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The co-evolution of policy realities and environmental liabilities: Analysing the ontological work of policy documents

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ABSTRACT

Environmental policies often leave room for case- or region-specific discretion. In this paper, we focus on the transformation of socio-material settings into objects of policy discretion. This move calls for manipulation—ontological work—enabling settings to be connected to policy aspirations. The settings become configured in terms of their professed policy-relevant dimensions. The outcomes affect how environmental liabilities become defined in policy processes. The paper develops a conceptual toolkit to analyse ontological work as it is performed by policy documents. We use the toolkit to analyse three types of policy documents defining how agricultural nutrient loading is to be reduced in the Finnish region of North Savo. The findings show that regulatory decisions and policy recommendations are, to a significant extent, outcomes of ontological work. Environmental liabilities are shaped by the ways 'unstable junctures' are brought into being. By these junctures we refer to the points in the configured policy landscapes where choices influential for water protection are, according to the documents, to be made. The documents also generate exclusions that narrow down what liability implies in the unstable junctures. Without a focus on the ontological work and emerging ordering effects, it would have been difficult to show how environmental liabilities became (un)defined in the policy documents. The approach is needed to understand how power is practiced in policy processes and how policy instruments come to have consequences.

1. Introduction

The persistence of environmental problems is related to their ambiguity and pervasiveness. As Harriet Bulkeley (2019, p. 12) argues, climate politics have the 'ability to get everywhere'. It is, therefore, misleading to suggest that the array of questions critical for policy-making would be known, and that the challenge is just to find the right means by which climate responses could be effectively realised. Instead, Bulkeley (2019, p. 5) calls for a relational perspective that 'places the politics of climate change—and the role of social science—not in singular responses to a discrete problem but in the ways in which climate change comes to be rendered more or less amenable to diverse forms of intervention, ethics and forms of resistance'. As such, there is a need to examine how liabilities materialising, for instance, as legal obligations or contractual commitments, become defined in relation to specific socio-material settings (Bulkeley, 2019).

In research drawing from science and technology studies (STS), the transformation of environmental concerns amenable to intervention has invoked questions not only about what this amenability implies in relation to specific settings, but also what these settings are and how they become configured. Joint spaces of policy deliberation and action must be treated as political achievements rather than as pre-existing or natural units (Valve et al., 2017, 2013). Even institutionalised settings such as regions or counties must be specifically transformed into sites and objects of environmental action. This calls for arrangement and ordering that counts as *ontological work* (Law, 2015). Through this work a region becomes associated with certain policy aspirations. The work is ontological since it produces a specific configuration of the setting and its policy-relevant activities and networks, indicating what exists and counts for policy-making.

A farm, for example, is a setting known by those intimately involved with its care. However, this does not mean that it would be easy for a farmer to say how the farm should be configured specifically as a site in which environmental liabilities are practiced. This is for two reasons. First, no farm is an island. Although farming is practiced in specific locations, it is shaped by markets, technologies and production contracts that do not originate in the place or region (Valve, 2018). Second, even a single field or pasture is 'a space of imprecision, with multiple variables

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that are difficult to control' (Proctor et al., 2012, p. 1698). This implies that environmental interactions cannot be considered without some form of manipulation and exclusion. The challenge and political stakes increase further when it is farming *in general* that should be rendered as a policy object, susceptible to governance. The array of variables and variations must be constrained, and relationships cut to produce an abstract account of farming. This manipulation transforms farming into an 'immutable mobile' (Latour, 1999) that can move across time and space relatively intact.

Policies and regulations, thus, put forward assumptions about the dimensions and interactions that matter for environmentally sound farming. They *enact* specific versions of reality (Law and Singleton, 2014). Questions about what there is in the common realm—such as in an abstract farm—merge with questions about relevant liabilities and obligations (e.g. Asdal, 2007; Barry, 2020; Hinchliffe et al., 2005; Latour, 2004a, 2004b; Whatmore, 2013). On the one hand, liabilities can be pinned down only in relation what exists for policy and deliberation. On the other hand, the settings of environmental action are enacted in relation to what is assumed about the potential solutions.

STS-inspired research points to the ways in which standardisations are questioned, resisted and reshaped during policy operationalisation (e.g. Boucquey et al., 2016; Hinchliffe, 2001; Peltola and Tuomisaari, 2015; Valve et al., 2013, 2017). However, despite the various forms of resistance, the standardisations may come to colonise life, forcing farming, for example, to be practiced as if the reality of the 'generalised' farm would be equal to the reality of a lived farm. In the policy-mediated realities there may be little room for established forms of care and liability (Hinchliffe and Ward, 2014; Singleton, 2012; Singleton and Law, 2013). The farmers may need to choose, for example, whether they practice responsibility to their cattle or accountability to the formal regulatory system (Singleton, 2012, p. 418).

Policy interventions and instruments thus come with *ordering effects* (Law and Lien, 2013) that standardise relationships, even in totalising ways. Ordering effects materialise as boundaries become drawn around farms, and farm life configured, following specific logics. While enacting some elements and relationships as real and relevant, policy-induced ordering simultaneously creates *exclusions*. By exclusions we refer to the variations and connections that are cut out as non-existent for policy operationalisation, but which can matter for the unfolding of farming practices and its environmental consequences.

We argue that asking how policy instruments, such as environmental permits and programmes, come to have ordering effects is critical for two reasons. First, due to the ordering effects, ontological work intervenes, along with the restrictions and incentives, in the lives of policy subjects. It shapes the conditions of agency and favours some forms of liability over others. Second, without focusing on the shaping of the ordering effects it is difficult to understand how liabilities become defined in open-ended policy processes. Even when the liabilities are explicitly articulated in the end, focusing on ontological work is needed in order to understand how they end up being defined in a particular way. Liabilities co-evolve with the enactment of a policy reality. Active policy discretion or deliberation can play a role in policy operationalisation, but this discretion does not take place in relation to a neutral or pre-existing setting.

