The Logic of Measuring, Managing and Governing Ecosystems (EcoLogic)

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1.1 Background

Recent decades have seen a fundamental shift in our understanding of nature, why nature is valuable and the establishment of environmental (including climate) problems as a major societal question. Since the 1990s there has been an 'ecological turn': environmental harm is accepted as a global, potentially irreversible and existential problem because humankind depends on 'goods' (food, water, air) that ecological systems provide (Andersen 2017; Hajer 1995; Lash, Wynne, & Szerszynski 1996). After this turn, a primary goal is to maintain or restore ecosystems to their 'original' or 'optimal' state, and to protect ecological systems from deterioration caused by human activity - to provide 'a safe operating space for humanity' (Rockstrom et al. 2009).

International cooperation such as the conventions on Biodiversity (CBD) and Climate Change (UNFCCC) and related scientific efforts such as IPBES, IPCC, DIVERSITAS and the UN Millennium Ecosystem Assessment (MEA 2005) clearly signify the enormous effort that already has been put into translating and operationalizing the general idea of ecosystem sustainability. Notwithstanding, the importance of these international processes and the global character of the problems, the actual implementation of new policy goals, concepts and management principles still takes place within nation-states. It is therefore crucial to understand how ecosystem-based environmental policies at the national level are developed; and how ambitious policy goals and concepts such as ecological sustainability, are translated, operationalized and used for decision-making purposes.

EcoLogic is designed to increase our knowledge of how environmental expertise on ecosystems is formed and how it performs in national policy-formation. Based on a comparison of Norway and Sweden, the project sets out to broaden *and* deepen the understanding of the political, administrative, and science-based processes that make 'nature' governable through specific technologies, seeking to measure, manage and, eventually, control ecosystems. It focuses on the *processes* directed towards *measuring* environmental impact, and the establishment of new *national regulations* directed towards implementing *ecosystem-based management (EBM)* systems and new ways of justifying the environmental impact from human activities.

In national policy formation, environmental questions are, as all other policy fields, shaped trough compromises between conflicting priorities and concerns (Hoppe 2005; Majone 1989). Rather than a shift towards a "more environmentally friendly" policy, our current knowledge of the new systems indicate that policy decisions seek to maximize the benefits for humans from ecosystems (Andersen 2017). We hypothesize that the shift towards EBM, represents a change in the key principles – the logic – for how compromises between competing priorities and concerns are reached. This change has been important to increase the capacity to take justifiable decisions, but the significance and its impact on the ecological turn for environmental governance remain open and uncertain.

Empirically, EcoLogic moves to close this knowledge gap by studying and comparing Norway and Sweden, two countries that have ambitious environmental policies and have been at the forefront

internationally in the work of implementing and making a more ecological environmental governance operational. They provide institutional settings that are similar enough to allow comparison, but the two countries differ on the formal and informal structures for integration of expertise in policy formation, as well as displaying different relationships to the European Union. They also differ in patterns of interaction at the interface between science and policy. Such variance makes it possible to use the countries as "contrast fluids" for each other, to uncover and highlight distinctive traits and peculiarities.

Our main motivation is to understand changes in environmental governance fuelled by the ecological turn. Thus, we are interested in the "the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes" (Lemos & Agrawal 2006: 298). Söderström et al. (2016) show how environmental governance and ecosystem management to a large extent have been covered by two separate research traditions: Firstly, there is a management literature dominated by natural science scholars focusing on how this approach can be (or is) implemented in various areas of resource management (fisheries, forests, marine areas), often in a specific (eco)region. Secondly, there is a governance literature dominated by social science scholars analysing new arrangements for environmental decision-making, without a specific focus on the ecological turn. Moreover, based on a large literature-review, Söderström et al. (2016) show that that the specific challenges facing the implementation of EBM is scarcely addressed in the governance literature and that discussions on the institutional design and science-policy interface in the management literature could fruitfully learn from the governance literature.

The term governance is in itself ambiguous**,** as it includes approaches from several disciplines within the social sciences. While the main focus of the governance debate is on institutional networks and the organisational structure of governing, it also interacts with the governmentality literature which highlights the processes and assumptions that govern subjects and societies (Rose & Miller 2010). Eco-governmentality (Lemke 2007) is a relevant concept for EcoLogic, in which Foucault's concepts of biopower and governmentality is applied to the interaction between the social and natural worlds. For EcoLogic, the governmentality and governance concepts provide a rich source of complementary approaches to understanding the ecological turn in governance and the logics that underpin these developments.

