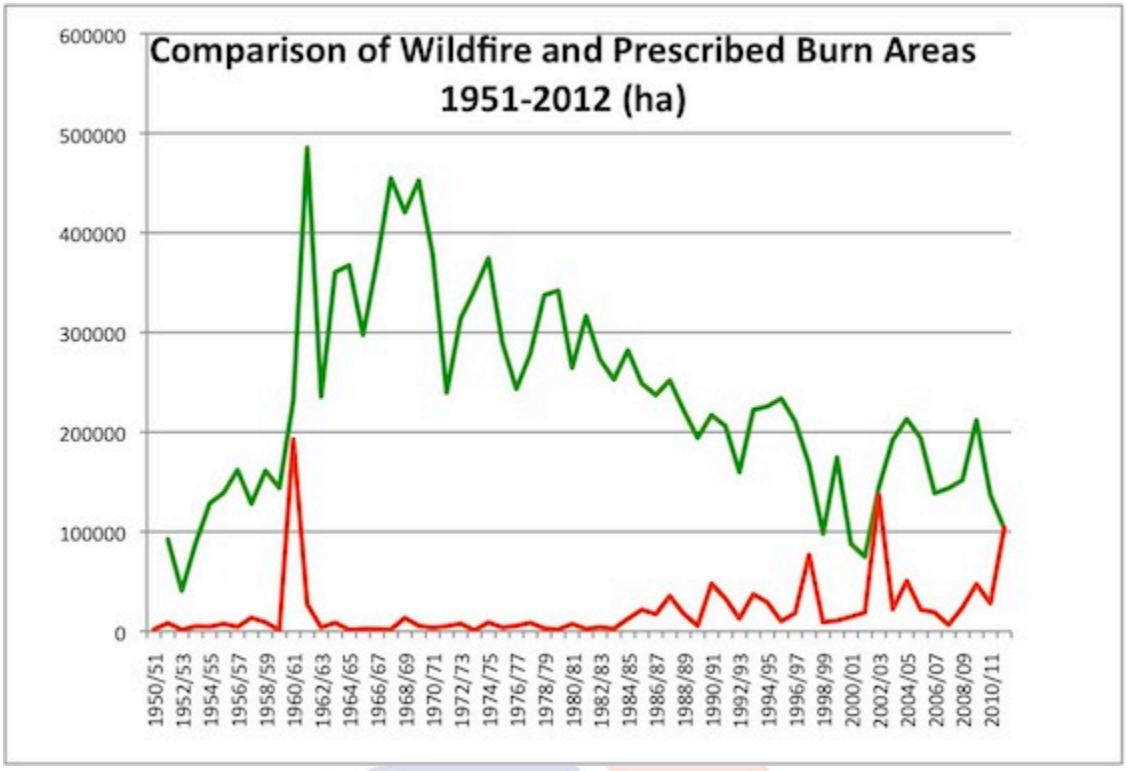

Figure 1: Comparison of wildfire and prescribed burn areas 1951-2012 (ha) in Western Australia. The red line represents the wildfire area and the green line represents the prescribed burn areas on Department of Environment and Conservation (DEC) land in Western Australia (Underwood et al., 2008).

While the annual prescribed burn area was about 300 000 ha, the area of wildfires was kept at a minor level. It was only after a shift in policy when the burning program gradually was gradually reduced, that the area of wildfires began to climb again after about 1990. The Western Australia Department of Environment and Conservation has a current annual target for prescribed burning of about 200 000 ha. In January and February 2015, a major bushfire burnt 98 000 ha of forest and private land near Northcliffe in Western Australia (Wahlquist, 2015). A certain minimum amount of prescribed burning is necessary to achieve a high level of protection. However, there were no casualties in the Northcliffe fire, and damage to property and infrastructure was relatively small. Although this is an example far away from Europe, the basic principles in this approach can be understood globally. There has also been considerable debate about whether broad-scale prescribed burning is an efficient method to promote safety (Altangerel and Kull, 2013; Clode and Elgar, 2014). The authors do not question that prescribed burning reduces the area burned in wildfires, but that the population and buildings may be better protected by other methods – such as small-scale fuel reduction around buildings and other infrastructure (Clode and Elgar, 2014).

In Europe, the most promising development and research as well as capacity building and collection of good practices has occurred in the EU projects like EU FireParadox[1](Sande Silva et al., 2010), FUME [2]

[1] http://www.fireparadox.eu/
[2] http://fumeproject.uclm.es/

(Moreno, 2014), FireSmart (Sebastián-López et al., 2011), EuroFire[3], FUELMAP (e.g. Sebastián-López et al., 2010), Cost Action FP0701 Post-fire management in southern Europe[4] (de las Heras et al., 2012), and, of course, FIREfficient[5] to name just a few. Organisations like the Pau Costa Foundation (PCF), Global Fire Monitoring Centre (GFMC), European Forest Institute (EFI) and many others are making such knowledge available; even providing training and capacity building, hosting workshops and fostering exchange of experts. There is also a raft of new projects dealing with disaster risk reduction and relevant for fires: MOVE – Methods for the improvement of vulnerability assessment in Europe[6]; ENHANCE – Enhancing risk management partnerships for catastrophic natural hazards in Europe[7]; CapHaz-Net – Social capacity building for natural hazards – towards more resilient societies[8]; CONHAZ – Costs of natural hazards[9].

Yet, the fire management model practiced across large parts of most all European countries is still largely based on an approach of fire exclusion, resulting in total fire bans, reliance on fire suppression and state-sponsored fire and rescue services.

But then, with all the existing knowledge, why is it that in Europe the application of existing knowledge is only patchy and not widespread? This question does not only refer to the land-use planning process, it also refers to land-use practices and the public opinion of fire management issues.

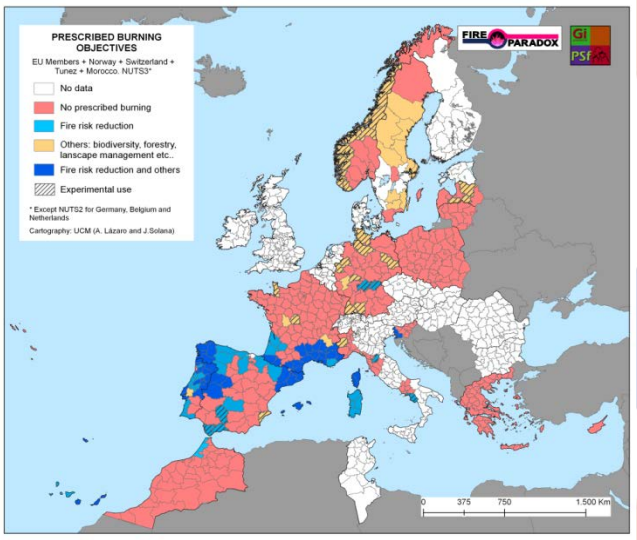

Figure 2: Distribution of prescribed burning practices with regard to its management objectives in Europe and North African countries (Lazaro and Montiel, 2010).

[3] http://www.euro-fire.eu/
[4] http://uaeco.edu.gr/cost/
[5] http://firefficient.ctfc.cat/
[6] http://www.move-fp7.eu/
[7] http://enhanceproject.eu/
[8] http://caphaz-net.org/
[9] http://conhaz.org/

Across Europe, land-use planning decisions concerning fire management are often discussed, influenced and decided upon under the influence of an urban population with an urban mindset. Decision-makers in the higher levels of administrations are usually situated in bigger cities. Few decision-makers and planners have ever experienced wildfire and the related dangers and losses, nor have they experiences of managing wildfire.

