

Wildfires and crisis management

– A systems analysis of the Swedish case

Introduction

Climate change mitigation and adaptation has arisen as one of the greatest challenges to maintaining societal resilience and avoiding known and uncertain negative impacts of varying magnitude and frequency. Although the interconnectedness of climate change adaptation (CCA) and disaster risk reduction (DRR) has been acknowledged in international frameworks, agreements and research, there are disquieting signs of society not taking adequate and timely measures. In the Swedish context this debate was brought to the fore with the 2014 Västmanland wildfire, which at the time allegedly became one of the greatest crises in a modern national context. It was followed by numerous investigations and a heated public debate on the state and capacity of Swedish crisis management as well as the responsibility of the forest sector for large scale hazards, but with the 2015 migration influx the debate on crisis management made an abrupt turn. Wildfires became, literally and metaphorically, not such hot stuff anymore. In the years that followed, the societal debate on crisis management diverted to matters such as the external border of the European union, social unrest and alienation of disadvantaged areas, IT-security leaks and disinformation campaigns, and perhaps most prominently the resurrection of the total defence

(see MSB & Försvarsmakten, 2016). Climate change related issues seemed to have grown out of fashion. It took the current year's record-warm May (SMHI, 2018) and a summer of raging wildfires way more extensive than the previous one in 2014, to again shed light on the matter. But despite the weather extremes and the subsequent extreme wildfire events, the question of CCA and DRR has arguably been overshadowed by a debate on matters such as the appropriate number of firefighting aircraft Sweden should have. This poses the question as to why that is, which this paper will discuss in some detail.

What used to be the greatest wildfire

The 2014 Västmanland wildfire developed into the then most extensive one in the country since the 1950s, as approximately 14 000 hectares of forest burnt in four municipalities situated in the Västmanland county (Sjökvist, 2015). At the time, Sweden experienced the year of the highest average temperature since the beginning of the measurements, which culminated in a heat wave in late July and early August (SMHI, 2015a). The Forest Fire Weather Index (FWI-value) had a remarkably high score. Still, ground preparation on a clear-cut area was carried out, which

was the probable ignitor of the fire despite that it is well known that such activities often start fires (Nerikes Brandkår, 2014). A combination of factors pertaining to weather conditions, forest properties, the organisation and execution of the rescue operations and crisis management interacted to create the conditions that allowed the fire to develop to the extent it did (Asp *et al.*, 2014; MSB, 2015b, 2016, Nerikes Brandkår, 2014b, 2014a; Sjökvist, 2015).

The consequences were plenty. The wildfire caused one fatality as well as injured and put several people in mortal danger; more than 1000 persons and 1700 domestic animals had to be evacuated (Sjökvist, 2015); the fire damaged 1.4 million forest cubic meters of timber (Skogsstyrelsen, 2018) and 70 buildings; and the costs of the rescue operations and damages due to the fire has been estimated to one billion Swedish kroners (NE, 2018). In 2015 the Swedish Forest Agency administered a temporary economic support for the purpose of restoration of forests damaged by the 2014 Västmanland wildfire (Skogsstyrelsen, 2016b). Although the incident is evidence that wildfires may pose a major threat relative to other natural and socio-natural hazards in the Swedish context, it had not been acknowledged as a risk in the regional risk and vulnerability assessments the preceding year (Länsstyrelsen Västmanlands län, 2013).

A ‘wicked’ perspective – bridging academics and practice

This paper is based on a master’s thesis written in conjunction to work conducted within the governmental commission

(JU2015/1400/SSK) on crisis preparedness assigned to the Swedish Civil Contingencies Agency (MSB) following the 2014 Västmanland wildfire, of which I participated as a civil servant. The commission had as a task to provide the government with suggestions for measures on how to increase societal resilience and preparedness for crisis, giving particular considerations to the risks and implications that climate change presently have and may pose in the future on society (Justitiedepartementet, 2015). Although an ambitious investigation was carried out, little emphasis was given to the matters of climate change related risks and hazards as well as preventative measures in the final report. Further, many of the suggestions on how to strengthen Swedish crisis management focused on the operational and judicial level and left out CCA and DRR (see MSB, 2016).

