Foundation of nature reserves after disasters and different modes of remembrance

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Received 18 October 2019
Revised 5 February 2020
28 February 2020
3 March 2020
Accepted 3 March 2020

Abstract

Purpose – A nature reserve set up in a disaster-stricken area can have various functions, e.g. as a place where biodiversity is favored and sometimes as a memory of a traumatic event. This study presents four different record-breaking disasters during 1992–2014 in Sweden, where the idea of setting up reserves has been advanced in the aftermath, but with slightly different results in relation to attitudes about nature conservation and modes of remembering. The phenomenon is primarily discussed against theory formation around disaster memorials and window of opportunity for change.

Design/methodology/approach – This paper uses a comparative case study approach. The cases are described through narratives on the basis of "grey" literature, i.e. documents from Swedish authorities in the form of evaluations, summaries from experience seminars, political decisions on the establishment of nature conservation or information material addressed to the public, and also media reporting.

Findings – The nature reserves will be reminiscent of the disasters since the natural regrowth will take decades but may also be accompanied by exhibitions in visitor centers, arts and plays, monuments and bureaucratic documents, all of which contribute to the memory. In all but one case, such artifacts are secondary in relation to the explicit goal of forest conservation. The local population's attitude to the reserve formation plays a big role for the plans to be implemented.

Originality/value – Foundation of nature reserves in the immediate aftermath of a disaster may have different functions for actors, affected people and interested public; some are exemplified and discussed here.

Keywords Biodiversity, Post-disaster recovery, Disaster memorials, Nature conservation, Window of opportunity for change

Paper type Case study

Introduction

The heat wave in Sweden during the summer of 2018 posed unusually severe problems with forest fires. The fire risk was extremely high in almost the entire country during the period May to August and a total of 250 km^2 of forest was burned in 500 different locations, compared to 100 normally occurring (Swedish Government Official Reports, 2019). In the mid-July, a dozen fires broke out in central Sweden (Gävleborg, Jämtland and Dalarna counties), turning into some of the most extensive forest fires in Sweden in modern times. The fire areas were extensive, resource-consuming and difficult to extinguish. In total, these fires covered 180 km^2 of forest. The fire-fighting succeeded in keeping larger communities undamaged, but not unaffected as some evacuations were necessary. In the aftermath of the disaster, the demand was soon heard in the media from politicians, private forest owners and the various county boards to set up large coherent nature reserves (a total of c. 27 km^2 was proposed) (Radio Sweden, 2019).

I am grateful for valuable comments provided by two anonymous reviewers. The study has received financial support from the Swedish government through its strategic research area funding for the Centre for Natural Hazards and Disaster Science (CNDS).

Disaster Prevention and Management: An International Journal
Vol. 30 No. 6, 2021
pp. 1-13
Emerald Publishing Limited
0965-3562
DOI 10.1108/DPM-10-2019-0323

This phenomenon is not new but has not been studied in Sweden before. The disasters appear to open a window of opportunities for change for conservation measures, but is it conceivable that the establishment will also meet other needs, such as remembrance? This study attempts to describe different modes of remembering and to relate them to the process of establishment of nature reserves. Using a comparative case study approach (Bartlett and Vavrus, 2017), narratives are presented and discussed from the aftermath of four different disasters that have occurred in Sweden over a c. 25-year period, where the issue of foundation of protected nature has been brought into play, but with slightly different results in relation to memorial expressions and attitudes about nature conservation.

Disaster memorials and natural monuments

Disaster memorials may take different forms, where the most common is some kind of monument. Linguistically, monuments can be defined roughly, as Oxford Dictionaries (2019) puts it: "A statue, building, or other structure erected to commemorate a notable person or event." In relation to disasters, the usually simple constructions, without unnecessary embellishment, should remind us of events that have been complex and tumultuous. The word is also used in less physical and more abstract terms as "an enduring and memorable example of something" (Oxford Dictionaries, 2019), and then it comes closer to the meaning of the synonym memorial.