EcoLogic thus draws on important insights from both management, governance and governmentality traditions and addresses the gap between them. In addition, the specific research focus and design are motivated by a set of theoretical and empirical findings and problems stated by the research literature and on research from the project team (Andersen 2017; 2019; Berg & Lidskog 2018a,b; Boström et al. 2018; Lundberg & Sataøen 2019; Neby 2019; Neby & Zannakis 2020; Rykkja, Neby, & Hope 2014; Sataøen 2018; Sataøen et al. 2015).

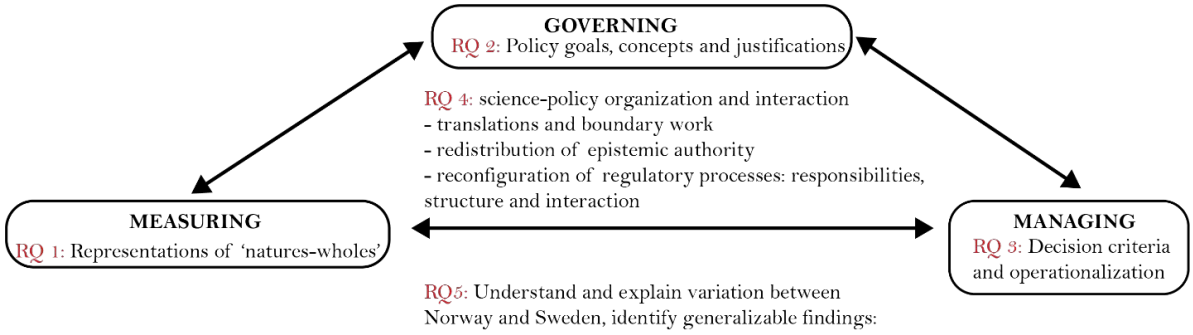
1.2 Theoretical approach and methodology

The overall research design is developed to analyze the science-based *processes* of *measuring* environmental impact, the regulatory processes when establishing new *national regulations* for implementing EBM systems and how environmental impact from human activities are justified in political

processes. They encompass different individual actors and organizations with different roles in the processes – scientific, administrative and political. We focus on state-level initiatives involving central environmental agencies and science-based knowledge production to meet specific policy goals for an ecosystem-based environmental policy, paying particular analytical attention to science-based attempts at standardizing the measurement, categorization and representation of the state of ecosystems. This means that our primary interest is on the performative effect of various ways to operationalize 'nature-wholes'. In this proposal we use the term EBM, but the processes of interest are often categorized under other terms, such as ecosystem services, biodiversity and sustainability policies, or the bioeconomy. Thus, our main focus is on the mechanisms, drivers and barriers at play. To investigate this, we will perform a systematic, empirically based comparative analysis that is based on – and seeks to develop – a number of interpretative social science perspectives.

Figure 1 illustrates, at a conceptual level, the relationship between the main processes that we will study, and their link to five research questions (RQs) for the project. In the following section we provide a more detailed description of each RQ, as well as the theoretical foundation, relevant data, and methodology for each RQ, and how the project expands on, and adds to current knowledge.

Figure 1: Illustration of main concepts and Research questions (RQs)



An important aspect of our proposal is that we understand managing, measuring and governing as processes that are dependent upon each other. To paraphrase Hacking (1990:6) - defining new classes of natures for the purpose of measurement and statistics could also have consequences for the ways in which we conceive of nature(s) and think of its possibilities and potentialities. But we would add that the need for defining new classes, measurements and ways of operationalizing the 'health of ecosystems' can be fueled by new policy concepts. We consider the direction, or order, of the processes as an empirical question. To support an empirical investigation of these processes, each RQ directs our analytical attention to different observable phenomena, strategically selected to inform our analytical objectives.

RQ 1: What kinds of representations of 'nature' are produced in ecosystem-based management?

