



Project Deliverable D2.2

A comparative study of best practices and theoretical governance models used in non-fire risk

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Executive Summary

This deliverable is a summary report of research conducted in work package 2 of the PyroLife Innovative Training Network, and during the secondments of Early Stage Researcher 11 with University of Birmingham and the Food and Agricultural Organization of the United Nations.

It presents a comparative study of theoretical governance models and best practices used in non-fire disaster risk. The report contributes to task D2.2, and it aims to offer a better understanding of wildfire governance through insights from the wider field of natural resources scholarship.

The summary draws from the following article which was submitted for publication:

- Kirschner, J.A., Clark, J.R.A, Boustras, G. (in preparation). Governing fires: towards a context-specific analytical framework.

In summary, we identified four governance themes that we argue need more attention to the successful management of wildfires in a warming world:

- i. Empowering actor participation in wildfire decision-making and decision-taking
- ii. Actor collaboration and coproduction of wildfire policies and initiatives across and within levels, scales, and networks
- iii. Examining path dependencies and local place-based dynamics that shape wildfire incidence and comprehension; and
- iv. Adaptation to and anticipation of wildfire risk to fashion effective institutions that address the global wildfire challenge.

We complement the summary of theoretical governance models with a selection of best-practice from risk governance of flooding, Earthquakes and tsunamis, storms, and pandemics.

In conclusion, we find that there are diverse possible solutions to governing fires, and some of the theories are already applied in a context of managing wildfire risk. However, substantial gaps remain across the four presented themes, on a local to national level and particularly in European countries, both in Southern and Mediterranean areas with a long tradition of fire occurrence and management, and also in Central and Northwest European countries that increasingly are exposed to fire activity associated with vulnerability connected to socio-demographic change and the climate crisis.

1 Introduction

Media reports and negativity biases contribute to feeding and nourishing narratives of wildfires as disasters, disruption, and economic burden. Nevertheless, as iterated in a recent UNEP report, acknowledgement and attention to the cultural and ecological role of fire are increasing (Sullivan et al. 2022), meaning that wildfires are a fundamental Earth system process, they are not always harmful, and not all wildfires require immediate suppression. Wildfire practitioners, researchers, and government agencies find that ‘fire is changing because we are changing the conditions in which it occurs’ (Sullivan et al. 2022, 6). Combined bioclimatic and human drivers of wildfire activity are complex, (Jones et al. 2022, IPCC 2022) and there is interest in understanding how social factors and **governance mechanisms** are shaping wildfire activity, their risk, impact, perception, and management addressing fire regimes and social vulnerability. Governance refers to “the processes through which public and private actors articulate their interests; frame and prioritise issues; and make, implement, monitor and enforce decisions.” (FAO, n.d.).

The backdrop in wildfire activity throughout the past decade (Portugal 2017, Greece 2018, Australia 2019/2020; US, Greece, Algeria, Cyprus, Russia, France, Italy 2021; Italy, Spain, Portugal, Germany 2022) accelerates global warming and substantially threatens ecosystems, wildlife and biodiversity. Consequently, wildfire governance at this point seems to not sufficiently address root causes of wildfires as a disaster risk to the social-ecological system (Berkes and Folke 1998, Ostrom 2009, Vigna et al. 2021), nor promotes them as a cultural-ecological process. Since beginning of the PyroLife ITN project in 2019 and throughout the past decade, however, wildfires were not the only disaster that societies are grappling with globally through different governance mechanisms. A record number of extreme weather events with severe floods (e.g., South Africa 2022; Europe, China, India, Afghanistan, Turkey 2021; India, East Africa 2020), droughts and heat waves (e.g., India, South America, US, Japan 2022; Europe, Russia, middle East, Canada 2021; Canada, Russia, Western US 2020), and devastating Earthquakes (Afghanistan 2022, Haiti 2021) interrupted the coupled human-natural system, causing havoc on the environment, human social life, health and infrastructure. Finally, since 2019, the Covid-19 pandemic is framed as an ongoing health and critical infrastructure emergency, with unknown secondary damage caused by restrictions for social gatherings, working and travels.

