Swedish University of Agricultural Sciences
Faculty of Forest Sciences

Department of Forest Products, Uppsala

Forest and water governance in Sweden

Styrning av skog och vatten i Sverige

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Abstract

Water related problems are highlighted as a challenge to sustainable development and the topic of forests and water is gaining increased attention worldwide. Governing forest and water is a complex issue, as the interactions are affected by policies and actors from multiple levels and sectors. In Sweden, forests cover much of the land and forestry is an important land-use, inevitably impacting the water in the landscape. This study aims to understand and explain the existing governance framework around forestry and water in Sweden. Based on the Policy Arrangement Approach, the study's research questions focused on the actors involved, the formal and informal rules, the resources and power structures and the discourses related to forestry and water in Sweden. To answer the research questions qualitative document analysis and interviews with relevant actors from different actor groups were undertaken. As a smaller part of the study discourses on the management level where examined by qualitative interviews with forestry practitioners.

The main findings of the study show that the issue of forestry and water in Sweden is a multi-actor, multi-level and cross-sectoral field. There is an overall agreement across all actor groups that the EU Water Framework Directive, adopted in 2000, raised the issue of forests and water on the Swedish agenda and that forestry as a land use impacts the water in the landscape. Furthermore, actors have a common understanding of the issue, where implementing water consideration in forestry is seen as a problem. However, two conflicting narratives concerning forestry regulations were found, where the ENGOs advocate more detailed steering, whereas authorities and the private forest sector advocate freedom under responsibility. At the management level forestry and water was considered a relevant issue as well, as forestry impacts water. Issues related to the quality of the operational plan were perceived as an impediment to achieving adequate water consideration in forest management.

Based on the findings, the study concludes that the involvement of multiple actors with differing interests call for participatory approaches in the policy making process, building on consensual goals, which could lead to a more solid implementation of the policy outputs. One option in the continuing policy making process could be to follow the ideal of deliberative democracy, creating regulations based on consensually agreed upon goals. Research organizations were highlighted as key actors by both ENGOs and the private forest sector, and could hold an important role as bridging organizations providing accountable expertise. Furthermore, the complex governance environment points to a need for developing the coordination and cooperation between authorities from different sectors.

Keywords*: forestry, water management, EU water framework directive, policy arrangement approach, water consideration, environmental consideration, participation, deliberative democracy.*

Sammanfattning

Vattenrelaterade problem har lyfts fram som en utmaning för hållbar utveckling och frågan om skogens inverkan på vatten får allt större uppmärksamhet världen över. Styrning av skog och vatten är en komplex fråga eftersom samspelet påverkas av politik och aktörer från flera nivåer och från flera sektorer. Större delen av Sveriges yta täcks av skog och skogsbruket är en viktig markanvändning som oundvikligen påverkar vattnet i landskapet. Denna studie syftar till att förstå och förklara den befintliga styrningen kring skogsbruk och vatten i Sverige. Studien baserar sig på det teoretiska ramverket Policy Arrangement Approach och forskningsfrågorna fokuserar på de involverade aktörerna, formella och informella regler, resurser och maktstrukturer samt diskurser relaterade till skogsbruk och vatten i Sverige. För att besvara forskningsfrågorna har en kvalitativ dokumentanalys och kvalitativa intervjuer med relevanta aktörer från olika aktörsgrupper genomförts. Som en mindre del av studien undersöktes även diskurser på förvaltningsnivå genom kvalitativa interjuver med praktiker i skogsbruket.

De viktigaste resultaten från studien visar att frågan om skogsbruk och vatten i Sverige inbegriper flera aktörer och flera sektorer på flera nivåer. Det finns en övergripande enighet i alla aktörsgrupper att EU:s ramdirektiv för vatten som antogs år 2000 lyfte frågan om skog och vatten på den svenska agendan och att skogsbruk som markanvändning påverkar vattnet i landskapet. Aktörerna har även en gemensam förståelse av frågan, där implementering av vattenhänsyn i skogsbruket ses som ett problem. Två motstridiga narrativ gällande reglering av skog hittades, där miljöorganisationer förespråkar mer detaljerad styrning och myndigheter och den privata skogssektorn förespråkar frihet under ansvar. Även på förvaltningsnivå ansågs skogsbruk och vatten vara en relevant fråga. Problem med kvaliteten på det operativa traktdirektiv lyftes som ett hinder för att nå god vattenhänsyn vid skogsskötselåtgärder.