In her literature review of disaster commemoration, associated with natural hazards, Zavar (2019) notes that there is a growing body of studies examining the commemoration of disaster sites through themes of landscape, memory and place. There is a long history in different parts of the world where memorials have been placed *in situ* where disasters have occurred (e.g. Foote, 1997; Ullberg, 2013). In a study of urban flooding and memory-scape in the flood-prone city of Santa Fe in Argentina, Ullberg (2013) shows that commemorative modes of remembering may range from memorials and rituals to bureaucratic documents, infrastructure and everyday practices. How these are manifested in the reconstruction phase appears to be largely contextually adapted and with different purposes from case to case resulting in sanctification, designation, rectification or obliteration (Foote, 1997 (see also a description by Zavar, 2019; Ullberg, 2013).

Eyre (1999) considers the creation of disaster memorials as an important disaster management activity with significance for "managing sensitively and appropriately the range of psychological, social and political issues associated with these aspects of the immediate post-impact and longer term rehabilitative stages of disaster." The actual process of establishing a collective memorial helps survivors and responders to process their experiences and move on (Moulton, 2015). It is one of several activities in the rebuilding phase where government representatives try to do the right things in a good way, which however can be quite difficult to manage successfully. In their study of the many different types of monuments erected at different times over the dead after the Great East Japan Earthquake 2011, Boret and Shibayama (2018) note that these monuments have played an active and fundamental role in healing, building social ties and place making, as well as learning and education. Their results challenge the (mis)conception that disaster memorials only represent objects of closure that confine disastrous events to the past (Boret and Shibayama, 2018; cf. Klein, 2000).

Nicholls (2006) summarizes different views in the literature on the importance of post-disaster memorials and concludes that their aims and how these are perceived are multifaceted, but that in general the memory should be addressed in a way that is meaningful to those who suffered from the disaster and to future generations, thus testifying to the shared experiences that exist. In Nicholl's (2006) study, which focuses on memorials as a communicative tool for governments, the following definition of the term is given: ". . . some combination of site, structure, building, planting, landscaping, artefact and/or monument

specifically designed and deliberately positioned to commemorate a disaster that has catastrophically affected some combination of people, other living things and/or places." In this view, these are explicit messages from the authority that decide on design and install the memorial, to those for whom the reason for the memorial is important today and in future. It is not far-fetched to imagine that such memorials are often clearly influenced by the character and missions of the various groups and organizations that constructed them, which Imai (2012) also found in his analysis of the many monuments erected after the Hanshin-Awaji earthquake in 1995. Since disaster memorials are emotionally charged involving many actors and victims with vastly different experiences of the disaster, it is not easy to create memory sites that feel right for everyone. The messages that those responsible for the constructions want to convey with the monuments can also be reinterpreted once the monument is in place and has been transmitted to the public to use and reflect on (Bellentani and Panico, 2016). Some researchers even question the capacity of monuments to keep memories alive after disasters over time (Nicholls, 2006). Tumarkin (2005) argues that monuments can eventually mystify and replace memory with stories that become something else. At the same time, the impetus for learning from what has happened is strong in both society and individuals, and this process often includes discussions about erecting a monument (Boret and Shibayama, 2018).