I found this curious, as the work had made it apparent to me that the 2014 Västmanland wildfire came to demonstrate two important things regarding socio-natural hazards and crisis management in the Swedish context. First, it was evidence of the potential of large wildfires in Swedish forests given that crucial factors converged in time and space such as weather extremes and forest practices. Second, it revealed how specific actors and society by large, may fail to recognise considerable risks and threats, thereby engaging in risk behaviour and not taking adequate preventative and preparatory measures. Notably this happened, as I will argue, despite the existence of available knowledge of potential risks regarding climate change (IPCC, 2014) as well as relevant international and

national policy frameworks that urge stakeholders to take mitigating and preventative measures. The situation further suggested that due to the lack of this capacity to apply and integrate existing knowledge and data as well as following and interpreting recommendations, actors may make un- or misinformed decisions which may pose serious threats to and costs for society.

It also appeared to me that the problem at hand had characteristics of what Rittel and Webber (1973) termed a ‘wicked problem’. First it was hard to delineate as there is no definite problem formulation available as the understanding of the problem is co-dependent on the understanding of potential solutions. In this case; is the problem with wildfire that we cannot extinguish it or that we increase the risk of it occurring? Second, there is no stopping rule. This means there is no way to at any given point in time know that the issue of the problem has been resolved. In this case; how do we know when we have successfully managed to deal with the risks of social-ecological hazards such as wildfires and wind throw? Finally, a wicked problem cannot be considered either true or false and thus the solutions are rather somewhere between better or worse. In this case; it is reasonable to assume that stakeholders of the forest industry and crisis management system will have varying ideas of what the problem is and thus what the solutions would be to the risks of wildfire and wind throw, and these solutions will probably be better or worse depending on which perspective is considered.

Interestingly, the thesis was finalized by early June 2018, just before this summer’s

extraordinary wildfires. I will argue that these events and the subsequent debate on how to tackle such new societal threats, will only further strengthen the thesis’ proposed hypothesis that the current structure of the Swedish crisis management system is not adequately adept to neither prevent nor manage the increased risks in forests associated with climate change. To test the hypothesis, I posed the question of whether the current structure and work of key stakeholders responsible for crisis prevention and management in forestry can deliver towards the societal change necessitated by current and future threats and risks associated with climate change, specifically wildfire and large-scale wind throw. By studying these major risks to forestry and related risks for society, I set out to identify system behaviour and weaknesses of the Swedish risk management- crisis preparedness- and resilience nexus. In order to bridge these different realms and to delve into the dynamic and evolution of biophysical aspects of climate change in Sweden, forest governance and practices as well as the crisis management system, I applied systems thinking and methodology along with resilience theory in order to see whether this approach could bring new insight.

Contextualising systems analysis and resilience theory

Systems thinking and systems analysis have been applied in natural and social sciences for decades (see Forrester, 1971; Meadows *et al.* 1972; Meadows *et al.* 2004; Senge, 2006; Sterman, 2002 for some seminal contributions). The first principle of

systems theory is that “[a] system is more than the sum of its parts” (Meadows, 2009, p. 188), and that the structure of the system generates its behaviour (Sterman, 2000). This theoretical baseline is applied to the understanding of any system, whether it is a biological one such as a forest; a social one such as a crisis management system comprising a government, governmental agencies, municipalities, private companies and citizens; or whether it is a socio-ecological system such as the combination of the two. The dynamics of a system can be described as the behaviour of a whole system or parts of it over time. Complex systems are described as dynamic, tightly coupled, governed by feedbacks and nonlinearities, self-organization, adaptation and evolution (Meadows, 2009; Sterman, 2000). Already in the 1970s, Forrester applied system dynamics to explain the counter-intuitive behaviour of social systems, of which he identified two as particularly dangerous. First, social systems are often resilient to any attempt of altering their behaviours and are thus inherently insensitive to policy change. This, he argued, is often a product of simple policies based on erroneous assumptions of cause and effect derived from simple system models or concepts of the world. Second, there is often a conflict between short-term and long-term outcomes of policy change of social systems, in which beneficial short-term outcomes often have negative effects in the long run, and vice versa (Forrester, 1971).