STS research supports analysis of ontological work by showing how calculative tools such as scientific inventories and modelling devices generate ordering effects (e.g., Boucquey et al., 2016; Rutland and Aylett, 2008; Whatmore, 2013). However, understanding how ontological work evolves along policy operationalisation calls for methodological means to analyse how different 'epistemic and administrative tools' (Asdal 2008, p. 16) work together, and in relation to each other, to produce 'controlled, objective and non-politicised situations and objects' (Asdal, 2008, p. 16). Moreover, focusing on the coevolution of ordering effects and liabilities implies that the analytical means must come with an increasingly nuanced understanding of what ontological work does in policy processes. Not only does the work locate choices and options 'in a thing or practice' (Boucquey et al., 2016, p. 9; Mol, 1999), but it also enacts the options in terms of specific registers. There is, thus, a need for tools that enable to trace *where options become located* in a policy setting and *in what terms the options are configured as being open*.

In this paper we develop a conceptual toolkit to analyse how ontological work unfolds in open-ended policy processes. The toolkit provides means to pin down the moves and manipulations through which ontological work and the definition of liabilities coevolve in policy processes. We use the conceptual toolkit to analyse ontological work performed by policy documents. Documents put governmental intentions into circulation while, at the same time, performing ontological, modifying work (Asdal, 2015; Asdal and Hobæk, 2016). When 'a practice perspective on texts' (Asdal, 2015, p. 87) is adopted, the assumption that the documents merely describe realities 'out there' no longer holds. Instead it becomes possible to acknowledge that documents produce ordering effects while 'working upon, modifying, and transforming' (Asdal, 2015, p. 74) settings into policy entities.

We use the practice perspective and the toolkit developed to examine policy documents operationalising water protection policies in a Finnish region, North Savo. We analyse three types of policy documents, asking *how the documents configure farming in North Savo as a setting for the abatement of nutrient loading; and how the ordering effects and environmental liabilities co-evolve while this occurs*. The documents communicate regional regulatory decisions and outcomes of planning and knowledge co-production processes. While so doing, they indicate who is to do what to reduce harmful nutrient loading from agriculture. At the same time, the documents standardise relationships and generate ordering effects. Agriculture in North Savo is rendered liable for water protection in specific ways. The outcomes reflect the distinct aims and legal premises of the policy instruments but are by no means determined by them.

We trace the ordering effects, first of all, by identifying the *unstable junctures* (Stripple and Bulkeley, 2019, p. 54) that the documents locate as critical for water protection. By unstable junctures we refer to the points where choices influential for water protection are to be made and relationships constitutive for farming practice reorganised and, as a result, environmental liabilities fulfilled. Second, we look for the notable exclusions at the cost of which ordering occurs. The parallel reading of the three types of documents helps us to elucidate the differences and interactions bypassed or abstracted from the separate accounts.

The region of North Savo is characterised by an abundance of lakes and waterways. It is also an intensive dairy production region. If cow manure is spread on fields that already have a high phosphorus content, or if manure spreading is carried out in an inappropriate manner, there is an increased risk of nutrient runoff into surface waters. This risk, to some extent, appears already to have materialised in North Savo. Changes in farming practices are needed to reduce run-offs, implying that new skills, equipment, spatial divisions and working rhythms may need to be adopted, and relations between animals, manure and fields reorganised. However, what do these needs imply in terms of liabilities: how could and should they be pinned down, and what can be assumed concerning the shaping of policy-relevant relationships? This, we propose, can be answered by the analysis of policy documents.

The paper is structured as follows. In the next section, drawing from earlier research, we introduce our conceptual basis and analytical tools. Section 3 presents a brief account of our empirical case, while Section 4 describes our data; the policy documents. In Section 5 the policy documents are analysed, followed by a discussion of the ordering effects and their political implications in Section 6. Section 7 provides our concluding remarks, suggesting that without a focus on the ordering effects, it would have been difficult to identify the means through which, and the terms in which, the policies came to (un)define environmental liabilities.

2. STS and political ordering by other means

According to Law and Singleton (2014, p. 381), 'policy is a set of

heterogeneous practices done variably in multiple locations'. If the aim is to understand, for instance, how an animal disease outbreak is transformed into a policy object, 'You will need to go everywhere, into the farms, the barracks, the laboratories, the government committees and the offices of vets. If you want to think well about policy, you will need to go to these places too' (Law and Singleton, 2014, p. 383).

While it is certainly true that the intentions of state institutions do not translate into action without changing and gaining new content on the way, policies—and specific policy instruments—are designed to exercise power and *materialise* governmental intentions (Le Galès, 2016). They typically have a legal basis that articulates the objectives and gives justification to intervention. Legal concepts are building blocks in the 'systems of thought' through which the problems of government are 'posed and specified' (Rose and Miller, 1992, p. 177). In addition, legislation identifies the competent authorities responsible for carrying out regulatory discretion, organising collaborative planning processes, or allocating subsidies. Policy instruments, thus, operate in terms of administrative arrangements and jurisdictional boundaries. At this level, the co-evolution of ordering effects and liabilities is quite explicit.

More active analytical tracing tends to be needed when the aim is to see how policies are *practiced* in terms of given arrangements. Focusing on policy operationalisation enables us to trace how the 'system of thought' is specified and how it generates ordering effects in relation to material and social complexities. Environmental policy instruments leave, ever more often, space for case- or region-specific discretion (Lee, 2009; Valve et al., 2017). In the literature drawing from STS, the co-evolution of this discretion and ontological work has been studied by focusing on attempts to establish technological zones (Barry, 2001) within the limits of which commodities can move freely. The newcomers to the common market are subjected to safety protocols and risk assessments that transform emergent technologies into standardised objects of regulation (e.g. Kautto and Valve, 2019; Lezaun, 2006; Robins, 2012; Valve and Kauppila, 2008). Genetically modified organisms and nanotechnology applications, for example, become objects of risk assessments through standardised practices that configure risk-relevant interactions in very particular ways.