The ecological turn has transformed what kind of knowledge and information that are considered relevant for making justifiable decisions and designing management systems, and for reconfiguring core concepts

and policy goals. Several contributions motivate our interest in the link between knowledge production and decision-making:

Science-historian Kristin Asdal (Asdal 2008) has traced the more holistic approach to environmental problems in Norway back to the late 1980's and the work of defining a safe threshold for long-range air pollutants. Asdal has illuminated how the work at the science-policy interface not only established a new management system for air pollutants, but also produced a representation of a new "nature-whole". Through the development of monitoring systems, measuring techniques as well as scientific-political negotiations needed to establish a critical limit, a new representation of nature as tables of numbers and maps was produced. Asdal (2008:125) argues that this representation helped produce "a governable space of 'pollution', a governable space which then lent itself to political intervention". A crucial point in Asdal's analysis is that this representation of a "nature-whole" also made it possible to link nature to the "economy" in new ways. The critical-limit approach made nature's ability to absorb pollution a scarce benefit that should, according to standard economics, be used to maximize the ecosystem services available. The question was not so much to reduce pollution per se but to find the "correct" amount of pollution. Comparable accounts of this development have been given for Sweden (Bäckstrand 2000), the UK and the Netherlands (Hajer 1995).

Following this literature, PI Andersen (2017) has showed that the shift towards a more 'holistic' and ecosystem-based approach has entrenched the core principles in Norwegian environmental policy. It is part of the legal context for management decisions, and has gradually become the standard for policy-goals in the management of many sectors. The empirical basis for his analysis was a broad set of Norwegian parliamentary debates from the period 1945-2013. The findings indicate that the ideas from the ecological turn since the 1990s has become part of policy concepts and how decisions are justified (relevant for RQ2 introduced below). However, rather than *avoiding* environmental harm the justifications are based on new representations (information and estimates) on how the ecosystems *will* be influenced if a particular activity is initiated (or continued). This indicates a new, somewhat paradoxical, logic of management of ecosystems:

The increased policy relevance of ecosystems is based on the realization that they are vital for human life and that even if humans have the capacity to change how they functions, we should refrain from doing so. Thus, a primary goal is to maintain or restore ecosystems to their 'original' or 'optimal' state, and to avoid industrial and extractive activities that could cause irreversible harm. However, the new measurements- and regulatory management systems that are established produce policy-relevant information on the state of ecosystems. The paradoxical outcome of this flow of 'eco-information' is that the state of ecosystems often comes to be treated as governable objects. That is, ecosystems and other 'nature-wholes' and what they *should be* in the future is up for political debate and decision-making.

RQ 1 directs our analytical attention to the representations of nature, but also on the (mis)alignment between the representations used by scientific, administrative and political actors. The literature indicate that there will often be considerable time-span between changes in policy goals and the actual implementation of new policies. Furthermore, the establishment of a new scientific representation does not necessarily lead to a new political understanding (see Sörlin 2013). While Asdal convincingly shows that

changes in a scientific approach for air-pollution can be traced back more than 30 years, Andersen (2017) shows that the political breakthrough of this approach in Norway can be dated to the late 1990s. And the first time measurements of ecosystem health was implemented as an EBM plan, was in a marine management plan from 2006 (White paper No. 8 (2005-2006)). In other sectors ecological measurements are still under development in both countries (an overview for Norway is given in the last biodiversity whitepaper: Meld. St. 14 (2015–2016)).

Why this time-gap? It can obviously take a lot of resources (time and money) to collect relevant data. Furthermore, it can be difficult to design measurements that provide relevant and robust information for decision-makers. However, the literature also supports that these processes are entangled in existing ways of both measuring and regulating. Thus, rather than a "mere" measurement problem, the task at hand will often be a broader reconfiguration of expertise (Sörlin 2013) or re-institutionalization of regulatory processes, that also could have legal and organizational consequences. As we will detail out later (see RQ3), these processes will typically also re-distribute epistemic authority, e.g. the professions and knowledge providers that have relevant knowledge. Thus, how policy-goals are translated into measurements have an impact on both forms of scientific representations and distribution of epistemic authority.

We understand the representations of nature as an important part of the analysis because they are closely linked to policy instrumentation. This can be defined as "the set of problems posed by the choice and use of instruments (techniques, methods of operation, devices) that allow government policy to be made material and operational" (Lascoumes & Le Gales 2007:4). The choice of instruments is not 'neutral' or something that follows directly from policy goals with broad political support. Instead the choice of policy instruments is a highly political activity that can also produce non-intended effects. This approach thus gives analytical tools to unpack how, by what arguments and based on what assumptions, the main actors in the field try to influence the choice of instruments and their specific composition.