Responsibility for fire management across Europe is generally given to the Fire Services and Civil Protection. That the mindset, training and approach of a structural fire service (putting out fire) does not and cannot reflect land management issues is an additional factor that needs extra attention. A structural fire service planning and decision-making will almost always think of suppression first, then firefighter safety, and then after that about fuel and land management. It is not in the nature and education of structural fire services.

Another serious problem related to climate change and wildfire (and the planning for its management) is the lack of credible and effective global leadership. With a credible and effective global leader, it is sometimes possible to establish institutional devices to overcome collective action problems.

2. International Policy Context

2.1. Disaster Risk Management

There are a number of international initiatives that address disaster risk management. The United Nations (UN), the European Union (EU) and the Organization for Security and Co-operation in Europe (OSCE), among others, have all placed an increasing emphasis on the need for *planning* to increase disaster risk resilience – i.e. wildfire planning in our context.

The *Hyogo Framework for Action* (2005–2015) defined the incorporation of risks like fire into policies and planning as a high priority and *Strategic Goal* to increase resilience:

> **"Priorities for action 2005–2015**
>
> *(iii) Land-use planning and other technical measures*
>
> (n) Incorporate disaster risk assessments into the urban planning and management of disaster-prone human settlements, in particular highly populated areas and quickly urbanizing settlements. The issues of informal or non-permanent housing and the location of housing in high-risk areas should be addressed as priorities, including in the framework of urban poverty reduction and slum-upgrading programs.
>
> (o) Mainstream disaster risk considerations into planning procedures for major infrastructure projects, including the criteria for design, approval and implementation of such projects and considerations based on social, economic and environmental impact assessments.
>
> (p) Develop, upgrade and encourage the use of guidelines and monitoring tools for the reduction of disaster risk in the context of land-use policy and planning.
>
> (q) Incorporate disaster risk assessment into rural development planning and management, in particular with regard to mountain and coastal flood plain areas, including through the identification of land zones that are available and safe for human settlement,
>
> (r) Encourage the revision of existing or the development of new building codes, standards, rehabilitation and reconstruction practices at the national or local levels, as appropriate, with the aim of making them more applicable in the local context, particularly in informal and marginal human settlements, and reinforce the capacity to implement, monitor and enforce such codes, through a consensus-based approach, with a view to fostering disaster-resistant structures." (UN ISDR, 2012, Extract from the final report of the World Conference on Disaster Reduction (A/CONF.206/6)) (UNISDR, 2015)

The Hyogo Framework has been succeeded by the *Sendai Framework for Disaster Risk Reduction* (2015–2030). In comparison with Hyogo the emphasis is placed on disaster risk management rather than disaster management. increasing emphasis was placed on: building resilience; promoting local solutions; and fostering inclusion. The Sendai Framework outlines seven global targets to be achieved over the next 15 years: (1) a substantial reduction in global disaster mortality; (2) a substantial reduction in numbers of affected people; (3) a reduction in economic losses in relation to global GDP; (4) substantial reduction in disaster damage to critical infrastructure and disruption of basic services, including health and education facilities; (5) an increase in the number of countries with national and local disaster risk

reduction strategies by 2020; (6) enhanced international cooperation; and (7) increased access to multi-hazard early warning systems and disaster risk information and assessments (UNISDR, 2015).

Pope Frances has even 'chipped in' in The *Enciclica Laudato Si*[10] published in June 2015. It includes some relevant messages for society and also relates to the *planning* for a better life in a more secure and sustainable environment:

> "150 Given the interrelationship between living space and human behaviour, those who design buildings, neighbourhoods, public spaces and cities, ought to draw on the various disciplines which help us to understand people's thought processes, symbolic language and ways of acting. It is not enough to seek the beauty of design. More precious still is the service we offer to another kind of beauty: people's quality of life, their adaptation to the environment, encounter and mutual assistance. Here too, we see how important it is that …. planning always take into consideration the views of those who will live in these areas.
>
> 151 There is also a need to protect those common areas, landmarks and (…) landscapes which (…)
>
> 177 Given the real potential (…), individual states can no longer ignore their responsibility for planning, coordination, oversight and enforcement within their respective borders."

Although the regulation for establishing Horizon 2020 does not make specific reference to wildfires or forest fires, in contrast to LIFE+, it does make reference to increasing the EU's resilience to disasters.[11]

The European Commission's Emergency Response Coordination Centre (ERCC), the operational heart of the EU Civil Protection Mechanism, monitors forest fire risk and incidence across Europe around the clock using national monitoring services and tools such as EFFIS (the European Forest Fire Information System). The EU Civil Protection Mechanism was activated more than 55 times since 2007 to respond to forest fires inside and outside Europe (including pre-alerts and monitoring requests). During the 2012 forest fire season, nine requests for assistance were received (Bulgaria, Montenegro, Albania, Slovenia, Bosnia and Herzegovina, Greece and, Portugal). In 2013, the Mechanism was activated to respond to requests for assistance for forest fires in Bosnia and Herzegovina and Portugal, and for a pre-alert in Bulgaria. In 2014, the mechanism was activated for Norway (pre-alert), Sweden and Greece. All of this is reactive and fire suppression only.

Where risk management dimensions are a feature of national legislation, positive changes are not always guaranteed (UNDP, 2004). A lack of financial, human, or technical resources and capacity constraints present significant obstacles to full implementation, especially as experience suggests that legislation should be implemented continuously from the national to local level and is contingent on strong monitoring and enforcement frameworks and adequate decentralization of responsibilities and human and financial resources at every scale (Pelling and Holloway, 2006; UNDP, 2004).

[10] http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html
[11] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1444390526623&uri=CELEX:32013R1291

2.2. European Forest Policy and Forest Fires

There have been several fire-related EU activities and instruments in the last three decades, starting with the Forest Action Programme (1988-1992), the Forest Fire regulation 2158/92 (1992-2002) [12], Forest Focus (2003-2006) [13], and LIFE+[14]. The EU also issued a communication on reinforcing the Union's Disaster Response Capacity as a response to the forests fires that occurred in Greece and the floods in the UK in 2007[15].

The issue of forest fires was highlighted at the Warsaw Ministerial Conference on the Protection of Forests in Europe in 2007, where the ministers expressed solidarity with the people and governments of southern Europe who have suffered during recent years from the effects of huge forest fires (with special reference to the fires in Greece in 2007)[16]. At the Oslo Ministerial Conference on the Protection of Forests in Europe in 2011, the ministers signed a mandate for negotiating a Legally Binding Agreement on Forests in Europe[17].

On 20 September 2013, the Commission adopted a New Forest Strategy for the EU was proposed in 2013[18]. The strategy aims to enhance coordination and facilitate the coherence of forest-related policies and allow for synergies with other sectors. It calls for national forest policies to fully take into account EU forest-related policies.

The expert group on forest fires is an informal expert group established in 1998 and made up of experts from national bodies (agriculture, environment, civil protection). The group meets twice a year. Regular items include the European Forest Fire Information System and exchange of good practices and lessons learned after serious fire events (FOREST EUROPE, 2010). It was announced in March 2015 that the expert group on forest fires will be a sub-group of the expert group on forest information along with the new sub-group on forest health and pests. The mission of the expert group on forest information is to contribute to the development of the Forest Information System for Europe.

[12] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992R2158
[13] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1444389799741&uri=CELEX:32003R2152
[14] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1444390372893&uri=CELEX:32007R0614
[15] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1444390115976&uri=CELEX:52008DC0130
[16] http://www.foresteurope.org/docs/MC/MC_warsaw_ministerial_stat.pdf
[17] http://www.foresteurope.org/en/LBA
[18] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0659

3. The Way Ahead

A proposal for a new approach was presented in the deliverable 17 of FIREfficient (FIREfficient, 2015). And there is indeed a proven successful alternative. The only realistic way to avoid large, high intensity vegetation fires in high risk areas is to keep fuel levels (i.e. vegetation) down to low levels by prescribed burning under mild weather conditions or other comparable measures, so that when unplanned fires do occur, they are of lower intensity and are much easier, and very much cheaper and safer, to control. This requires active management of (vegetation) fuels at different scales, including from broad-scale prescribed burning at the landscape level down to small-scale fuel management around buildings and infrastructure. This will not happen unless there is a dramatic change in land management policies by managing administrations.