A similar kind of modifying and ontological work is performed when environmental and safety concerns are sought to be controlled on an ad-hoc basis. Studies focusing on the regulatory responses invoked by animal disease outbreaks and other risk events provide rich accounts of the ordering effects that co-evolve with the operationalisation of regulatory measures. The analyses point to a potential mismatch between the realities enacted by regulation and those carved out through alternative engagements with the unruly subjects (e.g Goldman et al., 2016; Jones et al., 2014; Kautto and Valve, 2019; Singleton, 2012; Singleton and Law, 2013; Whatmore, 2013). Due to the resisting practices, materialities and living processes, the ontological work performed by policy instruments does not produce ordering effects in any straightforward way. This becomes particularly apparent in settings in which the instruments do not seek to determine what practices and elements define environmental liabilities but leave room for deliberation and adaption. Regulation may state, for example, how environmental objectives should be defined, and the plans made to achieve them. However, the boundaries of the emerging spaces may be contested (Valve et al., 2017, 2013).

It is also common that the attempts of policy institutions to grasp environmental problems co-evolve with numerous alternative configurations of the politicised issue (Marres, 2007). For example, Lahn (2021) shows how within the Intergovernmental Panel on Climate Change (IPCC), knowing and stabilisation of the climate 'has been implicated in efforts to "stabilize" a specific enactment of the climate issue' (Lahn, 2021, p. 4). The enactments are nonetheless challenged: '(T)he school strikes and similar calls for emergency climate action seem to pose a radical challenge to the traditional 'climate stabilization' approach of the UNFCCC and the IPCC. They, thereby, also illustrate how pinning down the precise boundaries of a stabilized 'climate issue' remains inherently difficult' (Lahn, 2021, pp. 4–5).

Although considerable emphasis has been placed on the political implications of the silences and exclusions that co-evolve with policy-driven ordering, it also important to remember that the link between intervention and ordering cannot be undone. This emphasises the need for new evaluative perspectives through which ordering efforts are scrutinised and the political implications of the practices rendered visible. When ontological work is studied as constitutive for the definition of liabilities, it is critical to learn not only how the supposedly common world of environmental action gains shape, but also how this world affords and indirectly generates obligations for liabilities. This requires a focus on the formation of what we call, following Stripple and Bulkeley (2019), unstable junctures. At the same time, analytical efforts are needed to show how silences and exclusions are enacted, and how this produces freedom from liabilities.

2.1. Analysing the ontological work of policy documents

Studying how policies are practiced and environmental policy instruments are operationalised takes us back to Law and Singleton (2014) and their advice 'to go everywhere'; to engage with various settings in which policies are realised at the same time. However, rather than suspecting that this would be possible, the point is to acknowledge that policy-making is a distributed affair and that policies gain content through different practices, including textual practices.

Regional policy documents are supposed to translate (inter)governmental intentions into decisions and programmes of action in ways that take regional and local characteristics into account. The documents describe how local or regional characteristics have been rendered amenable to intervention, for example, by means of scientific modelling tools or ecological assessments. These means are needed in order to generate knowledge about the policy-relevant aspects of the socio-material setting and to transform the setting into an object of discretion. The tools support policy-making but also perform ontological work. In their analysis focusing on how climate change mitigation transformed into an object of local environmental governance in Portland, Oregon, Rutland and Aylett (2008) found that '(f)rom carbon footprint analysis to emissions inventories, there are multiple ways of understanding and drawing boundaries around the object of LEG [local environmental governance], and they do not all yield the same results' (Rutland and Aylett, 2008, p. 627).

When tracing, from the policy documents, the moves and manipulations that generate ordering effects, we make two assumptions. First, we expect that whereas environmental liabilities can be defined only in relation to the differences, elements and relations that are implicated by the documents, it is important to differentiate the descriptive parts of the documents from the articulations that are critical for the operationalisation of governmental intentions. Policy instruments come with their, often implicit, conceptualisations of change. In policy studies, these are called intervention theories (Mickwitz, 2003). However, whilst this concept advices to analyse what is assumed about the transformation of policy inputs into policy outcomes, it does not provide means that would help to trace how the assumptions develop in open-ended policy processes. Meanwhile, the geographical metaphor of an unstable juncture serves such a task by indicating that the conceptualisation of change evolves along policy operationalisation. This operationalisation rests on ontological work that enacts a landscape with stable and unstable elements. In the unstable locations there is space for choice. Thus, we refer them as junctures. At these points, choices can be made in terms that are configured real and relevant for policy-making.

Second, we propose that tracing how liabilities are defined through ontological means 'requires us to stretch beyond the limits of what is readily observable' (Barry, 2020, 2013). Focusing on exclusions enables us to trace how liabilities, and freedom from liabilities, emerge as two parts of the same coin. In practice, we must limit ourselves 'to showing mere glimpses, specific bits and pieces, but pieces that might contribute

to breaking open our political imagination about how cases, issues and the political could have been shaped in radically new ways' (Asdal, 2007, p. 319). We make use of our prior expertise (Valve et al., 2020) and parallel analysis of the documents to create a broad understanding of the relationships that might be consequential for the reduction of agricultural nutrient loads in North Savo.

Since junctures and demarcations cannot be expected to be found readily articulated in the documents, our analysis is based on the identification of tools that are mobilised in the documents to generate ordering effects. First, we trace the *legitimating resources* to which the documents refer when stabilising relationships and delimiting the scope of relevant variables and interactions. These resources draw from the authority of law and science, or what Allen (2011, p. 288) calls 'consensual devices or objects of ritual and custom' to standardise relationships. For example, scientific calculations and models are likely to operate as legitimating resources.