The motivation to explore this dimension also stems from a research literature indicating that measuring 'ecosystem health' is difficult and typically builds on indirect measurements (proxies) such as ecological indicators. These are often summarized in nature-statistics, and increasingly linked with complex scenario or simulation models that seeks to predict how human action will influence ecosystems (Dessai et al. 2009; Pielke, Sarewitz, & Byerly 2000). This literature also shows how the ecological turn has contributed to an enormous expansion of data from environmental monitoring and assessment processes during the last decades. These data make it possible to represent the environment and ecosystems entities in the form of standard statistics. Especially, ecological indicators play a key role in this emerging representation of nature (Miller 2005; Rametsteiner et al. 2011; Turnhout, et al. 2007).

Norway and Sweden provide several examples of processes and systems that are set up to develop and refine the measurement of such categories. An interesting example is the Norwegian Nature Index. It uses a large number of species and ecosystem indicators to calculate the status of the ecosystem relative to its 'reference state', expressed as a decimal between 0 and 1 (Certain et al. 2011). This index and its impressive and problematic reduction of complexity may be paradigmatic for the approach to holistic environmental management that we focus on.

This kind of numerical mode of representing the state of nature could be understood as a new way of making it visible (Miller 2005). More specifically - qualities of nature that were not visible before, are made visible through statistics. Most of the existing literature in this field takes the establishment of statistics on social phenomena as its object (Desrosières 1992; Hacking 1990; Porter 1995; Rose & Miller 2010), and argues that it was important for the development of the modern state. Departing from this strand of literature, we will discuss the consequences of representing nature as statistics and investigate what new kinds of *natures* emerge.

RQ 2: How are representations of nature used to justify management and policy decisions?

In RQ 2 we are interested in analyzing management decisions and political decision-making. We are especially interested in the *reasons* put forward for the decisions taken and the basis for creating compromises between competing concerns and interests, such as profitability of natured-based industries versus ecosystem-health. To investigate this, we will analyze how decisions are justified in documents such as white papers and verbatim reports from parliamentary debates. We expect that these justifications (in public administration, at ministries, or in parliament) will include assessments of whether the proposed action or alternative is justifiable, e.g. whether the policy goals can be achieved, given the information provided on current status, and expected (predicted) outcome or impact of the proposed action.

We will use the theoretical concept of justification principles, as proposed by Boltanski and Thévenot (2006), in this analysis. Justification principles are crucial argumentative resources in public debates, also in debates on nature and the environment, thus they are observable in the language used by actors (Andersen 2017; Blok 2013; Centemeri 2015; Lafaye & Thévenot 1993; Thévenot, Moody, & Lafaye 2000). Boltanski and Thévenot (2006:159-211) present a model of justificatory argumentation in public debates, and describe how justifications are expressed in the form of different vocabularies or value systems (orders of worth). The principles refer to different conceptions of the common good; as tradition, solidarity, competition, efficiency, sustainability, etc. Justification principles are considered as the product of historical and cultural processes; they are embedded in social institutions and organizations, and important for the co-ordination of collective action that are key for processes that we study.

Boltanski and Thévenot do not propose this as a universal model of all the possible forms of justificatory argumentation. They state that the validity of principles is limited by spatio-temporal context, and tied to a specific culturally and linguistically unique vocabulary. The framework is well suited for a comparative project, both for comparing cases within each country, and to compare justifications between the two countries. Moreover, justification principles are not static; they are tested out, and their relevance is renegotiated in situations of disagreement and conflict. As a consequence, the theory focuses on situated action and language use, and how actors make various resources (such as ecological indicators) relevant. The framework can therefore be applied to examine the role of expert knowledge in justifications.

As indicated above Andersen (2017) has analyzed Norwegian parliamentary debates from before 2013 in a previous study, he is also part of another RCN funded research project (*Changing Nature*) that uses this analytical framework to analyze the public debate in Norway. In EcoLogic we will expand this work by

including a new set of debates from the last decade from both Norway and Sweden, compare these debates, and study how justifications can by linked to the other processes that we study.

Our interest in justifications also stems from the tendency to discuss and sometimes criticise the role of expert knowledge in policy formation and environmental decision-making. However, based on the literature we hypothesize that *the ecological turn intensifies well-known problems related to the movement of knowledge between the spheres of science and policymaking*: In addition to the specific uncertainties related to measuring 'ecosystem health', the operationalizations are often based on normative assumption on what kind of ecosystem states that is 'normal' or 'optimal'.