Of course, active management of fuels by fuel reduction burning is not something that can be embarked upon overnight. It requires careful research into fire behaviour in a variety of fuel and vegetation types, and the sad fact is that this research has not been carried out in a systematic way in most European States. Landscape planning in turn, is often neglecting fire management aspects in their overall land use plan. A positive example, however, is a program that has been carried out by the UK Forestry Commission.

The UK Forestry Commission has published a new guide that sets out good practice for building wildfire resilience into forest management planning (Forestry Commission, 2014). The guidance aims to help reduce the likelihood and severity of wildfires in forests and woodlands in the UK and promote appropriate fire prevention regimes. It is focused on the planning measures that can be used and only covers operational issues, such as fire suppression activities, and where they benefit from some element of forest management planning. The guide proposes a broad-scale risk assessment, with fuel management (including thinning, felling, and prescribed burning) in high hazard areas and zoning of wildfire management zones (asset zone, buffer zone, low-risk zone, fire exclusion zone). In areas where wildfire is identified as a risk, it is recommended that a representative from the fire and rescue services is included as part of the planning team. Monitoring for effectiveness of wildfire resilience measures should be part of the forest management plan review.

All stakeholders with responsibility for planning (land planners, forest owners, forest managers, farmers, shepherds) should ensure that planning for wildfires is included in the management plans for areas under their control. Some of the results could be put into practice now but much more research needs to be done to determine the effects across a range of vegetation, forest and fuel types across Europe.

Fire intensity is directly related to the amount of available fuel. Low fuel levels mean mild fire intensity, easy controllability and minimal damage. Prescribed burning in this context is the planned use of low intensity fire, under mild weather conditions, to reduce fuel loads over broad areas of vegetated land.

On the one hand, we have people with experience in fire management and firefighting and people who have been directly affected by the fires. This sector is making very clear demands for greatly increased prescribed burning programs to prevent catastrophic fires happening again. On the other hand there are

views opposing the widespread use of prescribed burning (e.g. Clode and Elgar, 2014). The effectiveness of broad-scale fuel reduction is questioned and other techniques for reducing fire risk are proposed, such as fuel reduction within 100 m around buildings and infrastructure. It is our contention that in areas of high risk, other fuel reduction measures such as small-scale fuel reduction, and grazing or removal of biomass for biofuels, with the current production costs associated with it, do not provide a big enough impact to reduce the risk of unplanned fire.

Lands-use planners have to take into account evidence and opinion from all quarters. With such varying influence and no clear political decision framework, the concerns of fire management are sometimes neglected and not reflected in the land-use planning process.

An integrated approach to fuel management is needed. Landscape-scale prescribed burning will be needed in some areas, and a small-scale fuel reduction is needed around buildings and infrastructure. Fuel reduction in small buffer areas in settled areas will be futile in some areas as large wildfires will simply throw spot fires over the buffer zone. All stakeholders need to be involved and making well-informed decisions, not just the fire services.

In order for prescribed burning or any alternative fuel management measure to provide a high level of protection, a large part of the landscape (5-10%) has to be treated annually (Fernandes, 2015). More research is needed to predict the effectiveness of prescribed burning in different vegetation types and what threshold levels are effective (Price et al., 2015). This idea of a threshold level of burning is missed by most people who are inexperienced about fire, and is the flaw in the argument that prescribed burning is OK so long as it is restricted to small areas around settlements. That leaves the majority of land unmanaged and prone to high intensity fires.

The idea that large wildfires are an inevitable consequence of global warming is illogical. The fact is that if a proper system of fire and land management is instituted, involving efficient detection, good access, fuel reduction and an effective fire fighting force, the predictions of future climate will add a new challenge, but do not make intense wildfires inevitable.

The tools for better land-use planning should support the adoption of a Good Practice approach to vegetation fire management in Europe.

What is a Good Practice Vegetation Fire Management System? It is a package of policies and actions that:

- delivers community protection from destructive vegetation fires;
- minimizes undesirable impacts on the environment and needless costs to the Government and the community;
- maximizes firefighter safety;
- is based on credible science;
- has widespread political, community and media support.

4. Obstacles to implementation

This chapter describes the analytic work on operational, political, cultural, social and technical obstacles and hindrances that obstruct the adoption of existing knowledge and capacity into better vegetation fire management across Europe. The work represented here is based on analysis of the IPCC SREX report and research conducted within several studies in forest risk management networks, such as the PUMA[19] network. Experiences from the FRISK GO[20] project are part of this PUMA analysis. The results presented here provide a solid overview on the causes why the so often demanded change is not happening and why the change is not yet affecting the land-, urban- and spatial planners.

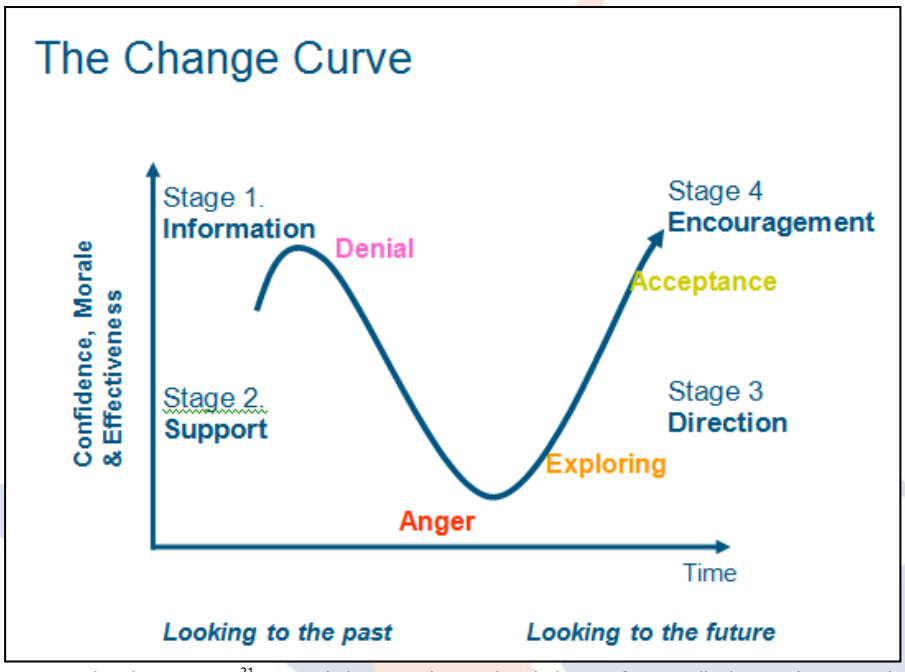

Figure 3: The Change Curve[21] – How do humans change their behaviour? Originally designed in 1969, this model is used for any crisis or change that humans go through. It can also be used to gauge change (if any) by individuals or organisations.

The change curve (Figure 3) is a model of how individuals adjust to change and explains why there might be difficulties for organizations to go through change. This deliverable focusses on why change of behaviour seems to be so difficult in so many cases. Figure 3 does not use vegetation terminology, but visualises that change is a process and is affected by factors that can alter or divert the direction of change, and that very often it can be a difficult process. There are different stages of the model: stage 1 begins when the change is first made and where the initial reaction may be shock and denial; stage 2 represents a phase there may be resistance to the change and anger and confusion associated with a decrease in confidence and effectiveness; stage 3 involves exploration of the change where individuals start to move on and start to accept the changes; stage 4 shows the stage where the changes have been full accepted, and any improvements in efficiency may be realized.