Since the phenomenon in focus here is that the rebuilding activities are manifested primarily in the foundation of protected nature areas, but where the nature reserve itself secondary can be said to be a monument over a shocking event with clear traces of, e.g. forest fires, it is close at hand to name them Natural monuments to highlight the natural values as well as the memory of the fires. However, the term has a well-established, and partly deviant, definition (International Union for Conservation of Nature, 2019). The intention here is not to propose an extension of the concept's definition but to problematize and relate similarities and differences to the established concept, as it helps in analyzing the characteristics of the studied cases. In their Protected Area Categories System, International Union for Conservation of Nature (IUCN) describes natural monuments as usually fairly small protected areas with a high visitor value. It can be about unusual and amazing landforms, e.g. sea mounts, waterfalls, coral formations or caves, or important archaeological/historical/cultural sites, where protection also includes significant biodiversity. As a rule, the protection value does not focus on a broad and large ecosystem, but it can be, for example, the spray zones of a waterfall or the plant communities found along steep rock formations. The protection of natural monuments is largely equivalent to National Parks, which are found at the level above in the six-degree scale over the IUCN's protected areas (Strict Nature Reserve/Wilderness Area – National Park – Natural Monument or Feature – Habitat/Species Management Area – Protected Landscape/Seascape – Protected Area with Sustainable Use of Natural Resources). IUCN (2019) also points out that "the term *natural* as used here can refer to both wholly natural features (the most common use) but also sometimes features that have been influenced by humans. In the latter case, these sites should also always have important associated biodiversity attributes, which should be reflected as a priority in their management objectives if they are to be classified as a protected area rather than a historical or spiritual site." The big difference in comparison with the examples discussed and reported in this study lies in the fact that it is not about sacred sites, small areas or fascinating geomorphological formations, but rather larger ecosystems that have been protected after a disaster such as forest fire. Characteristics such as high visitor value, unusual and significant biodiversity are considered tangent.

Change and nature conservation

A change in socio-ecological systems following disasters associated with natural hazards is an area that has been scantily studied scientifically (Birkmann *et al.*, 2010). Kingdon (2011)

describes a window of opportunity for change where, at a certain point in time, for example after a disaster, various political forces and agendas suddenly coincide which may result in "win-win" measures. Birkmann *et al.* (2010) put change as a concept in relation to disaster impact and argue that the latter is a passive change received by a social actor. Change on the other hand is responsive and active, and can be reflexive or reflective (Beck, 1998). Birkmann *et al.* (2010) deem that the concepts are theoretically separated and observe: "Impacts are closely defined as consequences resulting from a damaging act, changes are a product of conscious and unconscious social action or, in the environmental sphere, an alteration of functioning of ecosystems." They associate a variety of characteristics with the concept and note from the literature that change can be slow or rapid, planned or unplanned, linear or nonlinear, predictable or non-predictable, formal or informal, and intentional or unintentional. The two last opposite relationships are of particular interest in this study, in relation with a Swedish political strand that constitute the window of opportunity for change here – the national environmental goals of biodiversity and living forests.

The environmental goal has been a major challenge to the Swedish forest industry since 1998, because forestry methods need to be adapted to preserve and develop the forest's natural and cultural values, while remaining competitive. The forestry of the past 60–70 years has brought with it an increasing dominance of spruce in the Swedish forest, which is a problem in the biodiversity perspective. Increased regard for habitat adaptation is encouraged by the Swedish Forest Agency, but to preserve important forest environments, nature reserves and other forms of protection are also needed, as well as forest owners making voluntary land provisions. Several evaluations have shown that the environmental work in the forest is developing positively, but that the implemented measures are not enough to ensure biodiversity in future (Sweden's Environmental Goals, 2019).

Intentionally and through formal management, protected nature covers 10.6% of Sweden, which can be compared to 11.5% globally (Swedish Environmental Protection Agency, 2010) or 21% within the European Union (European Environment Agency, 2012). In total, there are almost 5,000 nature reserves in Sweden. Nearly 85% of their land area is found in northern Sweden (Jämtland, Västerbotten and Norrbotten counties) (Swedish Environmental Protection Agency, 2019a). Mountain hedges, mountain birch forests and coniferous forests dominate these reserve areas. There are a number of nature reserves which have been formed to preserve the fire-prone "primeval forest" through free development. It is mainly the nature type "Western taiga" with the presence of species (e.g. pine) that is dependent on recurring fires. How many of these reserves that have been founded as a change due to recent more or less extensive forest fires, or how many that have been set up based on the traces of older fires on tree trunks, are unknown at the moment. Since Sweden is below, or clearly below, average in international comparisons, it is interesting to study the phenomenon where politicians and/or administrative county boards regularly propose foundation of nature reserves in parts of newly arising disaster areas. Similar changes of the opposite type, i.e. that larger coherent ecosystems standing as memorials of catastrophic events are protected unintentionally and formally/informally, are hardly present in Sweden but can be found elsewhere. Examples are the 100 km long and 1.5 km wide Korean demilitarized zone (Wendel, 2015) or the abandoned zone of 4,200 km^2 around the nuclear power plant in Chernobyl (Deryabina *et al.*, 2015).