All the listed events highlight the urgency for society to prepare for and adapt to recurring and inevitable processes such as floods, fires, earthquakes, and pandemics. Examined through a lens of governance, they provide insights in how the social setting accommodates and supports decisions on disaster risk management under case-specific circumstances, with lessons learned that can be applied to different risks and contexts. In the global discourse on expanding knowledge of hazards and their potential impact, manifested in the UN Sendai framework for Disaster Risk Reduction (UNISDR 2015), two recent and innovative step changes should be mentioned here. Firstly, the to date commonly used term of ‘*natural* disasters’ is no longer considered accurate, as it is mostly *social* vulnerability (e.g., structures that do not withstand hazard impact), exposure (e.g., development in flood plains, fire sheds or earthquake zones), and direct and indirect human management interventions (e.g., decades of fire suppression result in fuel accumulation; anthropogenic climate warming contributes to extreme fire behaviour; channelling of streams combined with dams, land use change and sealing of surfaces increases peak run-off) that unintentionally exacerbate disaster likelihood and impact.

Secondly, a shift occurred from ‘disaster management’ towards ‘disaster *risk* management’. Instead of a reactive approach focused on disaster response, always too late by definition, a holistic and integrated approach is indispensable. *Holistic management* requires balanced measures along the full disaster risk management cycle, with strategies to prevent, reduce or mitigate the risk of a disaster in

a specific place, focusing on preparedness, response, recovery, and review (Sullivan et al. 2022). *Integrated management* acknowledges that different disciplines and sectors need to be involved to fully account for diverse drivers and interests in decisions around disaster risks (Vallejo Calzada et al. 2018). For example, for wildfires, it is not enough to rely exclusively on technocratic solutions and emergency services to solve the problem once the landscape is on fire. Instead, the management approach needs to account for interests and trade-offs of diverse fields such as forestry, agriculture, pastoralism, nature conservation, urban, rural and touristic development, on various scales from a community to state to global level.

In this summary report, we first present theoretical governance models commonly applied in the field of natural resources, to allow for new insights also in a context of governing fires. We then list best practice examples of non-fire disaster risk governance, thus further extracting lessons learned in risks other than wildfire, and how they can be transferred across different fields and disciplines. We conclude in the final section with recommendations for governing wildfires in diverse socio-ecological contexts.

2 Theoretical governance models from natural resources scholarship

In this section, we describe a selection of theoretical governance models from the wider field of natural resources scholarship. We differentiate between *governance*, as the social dimensions wherein different public and private actors attend processes of decision-making and decision-taking across temporal, organizational, and spatial scales; and *management*, which describes concrete strategies and measures agreed on or implemented as an output of the governance process (Armitage et al. 2012). Governing natural resources can, but does not have to, include a risk – defined according to the general paradigm as the product of likelihood and potential impact (Johnston et al. 2020).

2.1 Adaptive governance

Natural resource systems are intrinsically characterized by fluctuations – be it climatic variance, the occurrence of hazards, or the effect of human use and abuse of land, air, inland water systems and the sea. Change is not always gradually, but can be abrupt – under current scenarios of climate change, deviations from recorded disruptions are expected to occur more frequently, with higher magnitude, and extended duration. Management responses to variability are often manifested as control and simplification, however, the capacity of local to global systems to sustain productivity and reduce uncertainty is limited. Consequently, adaptive management (Folke et al. 2005) suggests to actively manage systems with the goal to increase their resilience, which is the system's capacity to reorganize and recover after disturbances (Walker et al. 2004), potentially using them as an opportunity to transform into a new state (Folke et al. 2005).

Adaptive governance (Folke et al. 2005) describes the social dimension enabling adaptive management of the environment. It supports continuous learning and different types of knowledge (traditional, local, scientific) to better understand dynamic processes and functions. In practice, this manifests in leadership and values encouraging continuous testing, monitoring, and evaluating of the implemented strategies. In adaptive governance systems, responsibility and power are shared across multiple levels, and involve various interlinked centers of organizations or agencies. Finally, there is acceptance towards uncertainty and unexpected disturbances, which is dealt with by proactive capacity building.

