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Extreme events, regulatory style and regional environmental governance

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Introduction

1. Extreme events are increasingly prominent in society. Both experienced environmental catastrophes, such as hurricanes, droughts and flooding and anticipated ones (such as the consequences of climate change) are reported in the media, discussed in public arenas and negotiated in political discussions. The focus is both on how to mitigate the events that occur and how to minimize the consequences of those events that it is assumed will occur (by developing adaptation capacity and coping strategies).
2. A changing climate has widespread consequences, for example extreme weather. An important task is to decrease exposure and vulnerability and increase the resilience of systems in order to minimize the adverse effects of climate-related extreme events. Even if many extreme events cannot be avoided or tamed, regulation can make systems more robust.
3. This presentation focuses on extreme events and their regulation. Three questions are in focus: what is an extreme event? To what extent are they preventable or at least manageable? And, what role do regions play in regulating extreme events?

What is an extreme event?

4. An *event* is something which occurs somewhere and sometime, that is, a phenomenon that appears in time and space.
5. An *extreme event* (EE) is when something is seen as extraordinary. It could be in terms of low probability (e.g. a total solar eclipse) but most often in term of high consequences (threat to vital functions of a system). Flooding may, for example, occur regularly in a region, but nevertheless it is seen as an EE if its consequences are disastrous. I will argue that an *extreme event is an event that threatens the normal functioning of an organization, system or whole society.*
6. The main *cause* of an EE can be located within nature (e.g. geophysical event such as earthquakes) or society (e.g. power outages, industrial disasters). However, because the definition of extreme events relates to their consequences, a cause cannot exclusively lie within nature itself. A social system may contain the key factor that causes a geophysical event to develop into a catastrophe. Thus, an extreme event is not external to society but internal to it; it concerns a system's functioning, its vulnerability, robustness, resilience and adaptive capacity.

7. The *character* of an EE can either be creeping/gradual (small-scale events spread in time and/or space resulting in an EE) or acute/sudden (one major cause resulting directly in an EE) (Peijun, Jaeger and Ye 2012)
8. The *consequences* of an EE can be of different kinds; economic, environmental, social, political and cultural. The partial reactor meltdown at Three Mile Islands in 1979 resulted not in any larger radioactive outlet, but in great economic loss. It is still the widest imbalance on record between the scale of an advisory and an actual evacuation (3,500 people were recommended to relocate but some 150,000 actually did) (Houts, Clearly and Hu 1988, Walker 2004).
9. The consequences can differ in both magnitude and *range*. Some EE can be restricted to particular geographical areas whereas other can be restricted to certain kinds of systems that exist in most parts of the world. Irrespective of whether an EE stems from a geophysical event or from failure of a technical system its consequences can be restricted or spread. The volcanic eruption at Eyjafjallajökul, Iceland, in 2010 resulted in cancellations of many European flights: in total 26 European countries issued restrictions on flights. Thus, even if certain geophysical events (such as flooding, earthquakes and volcanic eruptions) do not happen everywhere, their consequences may be felt globally. Likewise, many technical systems are spread around the world, which means that operational failures can occur around the world. They may have geographical restricted consequences, primarily hitting the geographical surroundings of particular parts of the system. But the consequences of a technical system failing can also have global reach. There are currently 435 nuclear power reactors in operation in 30 countries on four continents, with 64 new reactors under construction (most of them in China, the Russian Federation, India and Republic of Korea) (IAEA 2012). Nuclear disasters have occurred in Great Britain (1957), Russia (1957), US (1979), Ukraine (1986) and Japan (2011). Each had great consequences for the area in which they were located, but the disasters also had impacts far beyond the area in which disaster occurred. The spread of consequences is due to global interconnections, which means that an EE occurring in a particular geographical area may affect wider economic and political systems. An example of this is that the Fukushima disaster (2011) resulted in political decision in Germany to decommission its nuclear power program within eleven years.
10. Extreme events may be possible to *foresee*, but not necessarily in any detail. Some systems are more prone to result in extreme events (Perrow 1984) than others and some parts of the world are more frequently plagued by extreme events. At the same time, it is hard to predict when and where an extreme event will occur and impossible to predict its impacts. Hurricane Sandy in October 2012 was predicted, and public agencies issued recommendations and instructions. Nevertheless it cost 253 lives, left more than 200,000 homeless and at an estimated cost of 66 billion USD (making it to the second costliest Atlantic hurricane in history).
11. EE are *observable*, at least in retrospect, but not necessarily by all. Whereas storms and earthquakes, wildfires and industrial disasters are easily observed, other EEs are not. The cause-effect relationship may be hard to determine and understand, and technical equipment and professional expertise may have to be involved in order to explore the consequences as well as trace the causes of an EE. The dioxin disaster in Seveso (1976) was only detectable through chemical and medical expertise (Kleindorfer and Kunreuther 1987).