Second, we identify *ordering concepts* (Lahn, 2021, p. 10) that bring entities and relationships between them into being through naming, classification and association. Such concepts can be found already from the titles of the three types of documents that are analysed: the concept of an *environmental permit* draws a relationship between an action and its conditions of regulatory acceptability; a *measure* (as in *regional programmes of measures* for water protection) points to a distinguishable operation, and, finally, a *transition pathway* for the blue bioeconomy enacts a chain of directional steps and actions. These concepts play a critical role in the instrumentalisation of governmental aims, but their shaping is outside the scope of this paper. However, during regional implementation, additional ordering concepts can be expected to co-evolve with legitimating resources. Knol (2011, p. 990) provides an example of how ecosystem mapping in the Barents Sea-Lofoten area enacted a, later strongly contested, category of 'unproblematic petroleum activity' so that 'within certain borders, it became undesirable to proceed with petroleum activity; outside these borders it was unproblematic'.

With this toolkit we access the different types of documents that take us further into North Savo. However, before that, a short description is needed of the environmental concern that is addressed by all the documents; that of eutrophication.

3. Eutrophication as an environmental problem

Plants need nutrients such as phosphorus and nitrogen in order to grow. However, when phosphorus fertilisation (in the form of mineral fertiliser or manure) exceeds the crop uptake, phosphorus builds up in soils and becomes gradually lost to water. In aquatic systems, this nutrient loading boosts the growth of algae, triggers toxic algal blooms and consumes oxygen from near-bottom water layers as the algae are mineralised. This is referred to as eutrophication. In Finnish lakes, rivers and marine regions, eutrophication lowers biodiversity, harms fisheries and limits many recreational activities such as swimming and boating. In extreme situations lakes come to resemble overgrown wetlands.

In regions such as North Savo, where livestock farming is intensive, the amount of phosphorus-rich manure produced may exceed the needs of the crops cultivated in a farm or in its immediate surroundings. However, manure transport is costly and, therefore, the farmers may be inclined to spread it close to animal shelters. In North Savo, fields are sloped and often in the proximity of lakes and rivers. Spreading manure on fields already rich in phosphorus increases the risk of nutrient runoff. Some of the watersheds in the region are sensitive to eutrophication and already suffer from its symptoms.

4. Data: policy documents and an outlier

Farming in North Savo (see Fig. 1) provides a good case for our analysis as it is, on the one hand, spatially bounded in the sense that farms that contribute to water protection are placed within the region. On the other hand, practices and material flows intertwine, making it hard to pin down where and how water management aspirations should manifest. For farming practices to change, much needs to happen beyond the farms and even outside the region.

The policies and regulations that govern farming in North Savo can be divided into three types. First, legislation defines general standards to be followed. These standards are common for the whole country. For water protection, the Finnish Nitrates Decree (1250/2014), which implements the EU Nitrates Directive (91/676/EEC), is the most significant source of legal standards. The degree sets some broad limits to fertilisation and more specific requirements for manure storage and the use of manure spreading technologies.

Second, water protection in agriculture is advanced through economic incentives. The Rural Development Programme of Finland defines nation-wide terms and eligible measures for agri-environmental subsidies. For example, at the time the analysis was carried out, the terms called for phosphorus fertilisation to be restricted to specific levels (Thorsøe et al., 2021). These limits play an important role in farms committed to the voluntary scheme. In North Savo, 85 percent of the farms belonged to this category in 2020 (personal communication, Finnish Food Agency, 26/02/2021).

Finally, in addition to the national policy documents that do not differentiate North Savo as a policy setting different from other regions, it is possible to find documents that tell specifically what should happen in North Savo, or at farms of North Savo, for lakes and rivers of the region to be protected. In these documents farming in the region gains particular capacities as a setting for the abatement of nutrient loading. Therefore, in our analysis that follows, we focus on these types of documents. All-inclusive analysis of all policy documents would have been impossible in the scope of the paper. However, our analysis will position the analysed papers in the context of the wider policy-mix.

The policy documents under analysis include: (i) 15 environmental permits granted to animal farms on the basis of the Finnish Environmental Protection Act from 2016 to 2018; (ii) two regional Programme of Measures (PoM) operationalising the planning mandates of the Water Framework Directive of the European Union (EU) for the years 2010–2015 and 2016–2021; and (iii) the final report of a transition arena process initiated by a research project. The environmental permits represent traditional command-and-control policy instruments. The liabilities they define count as legal obligations. Meanwhile the PoMs combine binding environmental objectives with measures to be implemented to gain these objectives. The definition of liabilities is based on consensual agreement.

In order to increase the heterogeneity of the documents, we included a report from a 'transition arena' (Valve et al., 2019). This report is not an official document but was added to the data because of its potential to reach beyond 'the ontological settlement… which expert environmental management practices assume and perpetuate' (Whatmore, 2013, p. 45). The report presents a 'transition pathway' (Luederitz et al., 2017) for the management of cow manure in North Savo. This pathway is not restricted by any jurisdictional basis. Nor does it need to materialise governmental intentions. Therefore, the report can help to show how abatement of agricultural nutrient loading in North Savo could be enacted in a radically different way. However, this enactment also comes into being with its own ordering effects.

We performed a careful content analysis of the chosen documents. The analysis proceeded in two rounds so that, in the first round, we read each document by tracing how it defined liabilities and the terms of which ordering concepts this occurred. In the second round, we followed the moves and manipulations—taking place by the means of legitimating resources and additional ordering concepts—with the help of which the documents configured the policy setting and arrived at the