Although having the primary theoretical scope of systems thinking and analysis (Bagodi, 2015; Forrester, 1971; D. Meadows, 2010; Senge, 1994; Sterman, 2000), my thesis also drew from theoretical deve-

lopments within resilience thinking (Alexander, 2013; Bergström, 2016; Bergström *et al.* 2015; Folke, 2006). Resilience has become an ever increasingly popular concept in the last decades (Bergström *et al.*, 2015), widely used in academia (for example Folke, 2006; Folke *et al.*, 2002, 2010, 2016; Miller *et al.*, 2010; Weichselgartner & Kelman, 2015) and as a policy objective in overarching international agreements on sustainable development such as the UN Agenda 2030 and the Sustainable Development Goals, The Paris Agreement and The Sendai Framework for Disaster Risk Reduction. Thus, resilience has transitioned from having been a descriptive concept to emerge as a normative agenda in disaster policy and practice (Weichselgartner & Kelman, 2015), which also holds true in the Swedish context (Bergström, 2017).

I chose these theoretical and methodological points of departures to see what they could bring to the table in understanding this ‘wicked problem’. The study adopted a mixed methodology comprising of a literature research, qualitative interviews with practitioners from the Swedish Civil Contingencies Agency, qualitative systems analysis and conceptual modelling with primarily Causal Loop Diagrams (CLD). The models, of which two are exemplified below, aimed at discerning dominant system behaviours of Swedish crisis management and forestry in relation to climate change related risks. By this, I aimed at illuminating system behaviour and weaknesses of Swedish crisis management and forestry.

The Swedish forest factory

Sweden is one of Europe's most forested areas with 69 % of its surface being forest land (SCB, 2013), out of which 83 % is productive forest land (SLU, 2017, p. 41). The forest has for centuries been one of Sweden's principal industries (SCB, 2013) and still is, playing a major role in the country's economy and trade balance (KSLA, 2015). Statistics Sweden ranked paper products as Sweden's fourth most important export goods in 2017, with a value of 77 billion SEK (SCB, 2018). In 2013, Sweden held the third place of the world leading exporters of pulp, paper and sawed wood, only superseded by Canada and the USA. The forest industry accounts for approximately 9–12 percent of the national industry's total employment, exports, sales and added value (KSLA, 2015). Swedish forest land is primarily owned by private property holders, private-sector companies/corporations and the state in various capacities, amounting to ~ 330 000 forest owners (Skogsstyrelsen, 2014b).

Swedish forest governance has evolved over time and has undergone major shifts determined by changing goals, governance strategies and regulations since the 19th century until the present day (Arpi, 1959; Beland Lindahl *et al.*, 2017; Schlyter & Stjernquist, 2010). As Swedish forests are generally considered mature for logging at about 70 years of age and above (Schlyter, 2006), this relatively long turnover time makes the current stands capture different policy regimes. Early regulation during the 20th Century was by large economically incentivised, focusing on afforestation and the even stand method. The

1979 Forestry Act extended the regulations to all forest land and ownership categories, and provided the foundation to which the modern Swedish forestry model is based on (Beland Lindahl *et al.*, 2017). This period up until the policy update in 1993, has been described as “the heyday of hierarchical governance” (Schlyter & Stjernquist, 2010, p. 185) in which economic rationality deemed non-industrial small holdings as non-viable in a scheme that was to promote national industrial development through intensified large-scale forest management according to set schemes. Strict directions dictated what was considered as appropriate species for regeneration, forest density and stand age for felling. Notably, birch trees in spruce stands were to be removed, even without the consent of the forest owner, and environmental and cross-sectoral concerns were neglected. This mode of governance was however increasingly incompatible with the environmental sustainability ideas that developed during the 1980s (*op. cit.*). Thus, the 1993 revision brought a new forest regime that Beland Lindahl *et al.* (2017) described as aiming for “more of everything”, which can be seen as an institutional response to political pressures of sustainability along with market demands. Notably, the policy does not specifically address risks of hazards and crises connected with forestry (apart from infestation). Thus, these prescriptions and recommendations (SKSFS 2011:7)¹ do not address other risks of hazards and crises and possible preventative measures, but mainly risks related to biological and environmental concerns.