2.2 Collaborative governance

Global environmental change is associated with crisis related to human actions in various fields and sectors. A dramatic loss of biodiversity, stratospheric depletion and climatic warming, the release of novel entities such as chemical substances, GMOs and AI; and dramatically changing land and sea use (Rockström et al. 2009) are all symptoms of an emergency that can only be solved in a collaborative effort of diverse sectors such as the government, communities, and the business sector.

Collaborative governance (Gray 1985) is a model suitable to collectively address problems that cannot be solved by a single government entity alone, when traditional methods are insufficient to solve conflicts, and where independently acting or competing organisations are exposed to various feedback effects caused by themselves or others. Collaboration is thus defined as the sharing of resources (information, money, work force) between two or more entities, with the goal to solve problems that a single actor cannot solve alone (Gray 1985). Ansell and Gash (2008) suggest several crucial factors for successful collaboration, such as accommodating dialogue, trust-building, commitment, and a shared understanding of the issue at stake.

2.3 Network governance

When neither full state control nor privatization deliver a satisfactory response to the shared use of commons and natural resources, cooperation enabled in networks can be the response (Ostrom et al. 1990). Networked forms of organization are characterised by interdependent actors, where communication and exchange of information or resources is guided through both formal (i.e., written contracts or agreements) and informal mechanisms (e.g., trust, reciprocity and values) (Powell 1990).

Opposite to markets, the benefits achieved through cooperation in informal networks are not clearly specified in contracts, there is no bargaining to achieve the highest possible win, and there are no agreements with legal implications. Instead, networked exchanges can be guided and driven by formal authority, or social values such as reputation, mutual interests, and relationships (Powell 1990). Networks are different from hierarchies as there are no defined authorities (Powell 1990). Network governance as a key concept allows for community and citizen participation in decision processes, thus increasing representation and accountability through democratic processes.

2.4 Multi-level governance

Many issues related to the use of natural resources including global climate change and wildfires are characterised as 'wicked problems', which means they are caused by and have effects on actors across various jurisdictional and political-administrative scales (Carroll et al. 2007; Rittel and Webber 1973). Multi-level governance (MLG) theory (Hooghe et al. 2001) originates from studies on the European Union, where power and authority are exercised in an organisation that is not a state system, nor an international organisation. Instead, politics are steered by state and civil society actors and interest groups across local, regional, national and international scales and levels. MLG thus allows to govern natural resources across all levels affected or needed to implement a solution, while at the same time fostering representation in decision processes (Berkes 2008).

Governing natural resources across multiple levels includes to respect competencies and the role of various actors, to share responsibilities for conflicts, and to work towards possible solutions through cooperation across the different levels reaching from local and regional authorities to states and international levels. For example, the European Union does not aim to synchronise governance processes across all member states, instead, it maintains diverse governance modes of local and regional authorities,

the latter being responsible to implement most of the EU legislation. Consequently, local and regional stakeholders do not merely participate or consult in governance processes, but they share the responsibility, thus creating joint ownership and implementation of policy solutions (Van den Brande 2009).

2.5 Participatory governance

Participatory governance is a variant of governance theory in the field of democracy studies (Fischer 2012). It manifests in deliberative and equitable sharing of information and resources at various levels through maximum transparency and joint decision-making where possible (Schneider 1999). Fostering participation in decision-making and planning processes can contribute to a better fit and acceptance of solutions to conflicts around commons and shared resources, as local stakeholders usually have a better understanding of the problem, its causes, and can contribute to custom-fit solutions.

Key issues within the model of participatory governance are questions on who is involved in defining and finding solutions to an issue, and what the desirable outcome is including the intended or unintended contribution from involved citizens to achieve it (Turnhout et al. 2010). At risk to become merely a performative practice, participatory governance is assumed to go beyond pure representation, as participants enter the governance process with specific restrictions, assumptions and expectations (Turnhout et al. 2010).