The radical increase of death and unhealthiness in the Ojibwa Indian community was originally interpreted as caused by alcohol abuse, and only four years later was it discovered that a paper and pulp plant eighty miles upstream of the Wabigon river had poisoned the community's wells (Shkilnyk 1985). Methylmercury, which was later found in the wells, cannot be smelled, tasted or seen and it is also hard to locate in human tissue by any clinical test short of autopsy. Thus, the occurrence, causes and consequences of an EE may in certain cases be hard to locate for both residents and authorities.

12. EE can trigger *learning*. Experience of EE can be used to reduce exposure, strengthen resilience and develop regulatory capacities to handle unexpected situations, thereby decreasing the vulnerability of a system. Thus, even if extreme events cannot be fully prevented or even predicted, it is possible to develop more robust systems which are less prone to develop extreme events.
13. Some types of extreme events are *global* phenomena, connected to characters and systems that are inherent in all human societies. Other extreme events are *regional*; associated with spatial, social and cultural characters of a particular region, or *national*, connected to a particular country. Lastly, there may be EE that are *local*; associated with a particular community's way of functioning. The oil disaster caused by the Exxon Valdez running aground in Prince Wales Sound (1989) resulted not only in a wider ecological catastrophe, but also had the consequence that some 20 local fishing communities in Alaska were devastated (Picou, Gill and Cohen, 1997). In another example, the flood that devastated Buffalo Creek, USA, in 1972 killed 125 people and left 4000 homeless (Eriksson 1976).
14. Conclusion: An extreme event is an event that threatens the functioning of a system, community or society. Extreme events are always tied to context: one system may be able to cope with certain unplanned incidents, preventing them from developing into catastrophes. On the other hand, another social system may be more vulnerable and have restricted coping capacity, which may lead to an event becoming extreme. This means that all kind of extreme events – irrespective of whether it is of a geophysical, technical or social nature – are internal to society and are intrinsically related to a society's character. Earthquakes, power outages, economic crises or socio-political disruption do not have uniform consequences. Instead their consequences are an expression of the system in which they occur. EE are thus created within and by a social system. Consequently, the structure of a specific society as well as its regulatory style will make it more or less prone to generate extreme events.

Are extreme events manageable?

15. Every system is subject to failure, irrespective how hard organizations work to make things safe. Likewise, regulation is always imperfect. This means that extreme events will always occur, but their likelihood and consequences can be influenced. Regulation is one of the central means of mitigating EEs.
16. The aim of *regulation* is not to eradicate risk, but to manage it, establishing boundaries for what is acceptable and developing systems for risk control (Hutter 2001; Lidskog et al. 2005). Regulation aims both to mitigate the frequency of risks, but also to develop adaptive

capacity in order to manage risks. Thus, risk regulation aims to prevent certain negative events occurring (reducing their likelihood) and, in the cases when they do occur, preventing them from becoming extreme (reducing the consequences).

17. *Regulatory objects* are not stable or complete entities, ready to be governed. Instead, in the regulatory process, diverse issues are constructed as regulatory objects. Regulation explicitly or implicitly creates demarcations and boundaries that make objects appear hazardous or harmless, safe or risky, natural or unnatural, important or unimportant. An issue can be ascribed certain characteristics, such as being of local or global concern, calculable or indeterminate, curable or incurable, robust or vulnerable. Three processes are found to be particularly relevant for trying to render risks governable: complexity reduction, construction of a spatial identity, and ascription of capabilities to actors (Lidskog, Uggla and Soneryd 2011):
18. *Reducing complexity:* to make complex issues governable, complexity must be reduced and uncertainties managed. This can be done by delimiting the scope of the regulatory object: this is exemplified in various cases of environmental risk regulation, in which delimiting results in a regulatory process that emphasizes certain aspects of an issue and disregards others.
19. *Constructing spatial identities:* in a world organized in terms of territorial boundaries, to become subject to political action, environmental issues must be tied to particular administrative–geographical jurisdictions. Regulatory objects have to be spatially anchored in order to be manageable. Responsibilities, however, do not always follow predefined administrative boundaries. By ascribing a problem specific spatial characteristics actors implicitly advocate a certain handling of the problem and define who should be responsible for it. Ascription of spatial identity is thereby a performative act, as localizing or globalizing an issue imbues it with meaning and creates opportunities for action (Czarniawska and Joerges 1996). Through shaping the spatial identity of an issue, it can be handled as a matter of international priority, the sole responsibility of domestic politics or a local problem for a particular municipality. Actors vie to bind issues to specific spatial identities, thereby creating incentives for certain types of political action or inaction, placing expectations regarding accountability on certain actors.
20. *Ascribing capabilities:* To make an issue manageable it is not enough to reduce its complexity and construct a spatial identity: legitimate actors competent to act in and be responsible for the regulatory process must also be identified. Reducing the complexity and constructing the spatial identity of an issue involves drawing boundaries and making demarcations. These boundaries influence what tasks, mandates, responsibilities, and identities are ascribed to various actors, resulting in certain actors being seen as central to the regulatory work, while others are seen as irrelevant. Various actors endeavor to influence both regulatory processes and their outcomes. In trying to achieve such impact these actors explicitly or implicitly positioned themselves in relation to others. Regulation provides a space in which actors' identities are negotiated and shaped, resulting in the allocation of mandate and responsibility for regulating a given issue.
21. Deliberations between various actors about what is relevant regulation do not occur in a social vacuum, but are embedded in specific social contexts. The concept of a *risk regulatory regime* denotes the complex of institutions, norms, practices and knowledge that