Att flera aktörer med olika intressen är involverade i skog- och vattenfrågan belyser vikten av att använda metoder som bygger på deltagande i den politiska beslutsprocessen. Med mål som bygger på konsensus kan en mer solid implementering av de politiska besluten nås. Ett tillvägagångssätt i den fortsatta politiska processen skulle kunna vara att följa idealet i deliberativ demokrati genom att skapa regleringar som bygger på mål överenskomna genom konsensus. Forskningsorganisationer lyftes fram som viktiga aktörer av både miljöorganisationer och den privata skogssektorn. De skulle kunna ha en viktig roll som överbryggande organisationer som tillhandahåller expertis. Den komplexa situationen kring styrning av skogsbruk och vatten belyser också vikten av koordinering och samarbete mellan myndigheten från olika sektorer.

Nyckelord: *skog, vatten, skogsbruk, vattenförvaltning, EU:s ramdirektiv för vatten, vattenhänsyn, miljöhänsyn, deltagande, deliberativ demokrati.*

Preface

This study was conducted as a Master thesis for the University of Agricultural Sciences and concludes my five years as a forestry student. The study was made in collaboration with Swedish Water House (SWH), a neutral and independent platform for Swedish actors interested in international water issues, creating spaces for dialogue, cooperation and knowledge sharing. I want to thank my supervisors at SWH, Lotta Samuelson and Nicolai Schaaf, for giving me the opportunity to work with them on this interesting topic and for the support along the way. I also want to thank my supervisor at SLU, Daniela Kleinschmit, for invaluable guidance and support into the world of forest policy analysis. Finally, I want to express my gratitude to all the respondents for taking the time and effort to participate in the study.

Emma Berglund
Uppsala, June 2014

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1 Introduction

Humans and all other living beings on Earth depend on water for life and health. Freshwater is essential for agriculture, energy, drinking-water, sanitation and healthy ecosystems, all providing us essential benefits (UN-Water 2012). However, issues related to water are gaining increased attention, both globally and in Sweden. Population growth and economic development increase pressures on freshwater resources as domestic water use and demand for food, energy and industrial goods grow (UN-Water 2012). Freshwater scarcity, poor water quality, floods and droughts negatively impact human well-being, economic development and ecosystem functioning in many regions of the world, and water issues are highlighted as a main challenge to sustainable development (UNDESA 2005; Vörösmarty et al. 2010). In 2011, an estimated 768 million people in the world, or one in ten, did not have access to clean drinking water and four in ten people lacked access to improved sanitation (WHO 2013). The United Nations highlighted the water-challenge when declaring 2005-2015 the *Water for Life* decade and pointed out that "Water challenges will increase significantly in the coming years. Continuing population growth and rising incomes will lead to greater water consumption, as well as more waste" (UNDESA 2005). The World Economic Forum Global Risks Report ranks water as the third highest concern out of 31 global economic, environmental and societal risks, illustrating the growing concerns over scarce water resources (World Economic Forum 2014).

There is a recognition of the importance of sustainable water use and the need to view water as a vital part of, and integrated with, all major socio-economic sectors (UN-Water 2012). Sustainable freshwater use can be defined in two ways: by quantity and quality. Quantity means that the water use should not exceed the available, renewable supply of freshwater and quality refers to potential water quality degradation or negative impacts on ecosystems (Launiainen et al. 2014). In Sweden, 20% of the country's area is covered by lakes, watercourses and wetlands and in an international perspective the water in big parts of Sweden is very clean (Bleckert et al. 2010). However, 95% of the Swedish waters are affected by humans in one way or the other and in a future perspective the clean and abundant water in Sweden is a valuable resource (Bleckert et al. 2010).