RQ 3: How, and by whom, are new operationalizations and translations of policy concepts created?

Information provided from measurements should ideally be available in a form that supports regulation and decisions-making. Typically, there is a need to define decision-criteria, for example to operationalize *when* environmental harm or pollution is unacceptable or when 'sufficient' biological diversity is achieved. These are questions that analytically can be separated from measurement problems, although they are entangled. While measurement problems can be defined as questions that can be solved by scientific expertise, management problems often transgress 'the boundary' between science and politics, as they demand definitions of decision and quality criteria (Brown 2009; Collins & Evans 2008; Nowotny 2000).

Relevant examples are the definitions of 'normal nature' in nature indexes and 'particularly valuable areas' in biodiversity policy. These are measures that are important because they are used to define the distance between status and policy goals. They are often presented as 'science-based', but they are clearly (also) based on a normative definition of how the 'nature-whole' ought to be (Andersen 2017; Asdal 2008; Turnhout 2009; Turnhout et al. 2016; Turnhout et al. 2007; Turnhout et al. 2014).

RQ 3 addresses a core question (how and by whom are operationalizations made), because of the importance given to science-based expertise in late modern society. Science-based expertise plays a key role in identifying, describing, and thus solving environmental problems. It is assumed to be crucial for developing high quality, effective and legitimate policy responses to these problems. The relationship between knowledge production and policy development should be understood as a complex social interaction, involving stakeholders, industry, scientists, and policy advisers. Hence, the value of scientific knowledge for management and policy development is shaped by the interplay of these actors (Cash et al. 2002; Gieryn 1999; Guston 2000; Hoppe 2005; Jasanoff 2005; Wesselink et al. 2013).

Knowledge is embedded in social and material structures, it is contextual, and it takes active work to move it from one context to another, for example from a scientific to a political context. Such work can be termed boundary work (Gieryn 1999) The formal and informal structures that bridge science-based knowledge with policy decisions are important because they are crucial for how scientific findings are translated to policy relevant knowledge (Andersen 2019; Boezeman et al. 2013; Halffman & Hoppe 2005; Hoppe & Wesselink 2014; Lidskog 2014; Rametsteiner et al. 2011; Wesselink et al. 2013). Successful translation results in serviceable truths. This is achieved when the output is perceived to be scientifically

adequate (*credible*), relevant for the policy makers (*salient*) and acceptable for a divergent set of stakeholders (*legitimate*) (Cash et al. 2002).

While the concept of boundary organizations is relevant, it should be noted that the boundary work that is done in science-policy interactions does not have to be organized within a separate or permanent organization. Instead, it could be conceptualized as hybrid management (Miller 2001). In Norway, several of the research institutions in the environmental domain do research *and* management tasks for ministries (Andersen 2019). Sweden is often considered to have a clearer demarcation between science and policy. However, policy implementation is typically delegated from ministries to governmental agencies, thereby also delegating 'realpolitik' to expert institutions. The response to COVID-19 in the two countries illustrates this difference. In Sweden, the state epidemiologist has been responsible for justifying the relatively modest measures taken. The Norwegian response has been justified by the Prime minister, sometime against the advice from the Institute of Public Health. Also, short term and ad-hoc advisory committees, such as working groups selected by a ministry to produce Official Swedish or Norwegian Reports (SOU/NOU), can embody many of the properties of boundary organizations described above (see Boezeman et al. 2013).

Analytical terms like "boundary" and "hybrid" can be criticized for implicitly defining science and policy as spheres that ought to be separated, a view that is not necessarily shared among all engaged actors or reflected in how processes are organized. An analytical approach open to the potential variety of hybrid management is preferable. There is however, solid empirical evidence that moving knowledge is a difficult task due to the basic tension in science-policy interaction. Put shortly, such processes, must on the one hand officially be organized so that it can be depicted as transfer of 'objective' and 'sound' science, but on the other needs to allow for transactions and translations across the science-policy boundary. We will explore how the balance of these opposing considerations is managed in the environmental regulatory science processes that we study.