Methods

The comparative case study approach used in this article combines two logics of comparison: the normal compare and contrast; and what Bartlett and Vavrus (2017) describe as a "tracing" across sites or scales where similar policies or phenomenon unfold, focusing on capturing and describing the phenomenon of interest. The four case studies were selected on the basis that

they implied large consequences and/or very extensive, demanding, emergency management. Such events that were described in the media as record-breaking for their time and which thus attracted unusually high attention from the authorities, which are usually expressed in a greater number of evaluations (Johansson, 2015) and political actions. As a result, these case studies were assumed to offer comparable empirical material.

The qualitative empirical material for the following narratives of disasters and subsequent recovery work are compiled from "grey" literature. These are documents from Swedish authorities in the form of investigations, summary reports of experience seminars, political decisions on establishing nature protection or information material addressed to the public, but also news reporting from, e.g. Radio Sweden is included. The narratives are structured analytically based on the IUCN characteristics of natural monuments, different types of commemorative modes and actors' perception of setting up nature reserves.

Documents on the establishment of protected nature have been obtained from the database "Skyddad natur" (protected nature) at the Swedish Environmental Protection Agency (2019b). Newspaper articles from Swedish media are archived and searchable in the Mediearkivet/Retriever database through Swedish universities.

Swedish cases

Forest fire 1992 and Torsburgen nature reserve and Natura 2000

On July 9, 1992, a forest fire started on the island of Gotland, which was to be one of the largest in modern times in Sweden (Figure 1). The fire risk was high in the area after an unusually dry and hot summer. The fire did not take human lives, but the rescue efforts were resource-intensive (rescue service, civilian volunteers and military) and it took three days before they

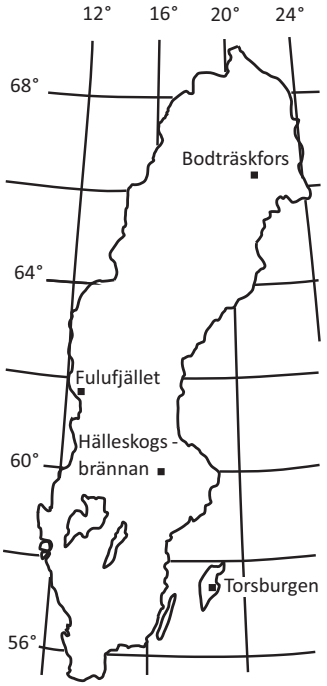

Figure 1.
Location of the four disasters in Sweden, used as case studies

managed to limit the spread with fire lines and one month before the operation was completed. A total of 43 landowners were affected in a burnt area of 24 km^2 (Dagens Industri, 1992) and c. 50 persons were evacuated (TT News Agency, 1992a). The area as a whole is located on one of Gotland's largest inland cliffs, where the Nordic region's largest hill fort can also be found. The Torsburgen hill fort is one of Europe's largest prehistoric defense facilities, built in stages during the Roman Iron Age (200–400 A.D.) and the Viking Age (800–1150 A.D.), and was before the fire a protected area (since 1937) based on high culture and nature values (Gotland County Administrative Board, 1994). The hill fort was not damaged in the fire, but excavators used in firefighting destroyed a number of settlements and burial grounds from the Iron Age. At the same time, the heavy burning of grass, peat and soil caused unknown ancient stone remains to come to light. Among the new finds were two ship settlements, a Viking-era settlement and some larger stone tombs.