As a result, Swedish forests today are to a large extent homogenous (Skogsstyrel-

sen, 2014a). The Swedish Forest Agency has identified the importance of diversified forestry in terms of both methods of management and an increase of mixed forests with regard to species of trees (Skogsstyrelsen, 2016b), but risks of hazards and crises are less emphasised in the Swedish forest policies. Still, there is plenty of research that suggests the risk of hazards in forestry will increase with climate change in Sweden (Kundzewicz *et al.*, 2007; Ou, 2017; Skogsstyrelsen, 2016a; SMHI, 2015b), and that silvicultural practices affect the risk of these hazards. For example, as coniferous species, are more flammable than deciduous species the integration of deciduous species in boreal forests may provide an important mitigation option in reducing wildfire risk (Terrier *et al.*, 2013). Further, a higher degree of spruce in Swedish forests will further increase the risk of wind throw (Skogsstyrelsen, 2012), whereas the promotion of a mixed stand in which broadleaf trees are introduced to storm-sensitive spruce stands have the potential to effectively reduce risk even at relatively low ratios (Schütz *et al.*, 2006). Further, silvicultural practices can affect stand susceptibility to windthrow (Bengtsson & Nilsson, 2007; Ruel, 1995). Research indicates that changed practices of forestry such as the introduction of mixed stands (Agestam *et al.*, 2006), thinning practices or changed species (Nilsson, 2013) may decrease damages and be financially viable.

Forest hazards may pose major threats to society by large, threatening life of people as well as wild and domestic animals, infrastructure and whole societies, which the wildfires of 2014 and 2018 have demonstrated, as well as previous windth-

row events such as Gudrun in 2005. Yet, a study by Lidskog and Sjödin (2015) on the risk perception of the Swedish forest sector relative to these recent crises indicated that the general perception is that the forest sector have little agency in affecting these kinds of risks. Further, risk management in the forestry sector has been criticized as not very active (Skogsstyrelsen, 2006), and that there is a lack of political initiative and motivation from the forest authorities to deal with risk (Kundzewicz *et al.*, 2007). This situation produces hazards that need to be handled by the crisis management system.

Swedish crisis management – an operative affair

Swedish crisis management relied, for much of the second half of the 20th Century, on the military defence and its resources. The post WW2- geopolitical developments and Cold War logic with a subsequent perceived threat of large scale (nuclear) war and Soviet aggression, incentivised Swedish armament and preparedness for decades. This created a greater redundancy in society in terms of capacity and material of public institutions which also strengthened civil crisis management. The era of centralized redundancy however changed in the 1980s in which nuclear war was not seen as an imminent threat (prop. 1986/87:95). Swedish crisis management, as is the case of many other OECD-countries, has since the end of the Cold War undergone a deregulation and decentralization from the national to the local level, although the state still recognizes that the safety and security of citizens is still a governmental respon-

sibility. Active attempts to decentralise the responsibility of crisis preparedness and management for both institutions and citizens has been ongoing since the turn of the millennium (Bergström, 2017).

A few key events came to be influential in the reformation of Swedish crisis management. In the beginning of the new millennium, Sweden suffered several incidents that developed into national crises. In 2004 the Indian earthquake and tsunami took Sweden by surprise, which was followed by the storm Gudrun that struck southern Sweden just a couple weeks later (Bergström, 2016). The tsunami event as handled by public actors raised critique, and was described by the following Tsunami-commission as evidence of the failure of a centralized crisis management system and the need of a shift towards a decentralized one (Bergström, 2016). In 2009, the Swedish Civil Contingencies Agency (MSB) was created with the termination of the Swedish Emergency Management Agency, the Swedish Rescue Services Agency and the Swedish National Board of Psychological Defence (Bergling *et al.*, 2015), and thus inherited a wide mandate. A new system was developed in which all actors that hold a responsibility continue to do so in crisis, unless war is declared². This leaves a great responsibility with the municipal rescue services and regional and governmental agencies to cooperate and coordinate all work related to crisis management, from the preventative to the operative and with an *all hazard approach*. In support, MSB holds the responsibility to develop and support societal ability for preparedness against accidents and crises and is further responsible to promote

preventative measures and work that reduces vulnerabilities (ordinance 2008:1002, 1 §, p. 1).