Based on the above discussion **the next section summarizes how our research questions, theoretical approach and empirical data are linked, and how data will be analyzed:** When we map out the structure of science-policy interface, we are especially interested in the sites and processes related to the establishment of serviceable truths. In addition to interviews, we will analyze relevant documents related to the development of ecosystem-based environmental management in both countries (**WP1**). We will then grant specific attention to the policy areas that we propose to study (**Marine and forest management in WP 2 & 3**). The different actors' views on what characterizes credible, salient and legitimate knowledge will be a main topic in the interviews - in terms of their attitudes on how it ideally should be (expectations), how they describe current practice (experiences), and in what ways it could be done better (critique). To complement the interviews, we will seek to obtain relevant observational data from sites and processes related to the establishment of serviceable truths, such as meetings and seminars where the content and formulations in a text that are to be published, are on the agenda.

The research design and the variety of empirical data gathered – from documents on formal policy goals and decisions, to interviews and observations of interaction – allow us to analyze environmental science-policy interaction as a multilevel phenomenon: Micro-level boundary work can be interpreted in light of the

specific institutional arrangements that this interaction is embedded within (see Hoppe 2010). When we are interested in both the *patterns* of interaction and *structure* of the science-policy interface, this pertains to the division of labour between science-based expertise, policy advisors and policymakers. This division of labour can be understood as both the outcome of, and the resources for, continuing work (potentially boundary work). Thus, the *processes* that we study will give examples of how this division of labour is articulated, reproduced and potentially modified (Halffman & Hoppe 2005). We will analyze how this can be understood as being shaped by current policy goals and existing science-based knowledge, international policy- and knowledge institutions such as EU and IPBES, as well as the historical, cultural and political trajectory of each country (Halffman 2005; Halffman & Hoppe 2005; Jasanoff 2005). RQ 4 and RQ 5 can specified:

> **RQ 4: How are the processes shaped by the formal and informal structures of the science-policy interface and the dominant public epistemology?**
>
> **RQ5: How can we understand and explain the observed variation on RQ 1-4 between Norway and Sweden, and what are the generalizable findings from this comparison?**

In sum, the planned analysis for RQ 4 and 5 will support a rich and nuanced comparison between the patterns and structures that we identify in the cases that we study. **RQ 4** takes stock of the processes related to both RQ 1,2 and 3 and direct our analytical attention to how they are interlinked. In light of the above discussion this can be specified to include both the processes of negotiation and interactions that make knowledge transaction possible, and the one that renders hybrid knowledge-constructs more credible by "discursive 'repurification' into distinct public categories of 'science' and 'policy'" (van der Sluijs et al. 1998: 295).

The concept of public epistemology in **RQ4** and the comparative effort formulated in **RQ5** takes synthesizing our findings one step further and aims to contribute to a rather sparse literature from similar comparative studies: Jasanoff (2005) and others (Halffman 2005; Lentsch & Weingart 2009; Miller 2008) have suggested that there exists different modalities of producing relevant, credible and legitimate public knowledge that varies between countries and between policy domains within a country. In sum, this can be conceptualized as a *public epistemology*. Different public epistemologies can cause differences in ways of structuring the science-policy boundary, the role expectations attributed to different actor groups (scientists and policy-advisors) and how the quality of science-based knowledge is evaluated. For example, based on a comparison of the biotechnology regulations in USA, UK and Germany, Jasanoff (2005) suggest that these countries have different public epistemologies due to their historical, cultural and political differences. For EcoLogic it is also relevant that Norway and Sweden display different relationships to the European Union (EU). Whereas Sweden became full member of the EU in 1995, Norway's relationship with the EU is governed by the agreement on the European Economic Area (EEA) from 1994. The EEA agreement implicate that Norwegian legislation is aligned with EU legislation, also in areas such as environmental protection. Nevertheless, it has been noted that the integration due to membership in EU and exposure to political and economic cooperative institutions has been deeper and more comprehensive in Sweden compared to Norway (Lægreid et al. 2004). How European and international policy and knowledge

processes (such as IPBES) interact with the domestic settings in Sweden and Norway is an integrated part of our analysis. We will contrast our findings to various existing typologies, and use the unique comparative dataset acquired to expand current knowledge in this field of research.