[19] www.waldwissen.net/waldwirtschaft/schaden/fva_ratgeber_forstliches_krisenmanagement_startseite/index_DE
[20] www.friskgo.org
[21] www.educational-business-articles.com

What do we mean by change and what is the difference to the current fire policy of fire control and suppression? We think we are on the safe side to describe a more holistic fire management approach on a European scale based on three main cohesive objectives, similar to the approaches adopted in the USA and Australia.

A Cohesive Vegetation Fire Management Strategy is a strategic move to work collaboratively among all stakeholders (including the urban and spatial planners) and across all landscapes, using the best science, to make meaningful progress towards three goals:

1. Fire Resilient Landscapes;
2. Fire Adapted Communities; and
3. Safe and Effective Wildfire Response.

Vision: *To safely and effectively extinguish fire when needed; use fire where allowable; manage our natural resources; and to live with vegetation fire.*

Such a European vision would establish a policy outline for vegetation fire management, would define three commonly agreed goals, would describe the vegetation fire challenges, would identify opportunities to reduce fire risks, and would establish priorities focused on achieving the goals. Such approaches would explore four broad challenges:

1. Managing vegetation and fuels;
2. Protecting homes, communities, and other values at risk;
3. Managing human-caused ignitions; and
4. Effectively and efficiently responding to wildfire.

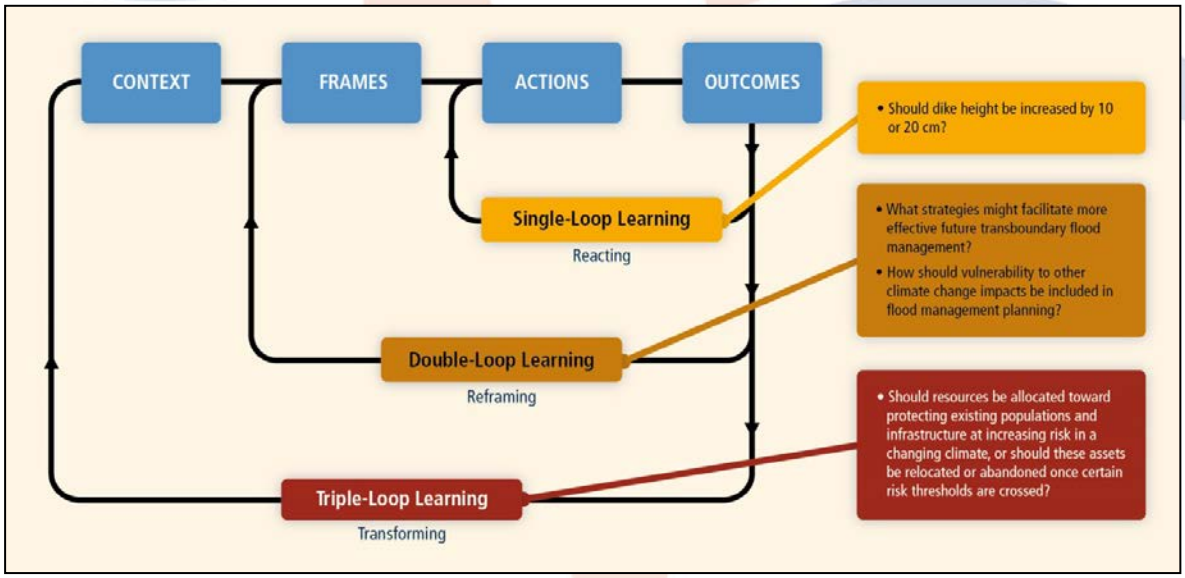

Figure 4: Learning loops: pathways, outcomes, and dynamics of single-, double-, and triple-loop learning and applications to flood management. In IPCC 2012. Adapted from Argyris and Schön, 1978; Folke et al., 2009; Hargrove, 2002; Pahl-Wostl, 2009; Sterman, 2006.

Figure 4 shows the difference between single loop learning and multiple loop learning. The single loop is a typical human approach that could be described as: going back to “normal” as quickly as possible, neglecting or avoiding the possibility that there might be more “loops” to look at and learn and then

maybe see a other options and links to other fields in dealing with risk and crisis. These other loops can be a motivation for change and the approach might enable changes towards adaptation and resilience, including incorporating risk into daily land management and decision making, rather than to "go back to normal" as quick as possible.

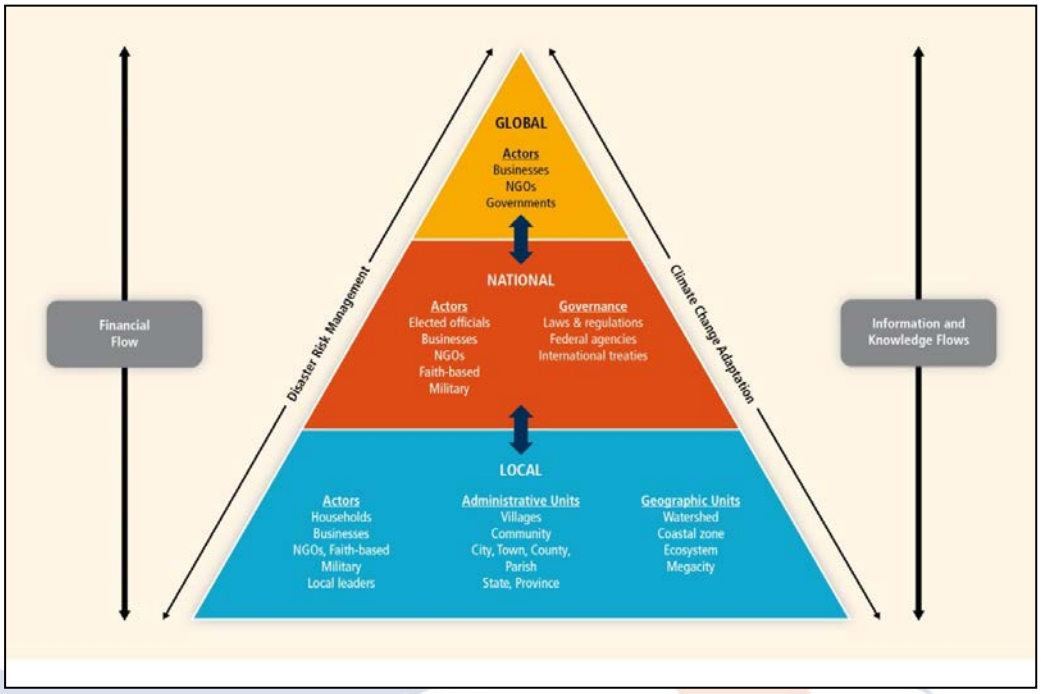

Figure 5: Linking local to global actors and responsibilities. In IPCC 2012.