The water-related problems are influenced by forests, as forested ecosystems provide 57% of the renewable freshwater supply and a large proportion of all water used for domestic, agricultural and industrial needs come from forested catchments (Millennium Ecosystem Assessment 2005; Calder et al. 2007). FAO (2013) describes an increasing international momentum gained by the topic of forests and water, taking off after the International Expert Meeting on Forests and Water in Shiga, Japan in 2002. The Shiga Declaration highlights the need for increased understanding of complex watersheds and a holistic view on the forest and water interactions as well as other land-uses and socio-economic factors (Calder et al. 2007). The declaration became the basis in the development of a new generation of forest-water policies (Calder et al. 2007). Another important milestone for the international forest and water process was the Warsaw Resolution 2 on Forests and Water adopted by the 5th Ministerial Conference on the Protection of Forests in Europe in 2007 (FAO 2013). The signatory states and the European community committed to address four areas of concern: (1) Sustainable management of forests in relation to water, (2) Coordinating policies on forests and water, (3) Forests, water and climate change and (4) Economic valuation of water-related forest services (5th MCPFE 2007). Governance of forest-water also takes place on the national level of policy making, for example through regulations in the Swedish Forestry Act and through the Environmental Quality Objective system (Swedish Forest Agency 2014a; Swedish

Environmental Protection Agency 2013). These, and other central government policies referring to forests and water, will be described further in the background chapter.

For the private forest sector in Sweden, sustainable water use is a significant issue, as the sector is an important user of freshwater, both in its processing industries as well as indirectly through wood production (Eriksson et al. 2011; StoraEnso 2011). Sustainable water use in the private forest sector can be understood as (1) minimizing negative impacts on water quantity and quality in forestry, i.e. when growing and managing forests, and (2) using efficient water and energy processes and technologies, efficient water purification and limiting consumption to sustainable levels in the processing industries (Launiainen et al. 2014).

Water governance is a complex process as water resources are influenced at multiple scales by many actors and sectors (Stein et al. 2011). Forest and water interactions can be affected at several levels; by policies at the macro level, by management at the meso level and by the use of private people at the micro level. Policies affecting forest-water interactions comprise many different areas, e.g. environmental, forestry and energy, and these might be overlapping or conflicting. These policies come from different political levels, e.g. national, EU and international and, finally, multiple actors are involved at the different levels. The complex situation makes it an interesting area to study, trying to clarify how forests and water interact at different levels. Previous studies concerning forest and water governance in Sweden have mainly looked at the implementation of the EU WFD. Swedish Water House is currently starting a cluster group for forests and water, bringing together Swedish stakeholders to discuss issues related to forests and water in Sweden and internationally. As a base for their work there is a need for further knowledge about how governance of forests and water in Sweden takes place today.

1.1 Study aim

The aim of this study is to understand and explain the factors that influence governance of forests and water in Sweden today. The study focuses on forest-water interactions in Swedish forestry, i.e. when growing and managing forests, and on the macro level referring to policies, but also takes a small look at the meso level referring to management.

The next chapter will provide a brief overview of forestry and water interactions and a background to policies and scientific literature related to forest and water governance. The third chapter develops the theory that has been used in the study and the fourth chapter describes the study's empirical design. The fifth chapter presents the results of the study and the sixth chapter the discussion, ending with a conclusion.

2 Background

The background chapter will start with an overview of forestry and water interactions. Secondly, the main aims of the central Swedish government policies referring to forests and water, as well as forest certification, will be described. The last part of the chapter will present scientific literature covering the topic of forest-water governance, with a focus on Swedish studies.

2.1 Forestry and water interactions

Forests influence the hydrological cycle and therefore have an impact on water supply and quality (FAO 2013). Sweden is a water abundant country and the total freshwater withdrawal is 1.5% of annual renewable water resources (FAO 2014). In Sweden, the total area of forest land amounts to 28.2 million ha, or about 68% of the land area (FAO 2010). Productive forestland cover 23.1 million ha of the land area and forestry is practiced on a major part of it (Swedish Forest Agency 2013). Swedish forestry consists of a number of management activities which may impact the water chemically, physically and biologically to varying degrees and over varying periods of time (Ring et al. 2008). Forest harvesting in watersheds may change forest composition, plant uptake rates, temperature and moisture, water fluxes and soil conditions, potentially altering the biogeochemical processes in the soil and often resulting in nutrient leaching to the aquatic system (Kreutzweiser et al. 2008).