Comparative design and description of cases

The comparative design is particularly well suited to explore the significance of the structure of the science-policy interface. It allows us to perform a systematic study of how different public administration systems respond to and integrate 'ecological concerns' in environmental policy decisions. The public administration systems in Norway and Sweden have similarities and they belong to the same Scandinavian political-administrative tradition (Painter & Peters 2010). This means, among other things, an emphasis on universal welfare systems, equality norms, administrative decentralization and consensus orientation. Both systems build on a comprehensive and well-developed public apparatus that enjoys legitimacy and support among both the population and private sectors. At the same time, the Norwegian and Swedish systems differ on important parameters, and a divide between eastern and western Nordic models have been emphasized (Knudsen & Rothstein 1994; Lægreid 2017). This means, among other things, that Norway employs a system of ministerial rule, where each minister is individually accountable for the all activities in underlying administrative bodies. The Eastern Nordic model, of which Sweden is a part prohibits ministerial rule, as the Government's executive power rests with the collective. Consequently, a Swedish minister cannot be held individually accountable: exercises of accountability thus jeopardizes the entire cabinet. This in turn implies more politically independent and autonomous agencies in Sweden, as direct ministerial instruction of subordinate entities plays a lesser role and the distinction between central politics and delegated policy interpretation and implementation becomes clearer.

The organization of the state administration is also a matter of the relationship between science and politics, and how expert-based interests and premises are linked to, and weighed against, political interests. It also influences the conditions of authority towards the expert- and political domain. These trade-offs have been resolved in slightly different ways in Norway and Sweden. The Swedish system is based on clearer distinctions between the political and the expert domain. The decision-making processes are therefore formally de-politicized, politicians have little degree of instructional authority, and the goal is to increase predictability in the exercise of authority. The Norwegian model allows for a lesser degree of formal boundaries for the political responsibility and the expert - and political domains are more infiltrated into each other (Andersen 2019; Sataøen 2018). This requires sensitivity in the exercise of political authority, e.g. in that the political domain does not interfere in matters where there traditionally has been a certain degree of expert autonomy. The approach is flexible in terms of the integration of politics and expertise, for instance illustrated by the fact that ministries formally have instructional authority over directorates in Norway. While we do know that the integration of expertise and policymaking differs between these two countries, there are to our knowledge no studies that have compared how the ecological turn play out within different state administrations.

Our strategy for selecting policy sectors for this comparison is to first **(WP1)** analyze the overall environmental approach in each country and general processes directed towards establishment of EBM and

similar efforts, such as biodiversity policies, ecological indicators and nature indexes. In addition, we will study two policy sectors in detail (**WP 2 and 3**). This design enables a more detailed study of the regulation of human and industrial activity and processes where priorities and concerns are expected to be more explicitly present than in the development of a general environmental policy. We plan to study the environmental policy and management of marine (WP2) and forest ecosystems (WP3) in each country. These are strategically selected because their importance varies significantly between the two countries. The major industries in Norway, offshore petroleum extraction, fisheries and salmon farming, are all spatially dependent upon the use of marine and coastal areas. Norway has been a forerunner of making EBM operational in the management of the marine ecosystems. While Norway also has timber and paper production, this industry is considerably more important in Sweden, reflecting the relative size and importance that forest resources have in Swedish economy.

Work Package structure, empirical data and plan for data collection

<table>
<tr><th>Work Package</th><th>Description</th><th>Case</th><th>Data from each subcase</th></tr>
<tr><td rowspan="2">WP 1: General development of ecosystem-based environmental policy</td><td rowspan="2">Environmental principles and policy goals, overall structure and interaction in public administration and science-policy interface. Representations, operationalizations, justifications. (RQ 1-4)</td><td>Norway (1)</td><td rowspan="5">Documents: Type 1-3, from 2010-2020 in both countries; see main text.
Interviews: 7-10 interviews from each case; total for project is 50-60.
Observations: To complement interviews we will seek access to relevant meetings and seminars.</td></tr>
<tr><td>Sweden (2)</td></tr>
<tr><td>WP 2: Marine ecosystems</td><td rowspan="2">Environmental principles and policy goals, structure of public administration and science-policy interface: Representations, operationalizations, justifications. (RQ 1-4)</td><td>Norway (3)
Sweden (4)</td></tr>
<tr><td>WP 3: Forest ecosystems</td><td>Norway (5)
Sweden (6)</td></tr>
<tr><td>W4: Systematic comparison</td><td colspan="2">Develop, present, and refine interpretations and explanations based on comparisons, both between countries and cases. (RQ 5)</td></tr>
<tr><td>WP 5: Research seminar series, dissemination</td><td colspan="2">Activities directed towards working together with colleagues and international network, with in-house natural-science advisory board, participation at conferences, stakeholder dissemination.</td></tr>
</table>

The type of data collected for WP 1, 2 and 3 are identical and will be: 1) documents that states official policy goals, identify knowledge needs or that justifies changes in action or regulation, such as Whitepapers and minutes from relevant parliamentary debates. We will also include 2) documents from the communication between governmental agencies, ministries and research institutions and 3) documents from expert assessments such as reports with policy advice. Both countries have had numerous debates on how sustainability should be measured and achieved. There are also several expert-based reports on questions such as national policies for biodiversity, on environmental targets, on ecosystem services and the value of nature.