Until 2015, MSB was heading the National platform for work on natural hazards³; a cross-sectoral collaboration of 22 governmental agencies and organizations including actors with specific responsibilities for the physical environment, climate change related issues and crisis management (MSB, 2015a). The platform's main objective was national implementation of the UN *Hyogo Framework of Action* (HFA) on building disaster resilience, a predecessor of the current *Sendai Framework for Disaster Risk Reduction*. The aim of the platform was to improve collaboration among actors working on the prevention mitigation and handling of natural hazards, and their effects at all levels, from the local to the national. However, this cross-sectoral work on CCA and DRR regarding natural and socio-natural hazards, underwent an abrupt reorganisation as the platform was quickly terminated in 2015. Instead, preventative work on natural hazards was to be integrated into the so called six coordination forums for identified *areas of cooperation*⁴ (stated in ordinance 2015:1052). Notably, agencies and organizations that had previously been members of the platform and further have responsibility of the physical environment, are not listed in the ordinance. Thus, Sweden currently lacks a proper cross-sectoral forum to handle risks and preventative work in the physical environment, which in turn weakens preventive work through CCA and DRR.

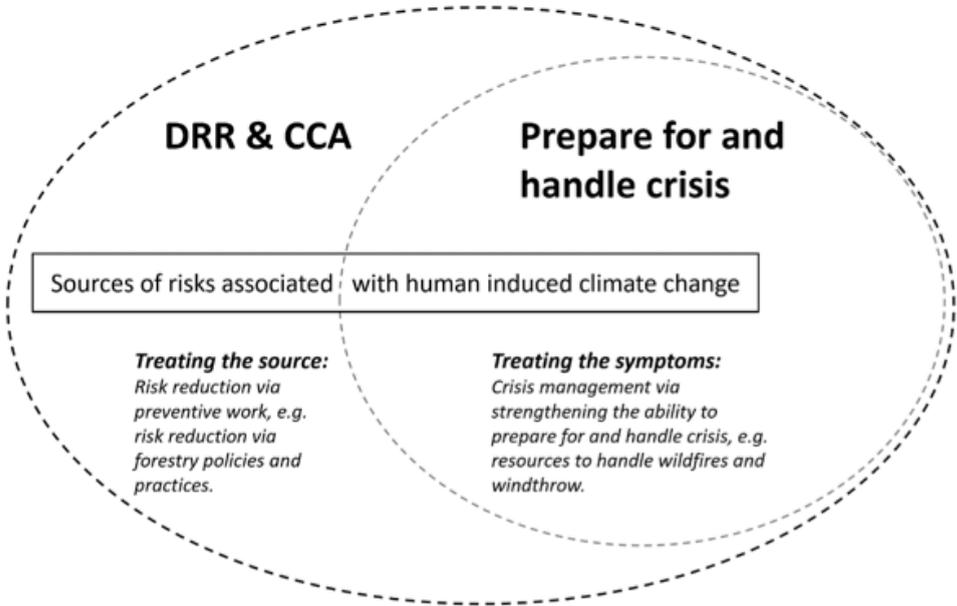


Figure 1. System boundaries of DRR and CCA versus the operative crisis management. DRR and CCA work are usually associated with strategic work, whereas preparative work and handling of crises are strategic but foremost operative by nature.

Prevention is better than cure

This change happened despite solid evidence that in terms of natural and socio-natural hazards, prevention is better than cure as CCA and DRR has proven to be cost effective (Environment Agency, 2014, 2013; Godschalk *et al.* 2009; Shreve & Kelman, 2014; Stern, 2006). Further, Sweden has committed to several policy frameworks on CCA and DRR, such as the UN Agenda 2030, The Paris Agreement, the Sendai framework and the national Generational goal. Despite this, preventative and mitigating measures are not undertaken in accordance to what several reports argue are satisfying levels of engagement (SMHI, 2015b; SOU 2007:60). The Sendai framework emphasises expanded system boundaries for conceptualizing cri-

sis management and stresses risk governance in the form of DRR and CCA as integral parts of the preventative measures such as risk reduction in physical planning, land use and societal risk governance (UNISDR, 2015). Figure 1 illustrates this relation. Note that the sources of risks associated with climate change must be dealt with both within the overarching work of DRR and CCA, and within the work concerned with preparation and handling of incidents and crises. From a systemic perspective, however, the first deals with treating the actual risk sources and thus has greater leverage for changing the system dynamics. Working on CCA and DRR is therefore working with fundamental solutions to the problem symptoms rather than symptomatic solutions, or in other words;