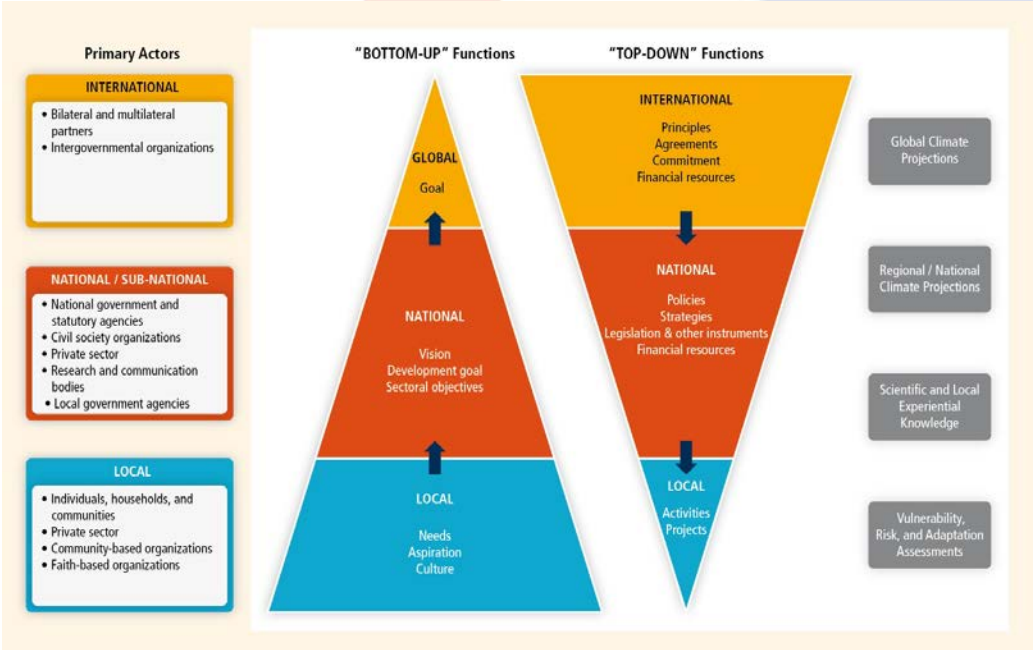

Figure 6: National system of actors and functions for managing disaster risk and adapting to climate change. The same pathways apply for vegetation fire risk management. In IPCC 2012.

In Europe we have to deal with a very fragmented landscape of vegetation fire policies, strategies, and governmental and non-governmental actors. Despite a quite diverse fire ecology and diverse fire regimes across Europe, a commonly agreed European approach needs to provide a stable framework and an enabling environment for all levels and actors displayed in Figures 5 and 6. Such a framework needs to include spatial planners to a much greater extent than it does currently. Both, the SREX postulated goals of "Disaster Resilience" and "Adaptation to Climate Change" as well as the three cohesive fire management goals (Fire Resilient Landscapes - Fire Adapted Communities – Adequate Wildfire Response) need consideration in the planning phase of land-use or urban spatial planning from the very beginning of the planning process.

A list of barriers to implementation of desired policies and actions is presented by (O'Brien et al., 2012) in the Special Report of Working Groups I and II of the IPCC – Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). There is also a tendency for individuals and organizations to focus on the short term and to ignore low probability but high-impact events (with the exception of when a high-impact event has recently happened when there is a tendency to place undue emphasis on the event). The following studies discuss some of the psychological and economic barriers shaping how people make decisions under uncertainty:

- *Underestimation of the risk*: Even when individuals are aware of the risks they often underestimate the likelihood of the event occurring (Smith and McCarty, 2006). This bias can be amplified by natural variability (Pielke Jr. et al. 2008) where this is expert disagreement, and where there is uncertainty. (Magat et al. (1987), Camerer and Kunreuther (1989) and Hogarth and Kunreuther (1995), for example provide considerable empirical evidence that individuals do not seek information on probabilities in making their decisions.
- *Budget constraints*: If there is a high upfront cost associated with investing in adaptation measures, individuals will often focus on short-run financial goals rather than on the potential long-term benefits in the form of reduced risks (Kunreuther et al., 1978; Thaler, 1999).
- *Difficulties in making tradeoffs*: Individuals are also not skilled in making tradeoffs between costs and benefits of these measures, which requires comparing the upfront costs of the measure with the expected discounted benefits in the form of loss reduction over time (Slovic, 1987).
- *Procrastination*: Individuals are observed to defer choosing between ambiguous choices (Trope and Liberman, 2003; Tversky and Shafir, 1992).
- *Samaritan's dilemma*: Anticipated availability of post-disaster support can undermine self-reliance when there are no incentives for risk reduction (Burby et al., 1991).
- *Politician's dilemma*: This phrase describes the conflict between the politician's short-term need for political survival and what is the long-term best interests of society. Time delays between public investment in risk reduction and benefits when hazards are infrequent, and the political invisibility of successful risk reduction can

result in a 'not in my term of office' attitude that leads to inaction (Michel-Kerjan, 2008).

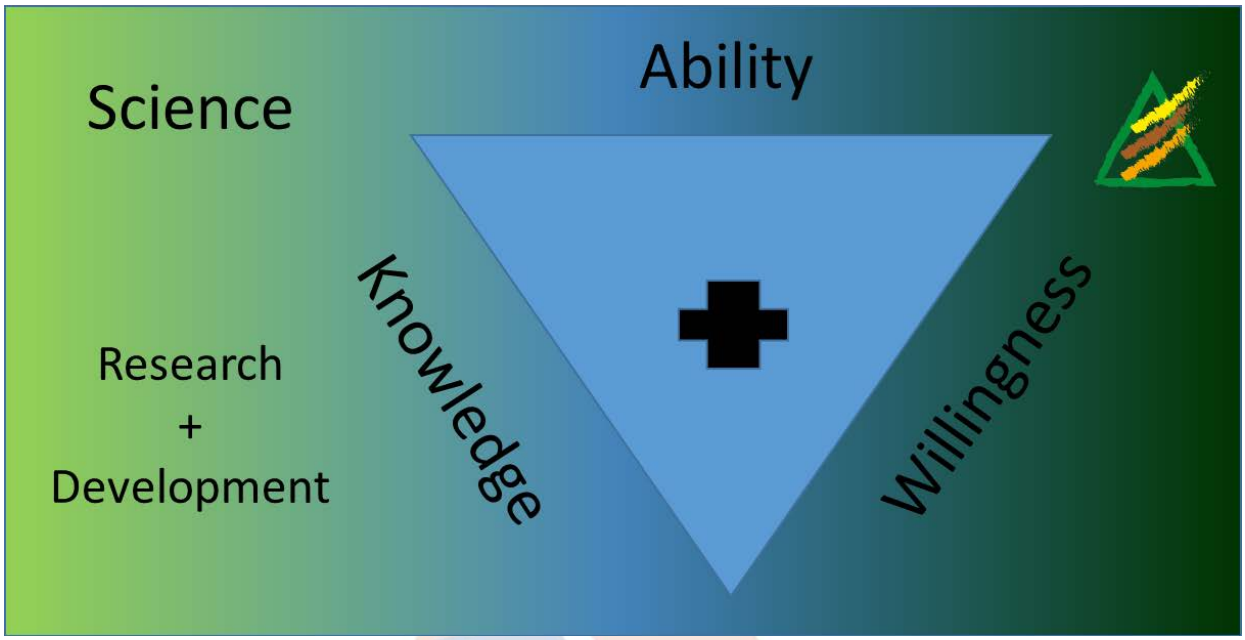

Figure 7: The triangle of knowledge, ability and will. We have knowledge through R&D, we have technical ability through training and capacity building, but seemingly there is a lack of will to apply or implement it into changed behavior. Source: www.friskgo.org

Forests can develop as a carbon sink and potential carbon sinks working to mitigate the carbon effects. However, this is substantially linked to the preservation of forest ecosystems, ideally optimized within the framework and expected conditions of climate change. Therefore in this context, preservation of forests can be seen as a prerequisite for mitigation. Forest fire management and the planning and inclusion thereof, in land-use practices play a vital role here. If that adaptation (through better fire management) fails, the European forests can become a carbon source though disturbance induced loss of growing stock. The risk of such disturbances is increasing as well. The IPCC (2007) formulates very clearly: "Even by the strictest mitigation measures will not be able to avoid further negative effects of climate change in the next decades. Therefore, adaptation measures - especially for managing short term consequences – are essential."