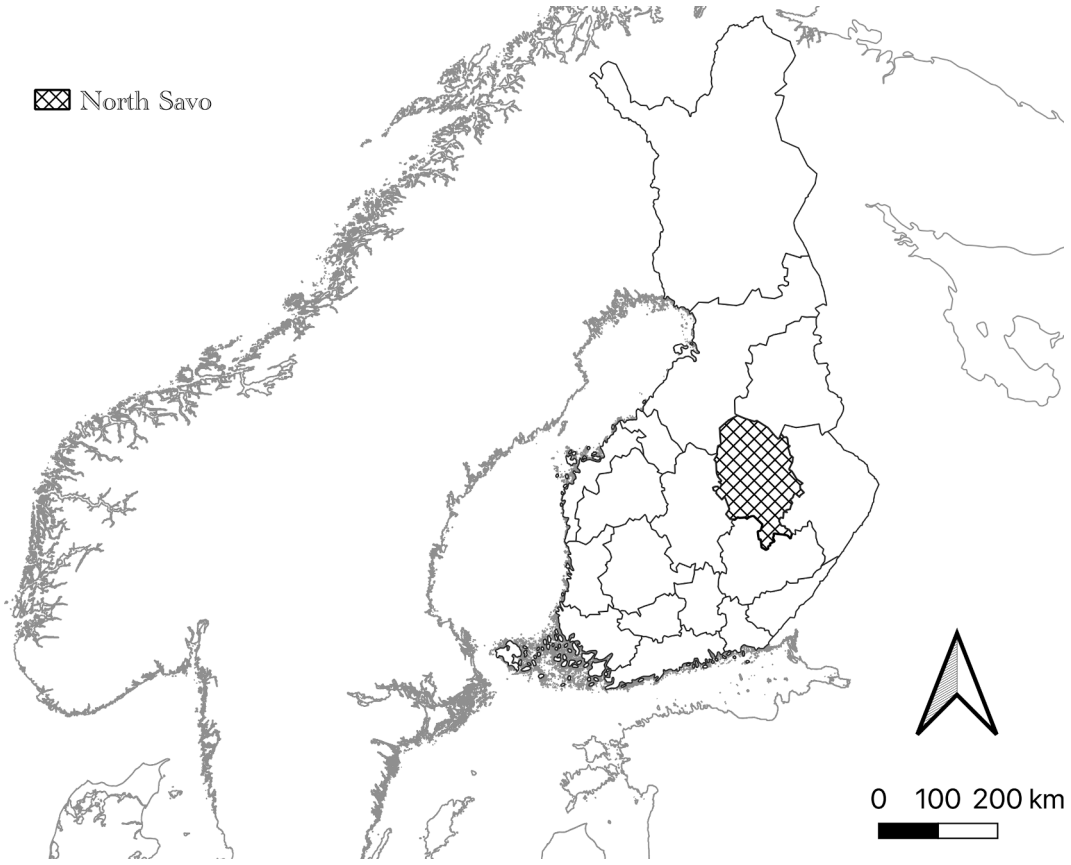

Fig. 1. Map of Finland and location of North Savo.

specific definition of liabilities. Main responsibility of analysis was divided between the authors section by section, but the findings were discussed and some of the documents re-analysed by the authors.[1]

5. Results

5.1. Environmental permits

5.1.1. The environmental permit as a policy instrument

The EU Directive on industrial emissions (2010/75/EU) requires all Member States to have a permit scheme for activities that may cause deterioration of the environment, including large livestock installations. In Finland, the requirement for an environmental permit is further defined in the Environmental Protection Act (527/2014). In the permit procedure the assigned authority uses case-based discretion to decide whether a permit can be granted and on what conditions.

In Finland, the environmental permit is a central policy instrument preventing environmental pollution (Kauppila and Anker, 2018). Permits for animal shelters are in most cases granted by Regional State Administrative Agencies (RSAA).[2] The 15 permit decisions we analyse include all the permissions granted by RSAA to animal shelters between 2016 and 2018. The permit documents include both new permits and permits for increasing or extending production.

The scope of the environmental permit is a single farm. When farmers apply for the permit, they need to provide information about the farm in the application form. The regional environmental authority provides a statement about the environmental terms of the permit. If the RSAA decides to permit the activity, it defines the conditions that practices and arrangements at the farm must meet.

5.1.2. Ontological work of environmental permits

When we started our analysis of the environmental permit decisions, we were at first overwhelmed by the rather rich descriptions which the permits provide about the farms. The descriptions highlighted factors such as the location of the animal shelter, its distance from neighbouring facilities and residential buildings, the amount, age and type of production animals, as well as the location and quality of nearby waterbodies:

> 'There are some farms, fields and forests in the immediate area. The nearest permanent residential property is approximately 160 meters northwest of the animal shelter. The nearest leisure residential building is located about 160 meters southeast of the current animal shelter. The farm centre is located in the [name] catchment area of the Vuoksi river basin. The activity is not located in an important groundwater area. Approximately 185 meters southeast of the new yard barn is a spring for domestic water use. The farm's fields are not located in the groundwater area. The shore of [name of the lake and the bay] is approximately 190 meters from the current yard barn. Lake [name] is a humus-rich lake with a satisfactory ecological status. The farm's fields are partly bordered by lake [name].' (Permit decision for a cattle farm, 2017)

The descriptive section also features, in open format, the farmer's assessment of what environmental impacts the operation is assumed to cause. The descriptions bear a high level of similarity from one permit decision to another. They follow a common logic that has a background

[1] Main responsibility of analysis by section: 5.1 [Pitzén], 5.2 [Valve], 5.3 [Lazarevic].

[2] According to the Environmental Protection Decree, an animal shelter that is meant for over 300 milk cows, over 500 bulls, over 600 suckler cows, over 750 adult sows, over 2 000 pigs, or for over 40 000 chickens or broilers requires a permit awarded by the RSAA.

in a *legitimating resource*. The descriptions assemble the farms in terms of the Nitrates Decree.