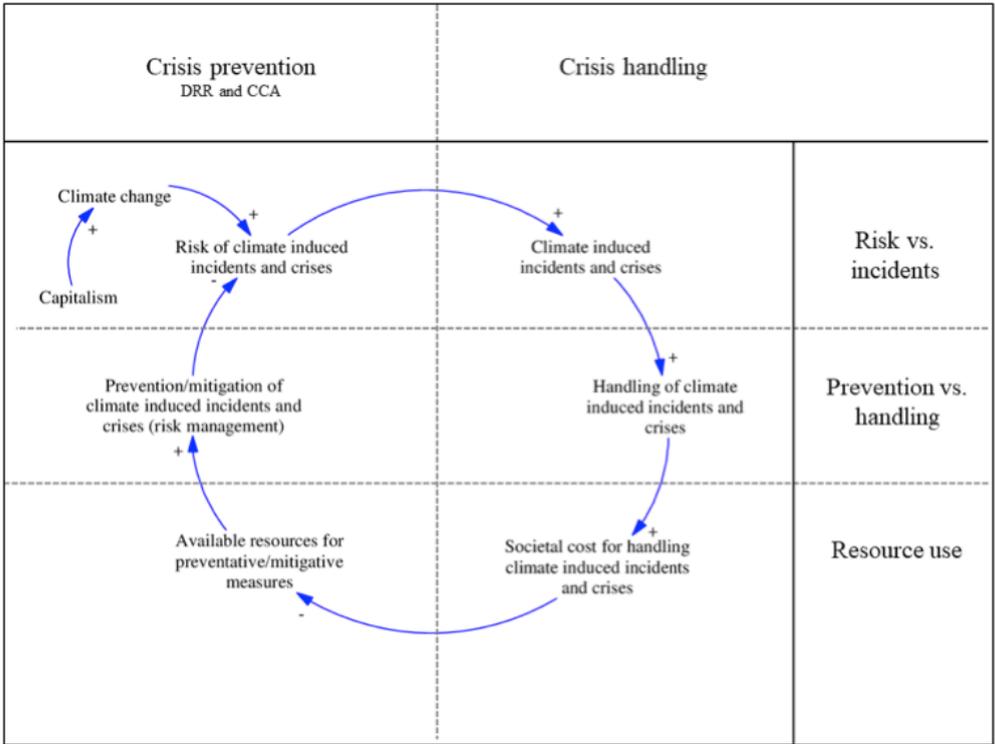


Figure 2. Causal Loop Diagram of the relationships between risk, preventative, mitigative, preparatory measures and management of climate induced events and crises. A two-dimensional grid has been overlaid to illuminate the competition between crisis prevention and crisis handling, and the levels at which the competition between prevention and handling takes place.

the dynamic of preventative measures versus that of the preparation and handling of crisis.

Meanwhile, figure 1 shows a static relation between treating the source of and treating the symptoms of risk, figure 2 captures a major dynamic between crisis prevention and the handling of crisis. This meta-model illustrates the dynamic relation between identified exogenous drivers of market-based capitalism that propel climate change induced risk, and these variables' effect on endogenous variables of crisis management such as the occurrence

of incidents and crises, and public finances and spending. The model can be translated into the societal issue of dealing with risks of forestry. The dynamic of the loop indicates that if fewer preventative measures are taken, the risk of climate change induced incidents and crises increase and with that the occurrence of incidents and crises. This generates more preparatory measures and handling of the same, which leads to more attention and public spending on these measures. That in turn decreases the available funds for crisis management, leaving less means for preventative measures.

This reduces societal capacity for prevention and mitigation of climate change induced incidents and crisis, which can be considered the same as risk management or DRR. A reduced capacity for risk management/DRR leads to an increased risk of climate induced incidents and crises and so on. A society trapped in this dynamic may find it difficult to address root causes of the problem.