heavily influence the regulation of a particular risk (cf. Hood et al. 2001). Regimes not only determine the formulation of regulation but also its implementation, because regulation needs an institutional machinery to have power. Also, regimes do not only influence how an issue should be regulated, but also affect the very definition of the issue (the regulatory object itself). This means that it is possible to explain why there are different regulatory styles within a country (due to different regimes for different sectors) and why there are different national styles of regulation.

22. Conclusion: Extreme events will always occur, but through regulation, the likelihood and consequences of extreme event can be mitigated. Regulating extreme events means that their complexity is reduced, that they are attached with spatial identities and that organizations are selected to be responsible for the handling of extreme events. Regulatory regimes emphasize that the invention of regulatory objects take place in specific contexts consisting of a complex of institutions, norms, knowledge and practices.

Does region matter?

23. Regulation is always situated *within institutional contexts* that both enable and restrict the scope of action and shape regulatory activities. Regulation always takes place within a regulatory organization: an organization with the political legitimacy and the administrative complexity to develop regulation, the economic resources to carry them out and the coercive power to enforce them (Lidskog, Soneryd and Uggla 2009). At an international level regulatory organizations can be an intergovernmental agency (eg. IAEA) or a political body (UN), on a national level: a state or a public agency, on a sub-national level: a county board or a municipal board.
24. Regulatory organizations are always tied to *space*: their mandate and responsibility are connected to specific territorial areas. Thus, even if an extreme event transcends geographical borders, the handling of this event is tied to organizations whose responsibility concerns a particular geographical area. Thus, even if a region's ontological status is debatable (Debarbieux 2012), regulation is always connected to specific spatial scales.
25. Within any country there exist different regulatory regimes: *domestic regulations vary considerable* from one domain to another (Hood, Rothstein and Baldwin 2001). Some areas are dominated by "cost-benefit analysis culture" where costs of additional safety measures are weighed against probable benefits using explicit value-of-life calculations. Other areas are dominated by "quantitative risk assessments culture" where the risks are measured in terms of costs, but not the costs of various types of regulation and safety measures. Thus, a single state regulates areas differently.
26. There are, however, *nation-specific ways to regulate risks*. As the case of biotechnology regulation illustrates: for example the US, Great Britain and Germany have rather different ways of handling and regulating this issue (Jasanoff 2005). The reason for this is that there are different nation-specific *civic epistemologies*: testing and accounting for policy-relevant, scientific claims varies substantially across countries and contexts. What may seem to be "similar" countries therefore diverge, because there is no linear passage from technical assessment via the public sphere to policy choice. Similarly, Perrow (2011) sees *culture* as a revolving door between those issuing regulation and those that have to follow them.

According to him, complex systems (such as nuclear power) that are privately run tend to lead to stronger regulatory capture than state-owned.