2.6 Polycentricity

Polycentricity connotes a form of governance where decisions are made across centres operating with varying degrees of autonomy on multiple levels (Polany 1951; Ostrom 1961; Ostrom 2010; Carlisle and Gruby 2017). They are steered by so-called 'nested institutions', which describes the norms and rules underlying human interactions (Ostrom 1998, Ostrom 2012). Polycentric governance arrangements are thus in between of state-led and community-led models. The different centres are connected through competition or cooperation, allowing for learning across diverse scales to address multiple goals (Blomquist 2009).

Polycentric governance systems engage diverse institutions and are highly adaptive to social and environmental change, they are capable to improve the institutional fit of structures, while accounting for the complexity of socio-ecological systems, and therefore reduce the risk of system collapse and loss. Shortcomings however are the costs inherent to transactions, and a lack of accountability as responsibility is not formally shared across levels. In addition, there is a risk of redundancy in procedures, while the latter increases the potential for diverse responses.

2.7 Anticipatory governance

Anticipatory governance (Quay 2010) is a future-oriented decision framework where uncertainty, complexity and variance inform pathways for management strategies to confront a future without reference to any historical records. The origins of anticipatory governance are related to emerging scientific and technological innovations with potential disruptive effects on society and the environment. Instead of relying on known ranges for example in climate variability, anticipatory governance assumes that some aspects of the future cannot be planned and predicted. Anticipatory governance emphasises flexibility, foresight, and constant monitoring to adapt current and future strategies (Quay 2010).

In a context of governing natural resources and disaster risk, anticipatory governance is of relevance as it assumes that crises can be managed before they occur through proactive risk assessment and reduction (Muiderman et al. 2020). Anticipating change closely connects to adapting to its potential impact, while moving from short-term decision-making to longer-term management pathways with diverse stakeholder engagement (Boyd et al. 2014).

2.8 Summary: four themes from theoretical governance models in natural disaster scholarship

A critical analysis of the theoretical governance models presented allows us to propose the following themes (see fig. 1) as research frontiers also in the wildfire field, where attention should now be focused. In combination, the themes provide dimensions of a context-specific analytical framework, where future research will significantly contribute to achieving equitable, context-specific and sustainable outcomes in reducing wildfire risk:

- i. Empowering actor participation in wildfire decisionmaking and decisiontaking
- ii. Actor collaboration and coproduction of wildfire policies and initiatives across and within levels, scales, and networks
- iii. Examining path dependencies and local place-based dynamics that shape wildfire incidence and comprehension; and
- iv. Adaptation to and anticipation of wildfire risk to fashion effective institutions that address the global wildfire challenge.

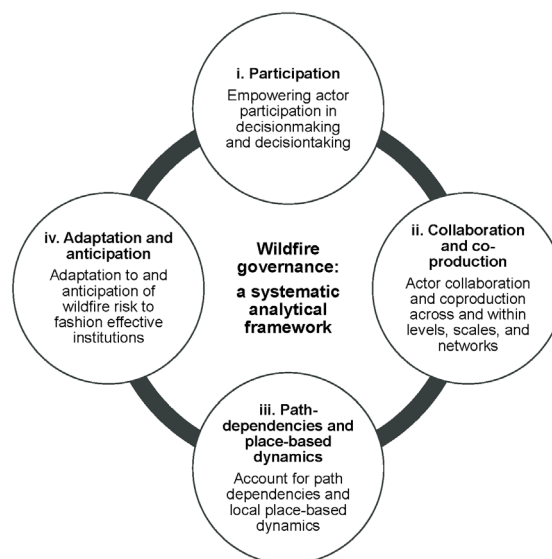


Fig. 1. A systematic analytical framework for wildfire governance (figure: Kirschner et al., in preparation)

3 Best practice: governing non-fire disaster risks

In this section, we list best-practice examples from different fields of non-fire disaster risk governance. We summarise transferrable lessons learned from a context of flooding, earthquakes and tsunamis, storms, and pandemics.