Following the fire in 1992, the County Administrative Board decided, through intrusion compensation and land change for private landowners, expanding the Torsburgen Nature Reserve to a total of 1.6 km^2. The intention was formulated in the decision as a desire to "preserve a larger fire-affected forest area for the future in order to be able to follow, for example, the natural rejuvenation of the forest and the development of flora and fauna" (Gotland County Administrative Board, 1994). The decision is also justified on the basis that larger forest fires, as a result of more effective firefighting and a reduction in the number of standing dry trees, have become increasingly unusual in modern times, and because the forest that is, after all, affected by fire is not allowed to remain, many fire-dependent plant and animal species are today severely supplant. The area has been expanded in two stages in recent years with an additional 2.7 km^2 of fire affected forest area (Swedish Environmental Protection Agency, 2019a).

In both the decision to set up the nature reserve and information material addressed to the public, there are ample and detailed descriptions of the hardships the actors faced during the forest fire in 1992 (Swedish Environmental Protection Agency, 2019a). However, the need for commemoration is not mentioned as a motive in the foundation decision. No physical monument has been erected to commemorate the event, but signs and information material are available for educational purposes. Additionally, a high view/bird tower and hiking trails through the fire field, along with the ancient hill fort, have given the area a high visitor value.

The residual value of the heavily burned forest was low. The burned trees were not good enough for pulpwood or timber and had to be ground into wood chips and sold as fuel for thermal power plants (TT News Agency, 1992b). In addition, 13 of the 43 forest owners lacked insurance for their forest and were thus hit hard financially (TT News Agency, 1992c). The County Administrative Board's redemption of land to form a nature reserve was therefore likely to be a welcome help for many.

Extreme precipitation 1997 and Fulufjället National Park

On August 30–31, 1997, the Fulufjället Mountain in central Sweden was hit by a violent thundery rainstorm. Private measurements in the otherwise almost uninhabited area showed 276 mm over 24 h, but the Swedish Meteorological and Hydrological Institute (SMHI) estimates that 300–400 mm fell over the eastern and southern parts of the mountain (SMHI, 2003). Historically, it is the largest known daily rainfall in Sweden. The lightning struck the mountain more than 700 times. A handful of creeks on the mountain borders grew rapidly to the size of a river, a bit downstream with a short-term flow of up to 300 m^3/s, and the erosion became catastrophic. In addition, soil and trees created an even greater dam in the stream Göljån, which eventually burst from the water pressure and a flood wave advanced wide beyond the river channel. Nearly 10,000 m^3 of forest and 50,000 m^3 of gravel and stone were washed away (Swedish Government, 2001).

Discussions and plans to set up the area around the Fulufjället Mountain as a National Park had really started in 1995. The authorities wanted to "preserve a southern mountainous area with special vegetation and great natural values in substantially unchanged condition" (Swedish Government, 2001). Fulufjället is an isolated mountain massif where a flat high plateau and deeply cut valleys have been formed, primarily through preglacial erosion and weathering. Sweden's highest waterfall (90 m), Njupeskär, is found in the area. The bedrock, mostly sandstone, together with the marked continental climate, has given rise to a bare mountain vegetation of Heather, grass and lichen heaths unique to the Swedish mountain world. The lichen-rich heath birch forests are a result of the area not being used for reindeer grazing by the indigenous Sami people during the summer, which makes the area an important reference area for studies of reindeer grazing effects and damage in other parts of the mountain range and adjacent forest areas (Swedish Government, 2001).