27. The differences between nation-specific regulations are not necessarily linked to quality but to *regulatory style.* Bijker (2007) explains why a hurricane like Katrina would not cause an extreme event in Netherlands. Both the US and the Netherlands have had numerous natural disasters (such as floods, surges and hurricane). However the role these natural disasters have played in shaping coastal engineering practice is strikingly different. The Netherlands' historical experience of storm surge disasters in 1953 ("De Ramp") lead to a cultural trauma that guided both the public perception of and the regulatory way of dealing with risks of flooding. The result is ambitious regulatory work for "keeping the water out". In the US, the focus is on predicting disasters and minimizing their consequences once they have occurred. The difference in regulation is partly explained by geographical factors (a large part of the Netherlands territory is below sea level) and partly by political culture (the role of the state), technological culture (the role of technology) and civic culture (the active engagement of civil society). Thus, regulation is shaped by dynamic interplay by factors of historical, social and spatial kind.
28. The context for regulation is not only at a nation-state level, but may also concerns particular regions. As such *regional differences* in regulation may exist. Political culture, civic epistemologies and technological culture may be broadly shared within a region, meaning that there may be similarities between countries in how regulation is shaped. Culture and way of organizing society may be shared by countries, sometimes due to geographical proximity other times between countries across geographically distances.
29. Also, there are *regional regulatory organizations*, i.e. organizations with regional mandate, such as European Union, the Association of Southeast Asian Nations (ASEAN), or the regional commissions under the UN's Economic and Social Council. These and other regional organizations have an increasingly important role in global environmental governance (Balsiger and VanDeveer 2012, Selin 2012). Also, there is a multitude of bilateral and multilateral agreements which are of regional character, i.e. share geographical borders or govern a transnational area (Balsinger, Prys and Steinhoff 2012).
30. An extreme event, or the work to prevent its occurrence, may construct *a specific spatial ontology* and also establish organizations with the aim to regulate activities within a specific spatial area. The Baltic Sea is an example of an invented region, based on certain geographical, political and economic characteristics (Lidskog and Elander 2012). Being highly vulnerable to pollution (like other regional seas, such as the Mediterranean and Black seas), states and environmental organizations struggle to protect it from emissions (not least oil spills). With the exception of its Russian waters, the Baltic Sea was designated as a Particularly Sensitive Sea Area (PSSA) by the International Maritime Organization (IMO) in 2005 (Uggla 2007). Thus, the Baltic Sea has been constructed as a transnational area in need of regulation.
31. Some disasters are caused by *certain kinds of systems* (Perrow 1984). If a system is characterized by complex interaction (interactions that occur in unfamiliar sequences) and tight coupling (minimal time lag between the processes it executes), it follows that odd failures and incidents can rapidly result in cascade effects and system accidents. Most engineered safety features (redundant components, emergency shut-offs, suppressors and

so forth) are incorporated in systems to prevent incidents from making the transition to accidents. Also, preventive maintenance, operator training and so forth can partly help to avoid failures and incidents. Thus, there may be similarities in systems across regions and spatial scales.

32. Specific regulatory regimes and safety cultures can be *spread within a sector that crosses geographical borders.* Ideas, knowledge, rules and practices travels from one region to another, meaning that policy and regulation are spread around the world and regions are reverberated For example, Nuclear Energy Agency (NEA) and IAEA develop knowledge and norms that are distributed to all countries with nuclear operators. In that sense policies and regulations are made mobile and diffuse between regions. At the same time, these policies and regulations always need interpretation and are situated in specific context, involving spatial and cultural features. Thus, regulation may simultaneously have regional features and interregional similarities as well as intraregional differences.
33. In some contexts (but not all), traditional top–down ways of managing environmental issues are becoming increasingly obsolete as creating new forms of governance and actor coalitions is often seen as a more feasible and efficient way to handle risks (Black 2002, Vogel 2001). However, when incidents are transformed to extreme events there is a need for rapid and strong responses. In the Chernobyl case, the work was organized almost as a military operation in combating the fire at the plant and mitigating the consequences of radioactive emissions (Read 1993). Thus, even if there are national or regional differences in regulations, in case of emergency these differences may have less importance in comparison with non-extreme situations.
34. Simultaneously, new differences may emerge when responding to extreme events where restricted regulatory guidance is available. When there is a shortage of knowledge and routines, it may be in the hands of the public managers ("street-level-bureaucrats") to actually shape and reshape the delivery of public measure by interpreting rules, setting priorities, and allocating resources through discretionary power (Lipsky 1980). Or the delivery of measures may be directed upwards in the formal organizational structure, resulting in decisions made by individuals with greater formal authority but lower relevant competence (Weick and Sutcliffe 2001).
35. Conclusion: Regional differences may matter, but not in a deterministic or uniform way. Regulatory regimes and safety culture are always part of a context and this context has spatial features. This context also has organizational features that may exist irrespective of geographical location and geographical scale. For example engineered safety features, operator training program, regulatory devices and policy measures are distributed between contexts. At the same time, knowledge, regulations and policies have to be reinterpreted and always negotiated in order to be meaningful, relevant and viable for a new context.

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