3.1 Flooding: prevention and mitigation

International comparative research by Driessen et al. (2018) identifies six key governance strategies to reduce the impact of flooding. They find that diversification and alignment of flood risk management strategies can help to address fragmentation found in flood governance structures. In addition, their findings highlight the need for involvement and cooperation of both public and private stakeholders. Setting formal rules might help to ensure both certainty and flexibility in the process, while there is a need to provide stakeholders with appropriate resources, both monetary, knowledge, and material. Finally, the authors suggest adopting normative principles to deal with trade-offs.

A comparative study on stability and change in flood risk governance arrangements in different European countries (Lieberink et al. 2018) suggests that Belgium currently shows most the most dynamic arrangement as manifested in trends of diversifying management strategies and a decentralisation of responsibilities. Overall, Belgium is characterised by a fragmented flood risk governance arrangement where responsibility for emergency planning and insurance policy are at state-level, whereas water management and spatial planning fall under full competence of the regions. The implemented 'integrated water management' approach *adds to* rather than *replaces* the dominant approach to flood defence. This includes nature-based flood protection measures, and coordination bodies to arrange between spatial planning and the water sector, different binding and non-binding decrees, acts and strategies, and the sharing of responsibility between governmental agencies and other actors such as citizens (Lieberink et al. 2018).

3.2 Earthquakes and tsunamis: preparedness

Seismic disaster risks such as earthquakes and tsunamis are a 'non climate hazard' and can hardly be predicted or prevented, thus requiring governance strategies focused on risk awareness, vulnerability analysis and mapping, early warning, preparedness, response, relief and recovery. To provide some best practice that could be applied in a context of governing wildfire risk, we focus on lessons learned and best-practice as identified in the ongoing recovery from the 2011 Great East Japan Earthquake (GEJE) by Maly and Supparsi (2020). Japan is one of the most seismically active countries globally and consequently has a long history of disaster experience, but also shows a high commitment to disaster risk reduction as indicated through global frameworks developed during conferences in Yokohama (1994), Hyogo (2005), and Sendai (2015).

In accordance with the Sendai priorities of better understanding disaster risk and strengthening disaster risk governance processes, Maly and Supparsi (2020) find three main pillars supporting pre-disaster Earthquake and tsunami risk reduction. The pillars include hazard warning with accurate detection, early warning and evacuation; the mapping of risk zones which also requires sharing of data and standards to increase their quality; and a vulnerability and risk assessment to understand demographic (e.g., gender, age) and engineering characteristics (e.g., build and infrastructure codes) that are associated with high vulnerability. For post-disaster recovery and rehabilitation, key points to be addressed in governance arrangements are the diversification of structural and non-structural measures, and inclusivity for the process where measures are agreed upon. Consequently, hazard mitigation cannot be achieved in an

isolated manner through top-down technological advances, at the expense of a different hazard, or with the side effect of increasing the hazard level in a different area. Instead, they must be organically implemented in wider community building and receive input from the local level.

3.3 Storm: response and recovery

Storm events are another hazard that cannot be avoided, thus reducing the range of management opportunities beyond response and recovery to pro-active measures of increasing system resilience of urban structures, forests, and ecosystems. Here, we present insights from selected studies on storm risk governance focusing on uncertainty in decisions on disaster response (Lidskog and Sjödin 2015). The case of responding to windthrow is particularly relevant, as both storm and fire events result in a similar outcome to be addressed in governance arrangements: fast decisions need to be taken on extracting a possibly large amount of remaining timber resources under consideration of consequential short and long-term risks such as pest infestation, soil erosion, and disruption of water cycles. In a next step, rather than restoring the system to its previous state by planting the exact same species, a system characterised by different age or species composition and management characteristics, might be better suitable and resilient in an economically, socially, and environmentally dynamic and uncertain future.