In the sections in which the actual permit decisions are announced and justified, the requirements of the Nitrates Decree are repeated, even though the requirements automatically apply to all farms. However, it also becomes clear that a permit is granted if the applicant can show that the farm has access to a manure spreading area (i.e., fields) that corresponds to the amount of manure produced at the farm. The manure spreading area operates as an *ordering concept* that renders animal farms amenable to permit decision-making. The existence of the spreading area is also the criterion on which decisions are based from the water protection point of view. The farmers stand at an *unstable juncture* when figuring out how to acquire enough field area for manure spreading either by purchasing, hiring or clearing fields, or by making special manure spreading contracts with their neighbours. Rules for the calculation of the required field area are provided by another *legitimating resource*; a soft law guide (Ministry of the Environment, 2010). The orders regarding the required spreading area were based on the soft law guide and remained almost identical between the documents:

> 'For the animal count presented in the application, a minimum of 156 hectares of field area must be available for manure spreading. Border strips and classified groundwater areas are not included in this area, as spreading manure on such areas is forbidden.' (Permit decision for a cattle farm, 2017)

Since decisions are based on the sufficiency of the manure spreading area, the other farm characteristics described in the opening sections cease to have any regulatory significance. Other substantial *exclusions* emerge as well. The environmental permits attempt to ensure a metabolism between the production of manure by livestock and its spreading on fields as a fertiliser. They seek to promote a circular system with a manure-to-field ratio that confirms there is an ecological sink to absorb the agricultural by-product. However, the fields are treated as ahistorical and homogeneous, and although it would be technically possible, their actual capacity to retain added phosphorus is not taken into account. Moreover, there is an implicit assumption that fields are not 'double-booked' and included in several manure spreading areas. It is also expected that the manure is spread evenly across the spreading area.

5.2. Programmes of measures for water management in North Savo

5.2.1. Legal basis and policy mandate

The programmes of measures for water management (PoMs) define, as their title indicates, measures to be taken within the region of North Savo to maintain or to improve the ecological status of waters. The programmes have their legal basis in the EU Water Framework Directive (WFD, 2000/60/EC), according to which the ecological status of European ground and surface waters should be in good status by 2015, or, if conditions so demand, by 2021 or 2027.

The two PoMs analysed specify the River Basin Management Plans that reach North Savo. The first programme covered the period 2010–2015 and the second 2016–2021. In the first instance, they define the current ecological status (poor, moderate, good, excellent) of water bodies. In the second stage, the PoMs suggest the cost-effective measures through which good ecological status can be reached or maintained.

5.2.2. The realities of water protection according to PoMs

While the environmental permits locate action relevant for the abatement of nutrient loading to individual farms from the start, the PoMs point to a much more open-ended approach. The PoMs have a regional coverage, but within that scope, the definition of water protection measures is presented as a topic that has been studied and specified in the planning processes:

> 'One of the basic ideas in drawing up the programme has been that a common view is to be reached on the necessary water management measures. In cooperation, it has been possible to significantly expand expertise about the state of the waters; the factors that affect that; and opportunities that exist for improving water status.' (Pohjois-Savon ELY-keskus, 2010, p. 4)

In the PoMs, descriptions of ecological status and needs for management measures are discussed in terms of the *ordering concept* of a water system. In the systems in which water bodies, another ordering concept, are below a good condition status, eutrophication caused by phosphorus loading from agriculture is identified as a key problem. This conclusion is made based on modelling, use of water quality tools and the application of land-use and monitoring registers. These *legitimating resources* generate results in terms of an *ordering concept* of an *economic sector*. North Savo is configured as a composition of sectors such as agriculture, forestry and industry. Estimations pointing to the respective nutrient loading shares of the different sectors show how the need for water protection measures varies between the sectors in the water systems.

After the PoM documents have established which sectors are responsible for the deterioration of the ecological status of water bodies, attention is shifted to the measures through which corrections could be implemented and environmental liabilities met. This calls for a conception of what kinds of actions can count as agricultural measures. The PoMs draw from a legitimating resource, building upon established understanding of agro-environmental measures: 'In practice, environmental protection in agriculture is based on the voluntary agri-environmental funding scheme to which most farmers are committed' (Pohjois-Savon ELY -keskus, 2010, p. 82). The voluntary agri-environmental funding scheme subsidises farms committed to measures such as reduced fertilisation, buffer zones, seasonal manure spreading restrictions and the cultivation of winter crops. The very same array of water protection measures also constitutes the toolkit through which the abatement of agricultural nutrient loading is discussed and operationalised. The PoMs offer accounts of what measures should be adopted by North-Savo farmers, and at what intensity. The *unstable junction* is thus placed at farms. In this location of liability there is, however, nothing new. The PoMs only provide recommendations for the choice of the voluntary measures.

In addition to ecological models, economic calculations and public consultations are also referred to as *legitimating resources* that enable conclusions to be drawn about the optimal array of agri-environmental measures. As summarised in the second PoM (Vallinkoski et al., 2016, p. 102), 'agricultural water protection was examined in relation to the agri-environmental subsidy scheme, the effectiveness of the measures and regional feasibility'. The PoM identifies the measures and their volumes (e.g., how many hectares of buffer zones or numbers of wetlands) by which nutrient loading reductions could be achieved in the region in a cost-efficient way. The cost-effectiveness calculations were carried out using a model that helped to show how many hectares of winter crops or fields with optimal fertilisation, for example, would constitute a cost-effective mix of measures.

The PoMs *exclude* non-institutionalised measures outside the planning scope.[3] The innovation of totally new approaches is restricted by the narrow definition of an eligible measure, although there was no legal ground for such a restricted approach. Farming became operationalised as a single entity, a sector, and liability was defined in terms of voluntary commitments for which the farmers are compensated. However, there is no guarantee that funding for these compensations exists. According to the second PoM, the take-up of the farming measures defined in the first round was behind schedule, because money had run out. Since the

[3] As a new measure, the second POM introduces biogas production, although the activity is not subsidised by the agri-environmental scheme.

measures are co-funded by the EU and the Finnish government, funding decisions taken outside the region make an *unstable juncture*. The PoM quite explicitly *locates unstable junctures outside the planning scope*, hoping that decision-makers in Brussels and Helsinki, as well as those at North-Savo farms, do their share based on the regional information which the PoMs provide.