The vast erosion that occurred in connection with the 1997 extreme rainfall was mentioned and considered to be another protectable natural value that supported the establishment of a new National Park. The areas should be left as they are for the public to enjoy and for researchers to study the succession of new plants over time. It is unclear if the extreme rain accelerated the establishment process further, but it was prominently mentioned in the decision material (Swedish Government, 2001). In 2002, the Swedish Parliament decided to establish a 385 km^2 large National Park enclosing the Fulufjället Mountain (Environmental and Agriculture Committee report, 2002). Hiking trails have been built through parts of the area, starting from a visitor center with exhibitions and information describing a.o. the rainstorm and its impacts in detail, as well as other natural values (Fulufjället National Park, 2019). Here, too, no monument was erected to commemorate the event, but a memory has been created through protection of erosion grooves and information material available to the public. In 2014, the National Park had nearly 40,000 visitors (Fredman and Wikström, 2015).

A new national park is often perceived as a threat by the local people involved and this was the case for a long time before the establishment. The Swedish Environmental Protection Agency and the County Administrative Board in Dalarna worked strategically with communication on nature conservation issues and held discussions with the local population about local development opportunities, and over time managed to achieve an attitude change. Experience from northern Sweden had shown that without the support of local residents, it is very difficult to form new national parks (Svenska Dagbladet, 1998). There is no documented information to suggest that the extreme rainfall contributed to this change in attitude.

Forest fire at Bodträskfors 2006

The summer of 2006 was unusually hot and dry throughout Sweden, but lasted the longest in the Northern parts where new heat records were measured locally (Swedish Meteorological and Hydrological Institute, 2006). On August 11, a fire started in the municipality of Boden, which became the largest forest fire in Sweden in modern times and was fought for c. four weeks. 19 km^2 of forest burned and the fire-fighting required acute assistance from southern parts of Sweden, the home defense and the voluntary resource group (Boden municipality, 2006). At the same time, forest fires were raging in several other places, creating severe pressure on fire-fighting resources locally and regionally. In total, 264 forest fires occurred in Norrbotten County during the summer, which was significantly more than normal (Swedish Civil Contingencies Agency, 2006).

No people were injured in the fire at Bodträskfors, but some small villages needed to be evacuated. Those affected expressed great sadness about their disrupted identity as forest owners and the changed conditions of living and working in the area (Boden municipality, 2006). The government ministers, who visited the fire area during the acute phase, expressed

their thoughts to the media on creating nature reserves and offering the affected landowners replacement forest (Swedish Civil Contingencies Agency, 2006). However, none of the forest owners showed interest in this. One of the forest owners explained that "We like to hunt here and do not want any nature reserve close to home" (Boden municipality, 2006).

Forest fire in Västmanland county 2014 and Hälleskogsbrännan nature reserve

At the end of July 2014 the weather was hot, dry and windy in Västmanland county, central Sweden. SMHI had issued a warning of extremely high fire risk in the region (Västmanland County Administrative Board, 2014). On July 31, spark formation from a forest harvester started what was to be the largest forest fire in modern times in Sweden. The explosive spread rate (for a couple of hours up to 5 km/h) on August 4 had not been experienced in Sweden before and the rescue services had to concentrate on retreating and regrouping all the time (Swedish Civil Contingencies Agency, 2014). Five hundred residents in the village Gammelby outside Virsbo were evacuated without warning (Västmanland County Administrative Board, 2014). In total, the fire covered 140 km^2, of which 2/3 began to burn during the afternoon of August 4 (Swedish Civil Contingencies Agency, 2014). It took 12 days for the rescue services to gain control of the forest fire, but months of fire extinguishing work remained. One person was killed and one was seriously burned. 1,000 people and 2,000 livestock animals were evacuated, 71 buildings were damaged or destroyed, and 107 landowners suffered damage to 1.4 million forest cubic meters of timber (Swedish Civil Contingencies Agency, 2014). The insurance companies paid out approximately 40 million euros in claims compensation, which shows that the burnt forest still had some residual value (Insurance Sweden, 2015).