A major activity line of appropriate adaptation measures according to the IPCC (2007) are "Initiatives and measures to reduce the susceptibility and vulnerability of natural and human systems against actual or expected impact of climate change."

With this, the link and connection to risk management (and the planning thereof) becomes obvious.

Increasing the capability of the forest sector to act preventive and to address forest related risks in an integrative way, can therefore be seen as one of the core activities for adaptation of forests and the forest sector.

As strategies for risk management in addition to risk acceptance (if unavoidable or insignificant) we need to highlight risk transfer (i.e. insurance, but only financial consequences are covered), and two that are particularly relevant for the forestry sector:

- reducing the likelihood of damage;
- reducing the harmful consequences or impact of disturbance.

Both can be supported by targeted development of the forest landscape. Planning is of crucial importance in this context.

The focus on the issue of risk and crisis management is completely consistent with the statements of the SREX report (IPCC, 2012). This report "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" demonstrates in an impressive way the relationship between climate changes on the one hand and risk, respectively forest crisis management on the other. A focus must be on developing a risk culture that manifests itself in the implementation of a conceptual risk management so that it is a central activity field at national and even global level. Again, land use planning plays an integral part in including forest management knowledge in the planning cycle.

4.1. Implementation barriers of adaptation in the forest sector

According to IPCC (2007), adaptation measures to expected climate change, that include fire management planning in land use planning, do only happen partially and to a relatively low extend. Within the FIREFFICIENT project we have analyzed the reasons for this lack of planning and resulting lack of implementation. The IPPC SREX report also lists a number of barriers for adaptation that can be also applied for the question of this FIREFFICEINT deliverable. Why is it that available knowledge does not find application in land-use planning to a wider extent? The following is a descriptive list of obstacles and hindrances.

Initially we can categorize five groups of barriers that hinder adaptation measures to be included into land-use planning:

1. Economically justified barriers
2. Environmental barriers
3. Information barriers
4. Attitude and behavioral barriers (psychosocial component)
5. Political barriers

The 21 identified barriers are presented and described in more detail.

4.1.1. Economic barriers

1 – Liquidity problems

While savings often occur very often only in the long term and at small "rates", adaptation measures are often initially linked with high investment costs. Many decision makers focus, consciously or unconsciously, but also necessarily, on short-term economic goals (Kunreuther et al., 1978; Thaler, 1999 cited in IPCC 2012).

2 – Problems with the assessment and understanding of interactions between risk avoidance/mitigation costs and risk effects

Many knowledge gaps exist that prevent a proper assessment of the economic effectiveness of risk mitigation costs (Slovic, 1987). Generally it can be stated that even basic knowledge in forest-economy is only relevant for specialized forest practitioners. The ability to perform specific calculations on the necessary methods of dynamic investment appraisal does not exist, or has no tradition in the forestry setting.

4.1.2. Environmental Barriers

3 – Current forest growth dynamics in the conflict to adaptation goals

Especially in systems managed using close-to-nature management, the forest and land use development is determined by the current climatic conditions. Due to the longevity of forestry production the current climatic and risk conditions may lead to forestry and land use that is not suited to the expected conditions under a changed climate. Under such scenarios "to work against nature" could be required and planning of such measures of adaptation and diversification is then difficult to justify.

4 – Long-term production

Many of the adaptation measures (tree species selection, management measures) can only be initiated or implemented in the early development phases of a forest. In a significant proportion of stands there may be no or only very marginal adaptation planning that can be implemented. This may give the false impression that there are no significant fields for action.

4.1.3. Information Barriers

Also information barriers hinder the adaptation planning processes. Despite the fact that number, frequency and intensity of wildfires have increased over the past decades, local events are still relatively rare. The problematic side effect of this rare local experience is that specific knowledge and expertise on local level is hardly available. Additionally, newly created scientific knowledge is normally not available in any other format other than scientific publications, and often in English only. This knowledge is not "available" or "applicable" knowledge for the operative planning practitioner.

Therefore, we have to differentiate between existing knowledge, available knowledge and applicable knowledge. Eventually, only the applicable knowledge can be implemented into the planning and land management cycle and it is of paramount importance to develop approaches, tools and media to

"translate" and transform knowledge to bridge the described gaps. White et al. (2001) indicate the presence of information barriers and describes four barriers that may impede or prevent the application of existing knowledge: incompleteness of knowledge; limited use of knowledge; time lag between implementation and impact of new knowledge; and aging of knowledge. Saab et al. (2008) and Marincioni (2007) (both cited in IPCC, 2012) designate additional barriers: quality of knowledge presentation; technical availability.

5 – Incompleteness of knowledge

Knowledge is always incomplete. There will always be areas where we have knowledge gaps. This is true in the given context for different areas of planning for fire management. For instance, there are uncertainties in climate predictions and the response of vegetation and fuel response to changes in climate.

6 – Limited use

Another obstacle is that although information is theoretically always available and more up-to-date information and knowledge is constantly being generated, it is still either not at all or only limited used effectively. This is also true for our context. The driver for this no-use of information is very often the view that catastrophic fires only happen very rarely and that the normal operations and working conditions are already demanding enough (without having to plan for the unexpected). If an unexpected large disturbance or fire then really happens – despite the best efforts in the past – only part of the latest knowledge will be in an applicable format that supports concrete action.

7 – Time lag between implementation and impact of new knowledge

We also have to consider that if knowledge is available and used at least partially, this use of the knowledge will not continue forever, because positive effects occur much later or in the end only in a non-visible and not provable reduction of damage. A fire that does not happen or only has a minor impact because of good land-use planning is not recorded as a success. Both mechanisms apply in forestry because of the long-term nature of production and the fact that avoided and mitigated damage are not seen and not recorded.

8 – Aging of Knowledge

The knowledge building will be overtaken by the speed of change, meaning that the available information is outdated. This effect applies mainly to issues of technical implementation of restoration measures respectively the legal framework.

9 – Quality of knowledge presentation

New knowledge is often presented in a form which is not or only partially in a usable format for the average user. This problem occurs especially when knowledge is not transferred from the scientific sphere to the reality of forest practitioners and forest owners, as well as the land-use planners. Although the process of providing applicable knowledge was started few years ago, we still have to state that quite a number of relevant disturbance (fire) topics have not been, or are only partially, contextualized to make it applicable for the land-use planner.

10 – Technical availability

The various media tools differ considerably in terms of their technical availability. Even with availability on the Internet, the problem may occur (especially during acute crisis situations) that a time-compressed occurring high demand cannot be served shortly. Information and information services which are relevant for the aspect of response and intervention after disturbances, must therefore have sufficient capacity to cope with a temporally compressed and high demand. The involvement in technically powerful, independent and well-known information platform (e.g. a forest risk facility such as proposed by FRISK GO) appears to have a high priority.

4.1.4. Psychosocial barriers (knowledge versus awareness)

So far, relatively little attention has been paid to the extent of existing psychological barriers that prevent the use of already applicable adaptation measures or their inclusion into the planning process. Over the past few years numerous studies on the underlying psychosocially causes have been presented. The variety of findings suggests that the psychosocial sphere should attract far more attention than has been the case up to now. The list of psychological barriers therefore represents a summary overview that does not claim to be complete. The multitude of findings nevertheless demonstrates the significance of this topic.

11 – Lack of visibility of effects of climate change

The short-term normal weather fluctuations mask the long-term climate trends; the short-term fluctuations are orders of magnitude greater than the long-term trends. Direct true observation of climate change can thus be virtually eliminated. In this respect there is no active experience of the problem among the actors.

12 – Lack of lighthouse events

On several occasions, it was found that only (negative) events with signal character trigger a significant impulse to act. In this respect, visible but non-dangerous events, do not provide sufficient impulse for action. Processes, such as climate change, that develop slowly lack such “danger” properties completely (see also item 19 “Creeping Normalcy”).