In addition to the set of documents from these processes we will 4) conduct a set of semi-structured qualitative interviews (25-30 in each country) with key scientists, experts and policy-advisors. Both countries have for example an environmental agency, but also several thematic agencies and a number of research institutes, permanent and ad-hoc expert bodies. 5) Observational data from meetings and seminars will be used to complement the interviews.

Thus, we plan to analyze three different thematic domains in each country, because we are comparing Norway and Sweden this results in a total of 6 cases. The table above provide an overview of the WP structure, RQs, cases and data material.

3.2 Project organisation and management

We organize the project in five partly successive work-packages: **WP 1, 2 and 3** are related to the three thematic cases described above and major analytical tasks are identical to those discussed in section 1.2. To support the comparison, these WPs are thematic, so data collection and analysis for both countries will be performed in parallel. Deliverables from each of them are at least two peer-reviewed papers, and an internal project report that sums up main findings from comparative efforts. Andersen will lead WP 1, 2 and 5, Berg and Sataøen WP 3. Neby will lead **WP 4** that is directed towards the overall theoretical and comparative ambition of the project, deliverable is a research monograph on the theoretical and empirical findings from the project and a PhD thesis (3 papers or a monograph).

WP 5 is dedicated towards collaboration with our established national and international network, and to expand this network. Planned activities include a series of 8 research seminars and workshops in the host cities Bergen and Örebro. We will invite relevant scholars to present work in-progress, and project team members will present preliminary findings and work in progress. The purpose is to provide additional experience, inspiration and outsider-perspectives, and to identifying weaknesses and gaps in our analysis. This WP will run throughout the project and the budget contains funding that allows us to cover expenses for planned activities, including a larger seminar in 2026 to present major findings from the project. This WP also includes other dissemination and publication activities. We have also set up a small in-house advisory panel with natural-science colleagues at NORCE that have expertise that is relevant for discussing the natural-science aspects of the processes that we study.

WP	Task	Description	Lead	2022				2023				2024				2025				2026			
				4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	1.1	Identify and collect relevant documents for 1.2-1.4, literature review, applications, employ PhD	GA																				
	1.2	Analyse RQ 1 - 4 based on documents (national policy in both countries)	GA																				
	1.3	Based on analysis in 1.2 select and conduct interviews of key respondets in each country	GA/HS																				
	1.4	Refine analysis of RQ 1-4 based on interview material	GA/HS																				
	1.5	Compare N and S (1.1-1.4), project report with results	GA/SN																				
	D	Deliverables: Project report, Paper #1 and #2	GA/HS																				
2	2.1	Identify and collect relevant documents, select interviewees and conduct interviews	GA/PhD																				
	2.2	Analyse RQ 1 - 4 based on documents (marine policy and management in both countries)	GA																				
	2.3	Compare N and S, project report with results	GA/SN																				
	D	Deliverables: Project report, Paper #3 and #4	GA/PhD																				
3	3.1	Identify and collect relevant documents, select interviewees and conduct interviews	MB/HS																				
	3.2	Analyse RQ 1 - 4 based on documents (forest policy and management in both countries)	MB/HS																				
	3.3	Compare results for N and S, project report with results	MB/HS																				
	D	Deliverables:Project report, Paper #5 and #6	MB/HS																				
4	4.1	Develop, present and refine theoretical concepts and models	SN																				
	4.2	RQ 5: Systematic comparison between cases&countries (project reports from 1.5, 2.3 and 3.3)	SN/PhD																				
	D	PhD thesis (Paper # 7,8,9 or monograph)	PhD																				
	D	Prepare and publish edited volume	SN/MB																				
5	5.1	NORCE natural-science advisory panel meeting	GA																				
	5.2	Research seminar serie with international colleagues invited to Bergen/Örebro	GA/HS																				
	5.3	PhD milestones: start-up, research stay abroad, deliver and defend thesis	PhD																				
	5.3	Present at international conference	All																				
	5.4	Dissemination activities directed towards stakeholders/public.	GA																				

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