Again, voices from various stakeholders (researchers, politicians, county administrative boards) were rapidly raised via the media to set up nature reserves after the fire (e.g. Radio Sweden, 2014). While the fire is still ongoing, several initiatives are being taken by the county administrative board to turn large parts of the fire area into a new cohesive nature reserve. The purpose is to protect the natural values created by the fire, and also to make the area accessible to people. In parallel with the work to create a new nature reserve, the County Administrative Board conducts information efforts and plans visiting facilities in the "fire trail" where, among other things, people should be able to remember the fire's hardships (Västmanland County Administrative Board, 2014). The forest owners were now more interested in replacement forests, intrusions or purchases, and in 2015, the County Administrative Board in Västmanland set up the Hälleskogsbrännan Nature Reserve, which with its 64 km^2 will be one of Southern/Central Sweden's largest protected forest areas (Västmanland County Administrative Board, 2015). The purpose of the nature reserve, according to the decision, is multifaceted, but among other things a stated aim is to "preserve the natural values associated with larger fire areas and fire-embedded natural environments with subsequent stages of ecological succession." It is noted as reasons for decision that forest fires in themselves are not unusual but that fires of this kind, where an entire landscape section has been affected in such a way that the conditions for vegetation and animal life are fundamentally changed, are rare in modern times. It is believed that this, together with the fire history, makes the area attractive in short and long terms for both residents and long-distance visitors. The County Administrative Board has erected a viewing tower at Grävlingberget with information boards about the fire and the ongoing ecological succession (Plate 1). The tower itself has a design and shape that is reminiscent of the forest fire. It is twisted and stacked around a center shaft, has a grayed facade and details of black painted steel and charred wood (Hök, 2019).

Initiatives to create memory sites or to treat traumatic memories in various ways subsequent to this fire also emerged beyond the sphere of authorities. A non-profit association runs a visitor center just outside the nature reserve with an exhibition of the

Source(s): Ulrika Mogren, Västmanland County Administrative Board

Plate 1.
The memorial viewing tower at Hälleskogsbrännan nature reserve

traumatic forest fire and the recovery towards a new type of forest (https://eldenoskogen.se/). The disaster has also inspired several artistic exhibitions (e.g. Art Promotion Västmanland, 2018) and even a theater play (Radio Sweden, 2017).

Discussion

The four cases all constitute shocking events that took the public and authorities by surprise at the time. They were record-breaking in terms of fire spread or short-term rainfall and size of rescue effort (not for the rainfall). Establishing a nature reserve in this context means that a remembrance in landscape scale is created on the grounds of protecting significant biodiversity. The establishment itself formulates a protection that is based on natural regrowth, which means that impacts from extreme rainfall or fire will be visible for decades. Some characteristics of these nature reserves are in this sense tangent to how IUCN defines natural monuments – high visitor value, unusual and significant biodiversity – but diverges in others such as the larger scale geographically for the protected area and that the protection focus on a broad and large ecosystem.

In addition, only in the case of the forest fire in Västmanland 2014 a designed monument to remind about the trauma is also erected, but memory expressions in the form of educational information material (cf. Boret and Shibayama, 2018) are also found at the Torsburgen Nature Reserve and the Fulufjället National Park. The disasters are furthermore commemorated by stories of what happened in the bureaucratic documents drawn up during the establishment of the protected areas, similar to the commemorative modes of remembering that Ullberg (2013) described from Santa Fe in Argentina.

The fact that no nature reserve was created after the record fire in Bodträskfors 2006 deviates from the other cases in this study, but otherwise there are mainly two things that are recurring and important for the understanding of why a nature reserve, or national park, is set up after the disasters. The first concerns wording in the decisions from the County Administrative Boards of Västmanland and Gotland; that larger fires in modern times are unusual and that this is negative for certain type of vegetation. Succession after fire is a natural rejuvenation process that in modern forestry is suppressed and thus threatens

biodiversity. One reason to protect the forest fairly soon after the fire is that forests that have burned usually get high natural values quickly. In the relatively short term, a couple of decades, values linked to deciduous environments will emerge, and in later stages of succession, values related to primeval forests as well. This is of particular importance in Sweden, with its modern forestry, that long has advocated clear cutting forestry, which has created a near monoculture of spruce as a raw material for the processing industry, as well as an ever smaller area of older forest stocks that are allowed to develop freely. The period of time for this window of opportunity to achieve the desired outcome (intentionally and formally; c.f. Birkman *et al.*, 2010) is therefore rather short. The administrative process of setting up a nature reserve can take a couple of years, but the decision not to clear up and cut down the burnt forest must be made closer to the event itself.