For the case of the severe 2015 storm Gudrun, forestry consultants employed by public or private actors were key actors, while the government's role was to offer information, advice, and recommendations next to providing economic grants and directives (Lidskog and Sjödin 2016). The study highlights that any risk governance practice will constantly produce (unintended) outcomes. Embodied knowledge and experience of decision-makers play a central role in providing guidance, but are not fully reliable for emerging management practices after unprecedented shifts in the systems baseline conditions (Lidskog and Sjödin 2016). Key in disaster responses is how the event is conceptualised or framed as a natural, a man-made, or a multi-causal disaster (Lidskog and Sjödin 2015). This in turn has implications for pre-disaster management incentives and strategies, where investments to increase preparedness are focused on the forestry sector, emergency services, or individual actors. The authors also find that understandings, beliefs and perceptions shape decisions for post-disaster management, thus pointing to the role of informal governance elements in addition to policy and frameworks to increase disaster resilience.

3.4 Pandemics: risk communication and education

Since 2019, the global community is experiencing the collective challenge of living with risk and disaster through the ongoing Covid-19 crisis. While most public and private actors quickly turned out to be insufficiently prepared for such an event, almost every stakeholder was forced soon to decide about strategies to respond and cope with the unfolding pandemic. A large variety in approaches was observed, from long-term top-down government control (e.g., China, Australia), to more relaxed approaches arguing in favour of the national economy or individual freedom (e.g., United Kingdom, Netherlands). Despite attempts to achieve full control over infection chains in early stages of the pandemic, it has now become evident that societies need to find ways to live with an acceptable risk of getting infected with Covid. Next to measures in disaster response through technological advancements – the development of a vaccine, medication, and investments into critical infrastructure – the Covid-19 pandemic offers valuable insights regarding risk perception, risk communication, education, and subsequent changes in citizens' behaviour. In addition, governance arrangements related to the pandemic provide lessons learned for multi-level decision-making, as regional organisations such as the European Union (EU) took a shared effort to align and coordinate measures across multiple scales and regions.

Traditional disaster risk education focuses on preparedness to evacuate, leaving out pro-active measures aiming at understanding risk through information. In the case of the pandemic, governments often played

a key role to ensure effective and transparent communication (Koinig 2021). Expanding to a wider understanding of disaster risk communication, Shaw et al. (2020) identified some basic principles to communicate and shape people's perception of risk in a context of pandemics: multi-disciplinary science supports decisionmakers in using all available information and plan for a worst-case scenario. Response and recovery planning need to be inclusive and implemented through transboundary and regional collaboration. Finally, media are responsible to cover the issue and address fake news, and the accountability of decisionmakers is increased through transparent information sharing (Shaw et al. 2020).

4 Conclusions

In this report, we delivered a summary of theoretical governance theories and best-practice of non-fire disaster risk governance. We identified four governance themes that will require more attention of academics, practitioners, and policymakers alike in a context of governing fires. The themes encompass the empowerment of actor participation in decision-making and decision-taking; the consideration of actor collaboration and coproduction of initiatives across scales, levels, and networks; the understanding of path-dependencies and local place-based dynamics contributing wildfire activity; and an emphasis on adaptation to and anticipation of wildfire risk in a dynamic and uncertain future.

Drawing from the peer-reviewed academic literature, we also provided examples of best-practice in non-fire disaster risk governance with valuable insights to governing wildfires. Flood risk governance illustrates a shift in management approaches from top-down governments focusing on 'fight and defend', towards more inclusive governance arrangements with diverse solutions, shared responsibility and stakeholder participation. Earthquake and tsunami disaster risk governance provides insights for better preparedness through vulnerability and risk assessment. The literature on storm risk offers insights on governance processes during unprecedented events requiring quick decision-making. Finally, the ongoing Covid-19 pandemic allows for knowledge transfer regarding risk awareness, education and communication.

In a context of governing wildfires, some of the theoretical governance arrangements are practically implemented (Kirschner et al, submitted), however, substantial knowledge gaps remain with considerable uncertainty about future wildfire activity on a local to federal level, and under consideration of diverse and dynamic socio-cultural-ecological systems.

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