13 – Underestimation of risk

There seems to be a tendency to underestimate risks especially when they (impact or frequency) are linked with a high natural variability. Especially the latter phenomenon is also described under psychophysics of low probability or likelihood (see Camerer and Kunreuther, 1989; Hogarth and Kunreuther, 1995; Magat et al., 1987 all cited in IPCC 2012).

14 – Postponing decisions under uncertainty

Tversky and Shafir (1992, cited in IPCC 2012) and Trope and Liberman (2003, cited in IPCC 2012) describe the phenomenon that decisions get postponed, particularly under conditions of uncertainty. In light of the fact that all the issues that relate to or predict the future climate scenarios have indeed prediction - or scenario uncertainty, this factor may be particularly relevant in explaining inaction.

15 – Time lag between cause and effect

Due to the longevity of forest production, the effects of adaptation measures (let alone the planning thereof) only become visible or effective in forest ecosystems with a high time delay. The effects of either action or inaction in forest ecosystems are usually only marginal in the short term. Negative consequences in the next 10-20 years will therefore only be visible to a very limited extent.

16 – Low perception of the effectiveness of protective measures

A similar causal chain problematically builds up for the people who always have an open and willing mind-set of readiness for adaptation measures. Adaptation measures are not "rewarded" immediately but develop their effectiveness often only in the subsequent (human) generations. In addition, unlike in some, often technocratic life areas where risks can be even largely excluded (risk avoidance), it is not possible to exclude the risk of natural events. A success thus manifests itself often only in a reduction of impact or severity compared to a potentially greater impact from failure of risk management measures. The avoided costs are barely visible. The ability of most people to perceive such opportunity effects and assess needs, is very limited.

17 – Creeping Normalcy

Gradual changes are hardly noticed by people, and the altered state is perceived as the new normal. This means that an incentive for action often only occurs when the rate of change has reached a tipping point (a point of no return). The phenomenon is known as *creeping normalcy* or as a *Creeping Environmental Problem (CEP).*

4.1.5. Political obstacles to adaptation

18 – Samaritan's Dilemma

The European forest owners have been accustomed to extensive government assistance after large disturbance events like fires or storms. This results in the undesired effect that minimizes personal responsibility, and consequently the motivation and capacity of owners to take adaptive and preventive measures (Burby et al., 1991, in IPCC 2012).

19 – Politician's Dilemma

There is a potential conflict between short-term political interests of politician's and government's (at all levels) and what is in the long-term interest of society. The time delay between risk mitigation activities and when their effects become apparent means that members of the community often do not make the connection between an investment that was made and the benefit (such as reduction in the deaths due to unplanned fires). In particular, successful avoidance of disasters leads is barely perceptible. This may result in a "not in my term mentality" that leads to inaction (Michel-Kerjan, 2008, in IPCC 2012). For instance, the hurricane risks and options for mitigation of the risks in New Orleans were known in detail long before the Hurricane Katrina struck the Gulf Coast of the USA, but had been largely ignored at all political levels (Kates et al., 2006, cited in IPCC 2012).

20 – Conflicting interests between minimizing risk and other management objectives

Especially in the forestry context, conflicts between risk reduction and other objectives of forest management may arise. For example, from the point of view of maximizing timber production or economic return there is an advantage to using particular fast-growing tree species such as Douglas fir, Sitka spruce, or maritime pine, and harvesting the stand as it reaches maturity but before the mature trees start to die. From a nature conservation point of view, it would be best to use native species and allowing individual trees or parts of the stand to grow into old-age and decay. Management to reduce fuel loads is likely to be different again. Management for a narrow set of objectives is likely to restrict the options for vegetation to provide multiple services. Close-to-nature management may not be optimum for any particular objective, but is likely to provide a greater range of management options for a wider range of objectives (Kraus and Krumm, 2013; Puettmann et al. 2012).

21 – Targeted dis-information

Mitigation, and also partly the adaptation strategies, are often associated with risks of additional costs or reduced yields. Avoidance of action may therefore be in the economic interests of some parties. It is well-known that lobbyists operate targeted efforts to avoid political pressure. This policy is, inter alia, due to the inherent uncertainties of predictions and preventive actions quite promising. It takes advantage of some of the above psychosocial barriers.

4.2. Summary of the obstacles and hindrances

The large number of barriers which are described in the literature show that the so far rather slow implementation of adaptation happens for a variety of reasons. A not inconsiderable number of these explanatory factors are not attributed to informational, but to the psychological level. It is therefore highly unlikely that a significant adaptation success can be achieved with only the further extension of information, knowledge and availability without the development of adequate concepts and methods of awareness rising.

Milad et al. (2013) show the discrepancy between knowledge and implementation activity concerning adaptation measures for climate change in the European forest sector. In a wide-ranging investigation within the forest sector they come to the conclusion that knowledge generally exists on possible adaptation measures. The implementation, however, “still is in its infancy”. The presence of obstacles can therefore also be assumed for the planning sector in the field of fire management.

5. What can be done?

First and foremost a global (European) leadership for guidance on fire management issues would be needed. In theory, the European level should be able to provide such guidance. In practice however, the mandates for practical fire management are allocated in fire services and partly in the land-based sector. On the higher policy making levels we have players like UN ECE, FAO, DG ECHO, DG AGRI, EC JRC, Global Fire Monitoring Center GFMC, CTIF, European Forest Institute EFI and others, to name just a few. All are dealing with wildfire issues, but none has the authority nor agreement by the others to provide such credible and accepted leadership. So, if even on the highest levels we have no agreement and clear line to follow (civil protection vs. land-based sector) how can we implement a unified vision of a good practice fire management with cohesive strategic goals? Such guidance would entail:

- Improved commitment of all levels of government(s) to better vegetation fire management.
- Improved fuel management practices on private and state land.
- Better appreciation of the importance of fire management issues in planning processes both at State and local government levels.
- The adoption of a “Good Practice” approach to forest fire management in Europe.

What do we mean by a “Good Practice Fire Management System”? It is a package of policies and activities that:

- Delivers community protection from destructive vegetation fires.
- Minimizes undesirable impacts on the environment and needless costs to the governments, the economy and the communities.
- Maximizes safety to firefighters.
- Is based on credible science.
- Has widespread political, community and media support.

Key points of a Good Practice Fire Management System:

1. Overarching legislation (A European wide framework is not in sight)
2. A EU Vegetation Fire Policy (or at least coherent national policies that entail more than fire suppression)
3. An intergovernmental agreement between the States and EU level
4. A State-level agreement between the forest / land management agencies and other key agencies
5. A single land management organization responsible for forest / land-use planning, forest / land management and vegetation fire management on vegetated lands.
6. Preparation of a Fire Management Plan by the responsible agency
7. Adequate funding for the responsible agency fire management operations
8. Independent monitoring and public reporting on outcomes on an annual basis.

The FIREFFICENT project has described a set of skills and competencies for Planners that should be known and understood for efficient land-use and urban spatial planning for better wildfire management.

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7. Annex - Essay on the psycho-social component of human in-action with special reference to planning in fire

based on The Future Is Not What It Used To Be – Climate Change and Energy Scarcity, by Jörg Friedrichs, 2013, MIT Press.