The dynamics may however be changed to the opposite. Suppose more preventative measures are taken, the dynamic reverses as that would reduce risk of incidents and crises leading to less incidents and crises and handling thereof. This in turn imply less spending on preparative measures and handling of crisis, leaving more resources for preventative and mitigative measures which enables more prevention which further reduces the risk. This is a crude simplification, but the basic dynamic and feedback of crisis prevention versus crisis handling may still prove a valid factor also as other factors are considered. In the case of Swedish forestry, attention and means of crisis management may be diverted to the handling of wildfires and wind-throw, instead of working on CCA and DRR with fundamental solutions such as prevention in the form of silvicultural practices. It should be noted that the time-delay between these preventative measures and the risk reduction which has a cycle of a stand's life-span, poses great challenge to the social system of crisis management that operates with a much shorter time-horizon. Further, such collaboration would imply cross-sectoral work and financial models.

Concluding discussion

Climate change effects will continue to alter the socio-natural hazard scape of Swedish forest land. Risks of wildfire and windthrow will likely increase in the coming decades, especially if the rate of biophysical change exceeds the rate at which the Swedish forest sector and the crisis management system can adapt their modes of operation. The results indicate that economic growth incentives in forestry, accelerating climate change-related risks and a focus on preparing for and handling crises rather than handling risk, makes society focus on symptomatic solutions rather than fundamental ones. This stifle necessary action of CCA and DRR. The 2018 summer wildfires and their aftermath focusing on operative measures, serve to confirm this argument (see for example MSB, 2019).

Systems analysis and methodologies can contribute to crisis prevention and management of the climate change related risks of forests by illuminating important system behaviour and causalities distant in time and space. A major challenge to the current system is that the revenues of risk-taking generated by the forest sector become private, but the expenses for treating the symptoms as in wildfires and windthrow hazards by large become public. This incentivises risk-taking and may pose a challenge for cross-sectoral work on CCA and DRR, despite the overall societal benefits of such work. The tendency of stakeholders of the Swedish crisis management system to focus on events rather than trends, thus dealing with a few trending issues at a time, poses further challenges. Thus, the analysis of the systemic cau-

ses of trends in forestry and crisis management suggests that the current structure of the Swedish crisis management system is not adequately adept to neither prevent nor manage the increased risks in forests associated with climate change.

To handle risk and crisis operatively as with firefighting capacity, may enhance societal resilience on the short term, but given the proposed system dynamic disincentivises actors such as the forest industry or MSB to work on root causes. This may in turn aggravate risk-taking and in the long run lessen societal resilience as the risks became greater. This counter-intuitive behaviour of societal resilience, which the Swedish case seems to illustrate, can be seen as a manifestation of Forrester's (1971) counter-intuitive behaviour of social systems. Thus, resilience as a policy objective and a societal quality is a double-edged sword, which on a short time-scale may create robust public institutions and a profitable forest industry, but for the same reason may stifle CCA and DRR and put society at greater risk on a larger time-scale as the risks grow with climate change. To this wicked problem there are no straight solutions, as this quasi-stable system is unlikely to change due to internal dynamics. Therefore, it will become pivotal to find leverage points in the system where effective intervention can happen.

MSB can play a major role in changing this dynamic by not only taking lead in coordinating actors on the operative level, but also on the preventative one by re-establishing cross-sectoral forums to work on CCA and DRR in the physical environment. Further, MSB could alert the poli-

tical level with regard to forestry related risks, to investigate whether forestry should also be regulated in terms of risk, as is done with other industries (eg. Seveso-industries). However, if we are serious in our intentions to address the problem which perpetuates the dominance of symptomatic solutions instead of addressing root causes by fundamental solutions, we will foremost have to challenge the overarching goal of economic profit as the foundation of our future.

Noter

- 1 The Swedish Forest Agency's prescriptions and general advice for The Swedish Forestry Act; *Skogsstyrelsens föreskrifter och allmänna råd till Skogsvårdslagen (SKSFS 2011:7)*.
2. See the Civil Protection Act (2003:778); the Act on municipal and county council measures prior to and during extra-ordinary events in peacetime and during periods of heightened alert (2006:544); the Ordinance (2015:1052) of emergency management and measures of agencies responsible for surveillance during heightened alert; the Total Defence and Heightened Alert Ordinance (2015:1053); the Ordinance with Instruction to the County Administrative Boards (2007:825).
3. Translated by the author from Swedish 'Nationell plattform för naturolyckor'.
4. In Swedish "Samverkansområden", translated into English by the author.

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