5.3. The North Savo transition arena for a blue bioeconomy

5.3.1. Transition arenas and pathways

The third document is not an official policy document, but the output of a regional transition arena process which focused on developing policy pathways for sustainable aquatic resources and water protection as the basis for economic growth in North Savo by 2035. The document '*Towards a change in the sustainable blue bioeconomy in North Savo - Transformation pathways and necessary measures*' (Valve et al., 2019) reports a transition arena process (see Hyysalo et al., 2019) and its outcomes. One of the transition pathways focuses on *advanced nutrient recycling solutions enabling transitions to circular agriculture.* The transition arena and report were the outcomes of a research project looking at adaptive governance to support blue growth in food production, energy production and tourism.[4]

5.3.2. Legitimating resources and ordering concepts

The transition arena document reports results from an exploratory process, bearing similarity with the PoMs in this respect. The document's opening sections provide a brief account of the transition arena process and the legitimating resources, on the basis of which a process was designed and participants were invited to take part. The process is described as a stepwise exercise during which 14 experts examined specific transition-related dimensions in six half-day workshops.

In the process, deliberation was to evolve according to an established protocol. This included the following phases: identifying challenges, opportunities and uncertainties (1 workshop), developing a vision and transition goals (1 workshop), co-constructing transition pathways (3 workshops) and eliciting comments on the immediate transition actions and the final report (1 workshop). Reference is made to the *legitimating resources* used to guide joint deliberation and co-creation; the same tools that were used in the Finnish Smart Energy Transition project (Hyysalo et al., 2017) and modified for the North Savo process. The process also utilised material devices, which consisted of hexagonal magnets for different action categories (i.e. *production*, *business*, *end consumption*, *regulation*, *investment*, *technology* and *pilots*) and were used to identify *change steps* that together build a transition pathway on a magnetic whiteboard, see Fig. 2. The action categories and change steps operated as *ordering concepts*, providing the categories for production of the transition pathway. The legitimating resources and ordering concepts sought to render the transition to advanced nutrient recycling in North Savo amenable to knowledge co-production.

The transition pathway draws a link between nutrient loads to water bodies and inefficient manure management. Like the environmental permits, the problem description enacts water management as an issue that depends on the extent to which nutrient flows between cows and fields can be balanced. However, the transition arena report takes the need for manure processing as a starting point. Instead of assuming, as the environmental permits do, an immediate relationship between manure-producing animals and fields as sites of manure spreading, the report describes a more complex dynamic. The manure nutrients should end up in the appropriate mixes (e.g. phosphorus, nitrogen and potassium) at the right fields at the right time. In conditions of intensive farming and manure accumulation, the equation cannot be solved without new technological options and the reorganisation of material flows. The coupling of existing (i.e. anaerobic digestion) and novel technologies (digestate processing) are described as solutions that can together close metabolic loops and reduce harmful nutrient loading. Digestate treatment removes water and separates nutrients into nitrogen and phosphorus fractions, which allows for greater transport distances and the optimisation of fertilisation depending upon the nutrient needs of specific fields.

A task of the transition arena was to co-create a solution to the problem of how to get manure on the move and processed into materials that can replace inorganic fertilisers and fossil energy sources. The outlined change steps are the *unstable junctures* that *together* are envisioned to transform manure from a source of nutrient leaching to one of economic potential. The key steps include i) a subsidy scheme for the deployment of advanced manure fractionation technology, ii) investments by farmers' collectives in centralised manure processing plants, iii) development and scale-up of manure processing via centralised solutions, iv) creation of a consumer demand for biogas as a transport fuel, and v) support for the productification of advanced organic fertiliser products. Unstable junctures are also located through the identification of policy instruments and measures (i.e. research and development funding for recycled fertilisers, strengthening of biogas demand, production subsidies) and listing the actors who should advance their adaptation. Liabilities are distributed based on existing jurisdictions, but not as a part of an official, authoritative process.[5]

The transition pathway does not respect sectoral divisions or the physical boundaries of North Savo. As a result, farming in North Savo becomes attached to national transport policy and biogas support schemes, for example. The farmers gain capacities as groups of potential investors and manure processors in multi-scalar and -sectoral networks; and governmental authorities as promotors and enablers of new material relations. However, despite this apparent inclusiveness, notable exclusions are also being enacted. The pathway operates solely in terms of 'carrots' (incentives), lacking any reference to 'sticks' (restrictions) in manure spreading. Limitations have no place in the enacted policy reality.

6. Discussion

The selected documents analysed present different accounts of the practices and relationships important for the reduction of agricultural nutrient loads in North Savo. In the documents, the question is addressed in terms of a single farm, the whole region and, in the case of the transition arena, following the networked space co-evolving with sociotechnical change. These differences are partially determined by the legal frameworks, and, in the case of the transition arena, by the theoretical framework; and hence they come to the region as given. However, in the limits of these arrangements, a lot of ontological, ordering work has taken place. North Savo and its farms transform into sociomaterial settings of policy operationalisation. This is necessary in order to enable the policy documents to declare who is supposed to act, and how, in order to protect North Savo waters from agricultural nutrient loading and eutrophication.

The documents generate ordering effects with the help of legitimating resources such as calculative tools and scientific models. In the case of environmental permits, decision-making equates to calculation. The interactions between a farm and its environment are narrowed down to the calculated animal-field ratio. Nutrient loading, or the lack of it, is treated as something determined by this ratio, implying that everything outside the equation is excluded as irrelevant for this instrument. The fact that all fields qualify as equally suitable for manure spreading indicates that the permits configure unstable junctures in terms that are, according to scientists (Ylivainio et al., 2014), misleading. Fields are simply not that equal.

[4] https://blueadapt.fi/en/frontpage/

[5] However, the realism of the actions was critically evaluated in the transition arena process.

Fig. 2. The cover photo of the TA report (Valve et al., 2019) showing the mid-range transition pathway creation toolset (Photo by Jani Lukkarinen).

In the case of the PoMs, scientific models play a critical role in making North Savo and its watersheds amenable to comprehensive planning. This transformation is decisive for the way in which liabilities are defined. Rendering the region amenable to intervention *is* the intervention. The scientific models make use of ordering concepts that operationalise liabilities in broad terms. The entangled moves end up locating liabilities to farms and to Helsinki and Brussels. This begs the question of whether the regional PoMs are misplaced. If, in the region, all unstable junctures are located at individual farms, is there not a risk that the PoMs raise false expectations about the potentials of what will happen at the regions and by regional actors?