What prevents us, together and as moral individuals, from confronting existential problems such as climate change and the escalating wildfire situation? On the face of it, an effective response is hindered not just by the inadequacy of existing knowledge regimes but also by a confluence of behavioral and cognitive dispositions. Despite the inescapability of the impasse and the efforts of countless well-intentioned people and groups, there is a full-fledged moral economy of inaction to ensure that our response to climate change and wildfire in particular falls short of what is required. The moral economy of inaction consists of three key elements. First, people tend to greatly undervalue future events and distant strangers. The more remote somebody or something is from us, the less we care. We may call this ethical discounting, and it comes in two different forms, temporal and spatial. Second, the pursuit of particular interests often thwarts collectively desirable outcomes. We may all agree that something needs to be done, and yet not a single one of us may be ready to do it. This amounts to collective action problems, which occur when the pursuit of particular interests impedes collectively desirable outcomes. Third, people often simply pretend that their problems do not exist. This is also called denial, and it can be defined as the habit of treating real problems as if they were non-issues. Denial in particular is an underappreciated but enormously important part of the moral economy of inaction. It has a rational core because it minimizes pain, but it often leads to tragic outcomes. The nature and gravity of these consequences depends on whether a problem is tractable or intractable, und whether it is permanent or escalating. In general the denial of intractable problems is less harmful than the denial of tractable problems, and the denial of permanent problems is less harmful than the denial of escalating problems. Unfortunately, climate change and wildfire (and planning for it) appear to be escalating problems. Because denial can have extremely harmful consequences, *Friedrichs* (2013) discusses the possibility of social intervention. What, if anything, can non-denialists do to liberate people from damaging forms of denial? The situation is complicated by the fact that denial is interconnected with ethical discounting and collective action problems to form an integrated moral economy of inaction.

Ethical Discounting

As observed by David Hume in his *Treatise of Human Nature (1739),* the more distant something is in time and space, the less we care about it. This implies that when our behavior is unsustainable in the long run, and/or when it is damaging to distant others, we have a tendency to discount the effects and focus on the here and now. This tendency may be called ethical discounting, and it comes in two distinct forms: temporal and spatial. Temporal discounting is a function of the time period between present decision making and future consequences, whereas spatial discounting is a function of the geographical or emotional distance between the people acting and the people affected.

Temporal Discounting

John Maynard Keynes famously cautioned that the *long run* is "a misleading guide to current affairs. In the long run we are all dead" (Keynes 1923, 80). The argument is that, no matter their inherent merits, long-term considerations are futile because our life happens now, and not in some distant future. We should therefore not unnecessarily worry about the future and instead put our focus on the events of the day. Whether or not this is morally desirable, it accurately describes the routine behavior of citizens, economic stakeholders, and even politicians who are notoriously concerned about (re-)election.

Climate change and wildfire are cases in point. The effects of this year's CO_2 emissions will be felt many years from now, and the worst effects accrue to future generations. Similarly, no matter how prodigally we fail in planning for cohesive fire management goals (fire resilient landscapes, fire adapted communities and adequate response) now, the worst effects of disaster- and mega-fires will occur in a (maybe no so) distant future.

Another problem is deep structural uncertainty. The links between the anthropogenic causes of climate change and the expected increased wildfire situations and systemic effects on human systems are so complex that after thirty years of modeling the consequences are still very hard to predict. Similarly, fire simulation models or future fire scenarios are obfuscated by unreliable data and depend on hazardous assumptions about land management approaches and technological fire management progress. The disruptive effects of more frequent disaster fires on the economy are almost impossible to estimate. Given such fundamental systemic uncertainty, there is an understandable tendency in many quarters to dismiss the risks of catastrophic climate change and escalating fire situations as unfathomable "low probability high impact" events.

One economist, Martin Weitzman, has undertaken a heroic attempt to factor the unfathomable deep risks and structural uncertainties of catastrophic climate change into conventional economic modeling (2009, 2011). He shows that the potential effects of catastrophic climate change make it very challenging to apply standard cost-benefit analysis. While Weitzman is still trying to reform economic modeling to incorporate deep risk and structural uncertainty, it is perhaps fair to draw an even more radical conclusion:

Existential civilizational predicaments such as climate change, or wildfire for that matter, are simply not amenable to economic modeling.

This does not mean that temporal discounting is not taking place. Instead, it simply follows a less rational but tragically all-too-human form. When deeply engrained habits are at stake, humans tend to discount the future much more radically than any utilitarian model would predict.

The longer the time frame, the greater the uncertainties, and the deeper the habit, the more future damage is accepted for the sake of instant gratification, and the less likely preventive action is undertaken. Such radial discounting of the future may be irresponsible, but it is incontrovertibly human.

Spatial Discounting

The other form of ethical discounting is spatial discounting. Sometimes this means literally discounting utility based on geographical distance (Perrings and Hannon 2001). More commonly, however, people discount on the basis of emotional rather than kilometrical distance. The main discounting criterion is perceived personal proximity or remoteness, which in turn may be determined by discriminations made on the basis of class, race, gender, and so on.

Once again, climate change and wildfires are cases in point.

Across Europe, most land use planning decisions concerning fire management are discussed, influenced and decided under the influence of an urban population and mindset. Decision makers in the higher levels of administrations are usually situated in bigger cities. Most NGOs that have opinions on fire management also draw their membership (and opinion) from the urban population. Hardly any decision maker or planner has ever self-experienced wildfire and the related dangers and losses, not have they made own experience in managing and suppressing an unwanted wildfire. The research conducted at universities is done by students that more often than not do not have a rural background and upbringing in a fire prone environment, yet they investigate, measure, model and publish. The effects or non-effects of their planning do not affect them.

Secondly, fire management across Europe is mostly mandated to the Fire Services and Civil Protection. That the mindset, training and approach of a Structural (!) Fire Service (putting out fire) does not and cannot reflect land management issues is an additional factor that would need extra attention. A Fire Service driven planning and decision making will always think of suppression first, then firefighter safety and hardly ever about fuel and land management. It's not in the nature and education of structural fire services.

Another serious problem related to climate change and wildfire (and the planning for its management) is the lack of credible and effective global leadership. With a credible and effective global leader, it is sometimes possible to establish institutional devices to overcome collective action problems.

The Twisted Rationality of Denial

Another cornerstone in the moral economy of in-action is *denial*, or the habit of treating a real problem as if it were a "non-issue". A real problem is one that makes us suffer regardless of whether or not we acknowledge it. Denying such a problem seems perverse from a moral and ethical viewpoint, and it may easily have pernicious consequences. And yet, denial has its own twisted rationality as a strategy of pain avoidance and harm minimization.

Denial is a ubiquitous social and psychological phenomenon (Goleman 1985; Cohen 2001; Zerubavel 2006). Any kind of problem, from personal trauma to planetary challenges such as climate change and wildfire, can be obfuscated by denial.

There are good reasons to see denial in a negative light. Disavowing one's problems is both cowardly and dishonest, and it often gets in the way of finding and adopting effective solutions. The consequences can be disastrous. Despite such perverse outcomes, denial is not irrational. When in denial, people follow what they feel to be in their best interest by minimizing real or perceived harm, thereby maximizing subjective and/or inter-subjective wellbeing. Acknowledging a problem may lead to considerable psychological and social cost: negative emotions such as fear, shame, and helplessness; cognitive dissonance; loss of identity, or loss of friends; embarrassment; and social conflict about the attribution of blame and responsibility. Many people have a predisposition to minimize such psychosocial cost by establishing regimes of denial, rather than relentlessly facing up to their problems. Such behavior may be shortsighted und morally dubious, but it is by no means irrational.

Overall, it seems fair to say that denial has a rational core but often leads to problematic side effects. The nature and gravity of these negative side effects depends on whether a problem is tractable or intractable, and whether it is permanent or escalating. The denial of intractable problems is less harmful than the denial of tractable problems, and the denial of permanent problems is less harmful than the denial of escalating problems.

Let us be optimists for a moment and assume that it is not too late. Let us imagine that we are climate scientists or fire management activists, fire ecologists and land-use planners, and that we desire to break the regime of denial in which people are caught. This raises the issue of social intervention: What can be done when denial does more harm than good?

ANNEX References

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