This further leads to the second thing that recurs – the media outlets where politicians and government officials during the early remedial phases put forward proposals to set up nature reserves. The efforts of the County Administrative Board following the fire in Västmanland 2014 in connection with the initiatives for a new large nature reserve are explicitly and clearly focused on both conservation efforts and commemorative measures (Västmanland County Administrative Board, 2014), but otherwise the different types of commemorative expressions are a secondary effect of the establishments. Visitor centers and information material are parts of the memory that are aimed more at the interested public who were not exposed or affected by the disaster. Of course, the nature reserve itself becomes a memorial during many decades for those directly affected, contrary to what it would have been like if the forest had been harvested and replanted within a couple of years.

Information material, at visitor centers, outlook towers or websites, that usually describes the biology of the nature reserve or the national park, as well as the nature conservation and its rules, also contains extensive writings on the disasters in the studied cases. While these are secondary effects, in all but Västmanland County, and not explicitly expressed by any actor as commemorative modes of remembering, they act as such and offer the important learning function that Boret and Shibayama (2018) describe from their studies of monuments after the Great East Japan Earthquake 2011. There, some sites of memorial monuments, e.g. the Junior High School Memorial built in Yuriage, became landmarks for disaster tourism and education. The stories and information at those monuments are just as much about remembrance as they are about disaster education, which is a feature that mainly connects to outside visitors who have not been directly affected by the disaster.

The importance of local support for the authorities to continue and set up nature reserves becomes clear in the case of Bodträskfors 2006, where this was missing. The authorities do not run over the affected locals and form nature reserves only on the basis of conservation aspects. This indicates that emotions commonly considered in relation to the establishment of a disaster memorial (e.g. Eyre, 1999) may play a part in successfully establishing the window of opportunity for expanding the protected areas in Sweden. In the case of the fire at Torsburgen, Gotland, the lack of forest insurance in 30% of landowners probably contributed to a positive attitude towards land redemption and reserve formation. If so, the nature conservation effort served as a cure and remedy in the aftermath of the disaster, but it is not documented whether this was the explicit intention of the authorities.

Zavar (2019) describes related, but somewhat deviant, circumstances in her study of floodplain property acquisition in the USA 1993–1998. In this case, it was a matter of buying out flooded areas and abandoning the settlements in favor of the creation of open natural environments. Similarly, nature-protected areas were thus set up, with the difference that those affected expressed an experienced loss twice: when the disaster itself took place, and in connection with the adaptation measures needed to reduce flood risks, involving abandoning land that might have been inhabited by generations (Zavar, 2019). Such proposed measures forced those affected to make difficult choices. Loss of neighborhood and local cultures may

in fact be more important than future flood risks for residents who must decide on a buyout (Fraser *et al.*, 2003). In the Swedish examples, the formation of nature reserves was a voluntary commitment unrelated to any risk reduction or abandoning housing. Still, it requires a decision on a changed living space and identity as a forest owner, where the position can sometimes be that one does not want to make that change too – as the case in Bodträskfors illustrates.

In conclusion, the Swedish cases show that the formation of nature reserves after disasters primarily has nature conservation causes, but as an output of the establishment processes different modes of remembering are also found in bureaucratic documents and information material for the public visiting the reserves. The slow natural regrowth will remind visitors of the disasters for decades and thus in itself function as a disaster memorial.

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