According to the nutrient recycling pathway, this is true in some respects. The identified change steps, i.e. unstable junctures, are only partially located in the region. However, some important steps are to be taken within North Savo. For example, investments should be made in manure processing, and old public transportation buses should be replaced with biogas vehicles. These actions could constitute an important part of the assemblage triggering a transition in nutrient recycling and water protection. The problem is that such measures alone would probably be ineffective and even unfeasible to implement. However, the pathway shows what happens when the problem of agricultural nutrient loading is not addressed in terms of fixed administrative spaces, but by allowing problem-solving to lead to the configuration of the networked space (Lury, 2009, cited by Ruppert, 2012). The pathway can therefore be viewed as an alternative to the established modes in which nutrient abatement is 'posed and specified' (Rose and Miller, 1992, p. 177). Indeed, there is no legal restriction explaining why the PoMs would not have resembled the transition pathway in critical respects.[6]

The parallel analysis of the three types of documents shows that the co-evolution of ordering effects and liabilities is shaped, on the one hand, by the ways unstable junctures are brought into being. The PoMs locate these junctures to farms and to the EU, *freeing* the regional administrative units and other specifically regional actors *from liabilities*. Likewise, the transition pathway defined junctures following a logic that transformed the region mainly as a locus of new investments and a recipient of subsidies. On the other hand, the environmental permits and PoMs generated exclusions that narrowed down *what liability implies* in the critical unstable junctures.

Since the location of the junctures and their configuration in unspecified terms appear incapacitating, it is unclear what added value the documents generate on top of existing policies and regulations. The policy documents operationalising EU legislation define, perhaps unsurprisingly, farmers alone as liable for the abatement of agricultural nutrient loading in North Savo, but do so in terms that may not help to fight the eutrophication of North Savo watersheds. Meanwhile the transition pathway document enacts a reality in which a lot can, and should, take place particularly beyond the individual farms. This suggests the existence of potential complementary synergies. Nonetheless, in their current form the documents suggest that the governmental intentions related to abatement of agricultural nutrient loading become neutralised when encountering North Savo. The downside of the document analysis is that is hard to say what is, for example, the responsibility of regional authorities in the processes. It is likely that national authorities have streamlined policy operationalisation in the regions through guidance and unofficial protocols that have not been

[6] Practical hindrances nonetheless exist. The regional process must produce outcomes that can be assembled into river basin management plans and these must be reported to the EU commission in an aggregated format. Likewise, the identification of measures needs to be linked to the water bodies and systems. Therefore, the transition pathway would not qualify, as such, as a programme of measures.

mentioned in the policy documents.

In North Savo, environmental *politics* had definitely found their way into the policy documents. Yet the ordering effects come into being without public deliberation or reference to explicit decisions. The outcomes are enacted in apolitical spaces by 'mundane epistemic and administrative tools' (Asdal, 2008, p. 16), to which we refer as legitimating resources and ordering concepts. However, while the tools and the processes in which they are applied are apparently apolitical, the outcomes are not. In North Savo, but also elsewhere, interests and inequalities may become 'hardwired' (Barry, 2020; McCubbins et al., 1987; Valve et al., 2017) into the modes of modifying, ontological work. This means that while the ordering effects may be unintended side-effects of the efforts to make abatement of agricultural nutrient loading governable by permits and programmes, the outcomes, the (un) defined liabilities, can be a welcomed outcome by some groups and actors; or even the only accepted outcome (Valve et al., 2013, 2017).

7. Conclusions

In this paper, we have argued that analysing policy documents through a practice perspective can provide valuable means to analyse the transformation of socio-material settings into objects of policy discretion. This transformation calls for manipulation—ontological work—enabling settings to be connected to policy aspirations. Focusing on this work is critical when the aim is to better understand how environmental liabilities become defined along the operationalisation of policies and regulations.

The conceptual toolkit developed in the paper enabled us to unravel the ontological work through which policy documents made complex, but regionally specific problems amenable to intervention in a particular case. We used the toolkit to analyse three types of policy documents defining how agricultural nutrient loading is to be reduced in the region of North Savo, Finland. The documents communicate decisions and recommendations. They arrive at these outcomes by way of ontological work that is carried out by an array of legitimating tools and ordering concepts. The work often ends up determining the outcomes, implying that little or no space is, in the end, left for discretion or policy deliberation.

The challenge in the analysis of policy documents is that it is not enough to trace how the documents grant visibility to specific elements and interactions. Only a fraction of these elements gain presence in the policy reality in terms of which environmental liabilities become defined. The conceptual toolkit developed in the paper allows the analyst to trace how this distillation occurs. In the studied case, it guided our focus on the ways in which the documents generated, on the one hand, unstable junctures as points in which farming and farming practices are the crossroads; and, on the other hand, exclusions of variations, dimensions and possibilities. The findings show that the documents modify the regional setting so that policy-relevant liabilities become mostly placed at individual farms or outside the region. Actors became freed from liabilities, but policies also became watered down due to exclusions that narrowed down what liability implies in the unstable junctures.

In policy processes, ontological work locates options into policy settings in specific ways, but it also affects in what terms the options are configured as being open. Without this extended understanding, it would had been difficult for us to show how, and in which terms, environmental liabilities became pinned down, or alternatively, circumvented. The findings invite anyone interested in understanding how policy instruments come to have consequences to add STS based resources, including the additional ones developed in this paper, to their analytical toolbox. Since ontological work counts significantly as policy work, our findings speak to policy analysts across different disciplines.

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CRediT authorship contribution statement

Helena Valve: Conceptualisation, Investigation, Methodology, Writing – original draft, Writing – reviewing & editing. **David Lazarevic:** Investigation, Writing – original draft, Writing – reviewing & editing. **Samuli Pitzén:** Investigation, Writing – original draft, Writing – reviewing & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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