In Sweden typical forest management include clear-felling followed by site preparation and planting. During the rotation period, which varies between 60-120 years depending on tree species and ecological zone, pre-commercial thinning and commercial thinning is carried out. Forest fertilization is carried out on a relatively small part of the forest land (Swedish Forest Agency 2013). Site preparation, final felling, off-road driving and soil drainage are the forestry activities associated with highest risk of leading to habitat deterioration by creating chemical and physical damage to the environment (Ring et al. 2008). Forestry activities might lead to altering water flows, changing light and temperature conditions, increased levels of dissolved organic carbon in the water, nutrient and methyl mercury leaching, erosion and decreased amounts of dead wood and leaves in the water (Henrikson 2007). How the forestry activities impact the aquatic environment depends on a number of factors; which activity is carried out and how it is performed, the time of the year and the location within the catchment area, the proportion of the catchment area and length of the watercourse that is effected, the type of soil and topography, the geographical location and the spatial scale (Ring et al. 2008). Generally, forest management activities have the highest impact on water on the local level and in smaller water bodies (Ring et al. 2008).

Good water management in forestry can play an important role in keeping and restoring clean waters with rich biodiversity and especially creating forested buffer zones alongside watercourses and avoiding rutting has been highlighted as important measures (Bleckert et al. 2010; Ring et al. 2008; Swedish Forest Agency n.d.).

2.2 Swedish forest-water policies

2.2.1 The Swedish Forestry Act

The most recent Forestry Act from 1993 is based on the equal goals of production and environment, and sets the frame and the basic requirements for how forestry should be performed. This means that the forests should be used in an efficient and responsible way to provide sustainable yield and at the same time preserve biological and genetic diversity.

(Swedish Forest Agency 2014a) The law is characterized by freedom under responsibility and soft laws with focus on partnerships, knowledge and participation (Appelstrand 2012). Environmental consideration must be taken at all forestry activities and is specified in the Forestry Act Section 30 and its prescriptions and advice, which includes consideration to aquatic environments. The goal is that "water damage should be avoided or limited at any type of forestry measure". Included in the prescriptions and advice is to leave protective buffer zones, prevent nutrient runoff and sediment loads into water bodies and maintain or improve the water quality, prevent rutting and ditching should be done with consideration to water. If there is a need to prioritize between different types of environmental consideration, water is one of the prioritized areas and if the regulations have not been followed and there has been damage to the water or serious rutting, this should be repaired. (Swedish Forest Agency 2014a)

2.2.2 The Environmental Code, the EU Water Framework Directive and the Water Quality Management Ordinance

The Environmental Code Chapter 2 determines the general considerations that must be taken by all who perform activities that may harm the environment, which are to be applied parallel to the regulations about consideration in the Forestry Act (Swedish Forest Agency 2014b). The Environmental Code also concerns the protection of forests with high values and ditching.

In 2000, the EU Water Framework Directive (WFD) (2000/60/EC) was adopted, with the aim that all waters in the EU countries should reach good status by 2015. The directive aims at establishing water management based on river basins, streamlining legislation and extending the role of public participation (European Commission 2014). The implementation of the WFD in Sweden led to the establishment of Sweden's 5 Water Authorities and the Water Quality Management Ordinance (SFS 2004:660), which describes the implementation of the directive (The Water Authorities n.d.). Environmental quality norms express the quality a certain water body should have by a certain time and are used as a steering instrument within the Water Quality Management to reach good status by 2015 (Swedish Forest Agency 2010).

The 21 County Administrative Boards in Sweden are jointly responsible for managing the water quality in the country. Based on the idea that water management should focus on the drainage area, Sweden has been divided into 5 river basin districts. In each district one County Administrative Board is appointed Water Authority with responsibility for decisions and coordination. SwAM is responsible for coordinating the Water Authorities and for the implementation of the Water Quality Management Ordinance. Each Water Authority has a water delegation consisting of experts from the County Administrative Boards, municipalities and other bodies, appointed by the Government. The chairman is the county governor. The delegation makes decisions on larger issues for the entire river basin district, for example environmental quality norms, local measure plans and management plans. (Länsstyrelsen Västmanlands län 2009)

The Water Authorities have identified a number of environmental issues in Swedish waters, of which some can be associated with effects of forestry activities (Swedish Forest Agency 2010). This, coupled with the fact that a significant part of the aquatic environments are found in the forested landscape, makes forestry's potential to impact the aquatic environments large and therefore forest use will be of importance for the implementation of the WFD (Swedish Forest Agency 2010). The Water Authorities have decided on 37 measures aimed at forming the basis for achieving the environmental quality norms, which they have mandate to direct to authorities and municipalities. The Forest Agency is responsible for one of the measures:

"After consultation with the Environmental Protection Agency and the National Board of Fisheries, the Forest Agency should produce documentation and develop regulations and/or other instruments for appropriate buffer zones and other protective measures adjacent to water bodies so that good chemical status and good or high ecological status is maintained or achieved." The Forest Agency is responsible to ensure that the environmental quality norms are taken into consideration when dealing with notifications, permits, exemptions and approvals. The Forest Agency reports annually to the Water Authorities about the measures taken during the year in order to ensure that the environmental quality standards are followed. (Swedish Forest Agency 2010)

2.2.3 The Dialogue about environmental consideration in forestry

In 2010 the Government commissioned the Forest Agency and SEPA to develop a knowledgebase on how to better reach the environmental goals of forestry. They identified a clear gap between the Forest Agency's and the forestry sector's view on environmental consideration that ought to be achieved. As a result, the Dialogue about environmental consideration in forestry was initiated, aiming at creating "target images" and creating a better consensus between the Forest Agency and the forestry sector about which environmental considerations in forest management are necessary to reach the environmental goals. The target images shall reflect an expected level of environmental consideration based on the sectoral responsibility and a control station is settled for 2017. The focus of the target images concerning water is on functional buffer zones at regeneration felling and on how to avoid rutting. A functional buffer zone means that the consideration taken around a water body should be adapted to the local conditions to be most efficient. In Table 1, examples of the description of target images for a number of forest management activities. (Andersson et al. 2013)

Table 1. Examples of descriptions of target images for a number of forest management activities (Andersson et al. 2013)

Forestry activity / **Description of target image**	Regeneration felling	Stand establishment	Pre-commercial thinning	Commercial thinning	Off-road stream crossing
No cutting in discharge areas directly adjacent to water	X			X	
Leave broadleaves in coniferous stands	X				
Leave trees etc. for shadow, food, dead wood	X				
No rutting - no driving within ca. 10 m of water	X			X	
No soil scarification in buffer zone or within 10/5m of water		X			
No rutting		X			
No thinning if the buffer zone is functional			X	X	
No driving in water or ditches					X
No damage to bottoms and no sediment transport					X

The target images concerning water comply with the prescriptions and advice to the Forestry Act concerning water, but they are much more detailed as they describe how each forestry operation should be performed to reach the target image. However, target images concerning ditching and construction of forest roads are not yet developed. (Andersson et al. 2013)

2.2.4 Environmental Quality Objectives

The Swedish Parliament has adopted 16 Environmental Quality Objectives, which describe a long-term sustainable quality and state of the Swedish environment. Eight government agencies are responsible for follow-ups and for working with organizations and companies to reach the objectives. An All Party Committee on Environmental Objectives advises the Government on how to achieve the objectives. Over half of the objectives are to varying degrees related to forests and water; Sustainable forests, Natural acidification only, Zero eutrophication, Flourishing lakes and streams, Good-quality groundwater, Thriving wetlands, A rich diversity of plant and animal life, A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos and A Non-Toxic Environment. (Swedish Environmental Protection Agency 2013)

2.2.5 Forest certification

Forest certification has been an important private initiative in Swedish forestry, adding influence on state regulation by having higher requirements than the law (Keskitalo & Pettersson 2012). In Sweden, there are two main certification organizations; the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification Schemes (PEFC). Organizations can be certified if they follow certain social and ecological criteria decided by the certification organizations. Compliance is controlled by an independent third party auditor.

The Swedish FSC and PEFC standards for forest certification both contain a number of criteria concerning considerations to aquatic environments, for example that site preparation should not be performed in buffer zones adjacent to water, rutting should be avoided or fixed if it occurs, road construction should be planned not to alter the running of watercourses, buffer zones should be promoted and ditching is restricted (PEFC Sweden 2012; FSC Sweden 2010).

2.3 Literature background

There are a number of studies on water governance and the implementation of the WFD from other European countries. For example, Behagel and van der Arend (2013) look at participatory institutions and practices in the context of implementing the WFD in the Netherlands. They conclude that the introduction of participatory institutions failed to empower participants and did not take into account the context in which participants are situated, thus creating frustration and disappointment among the participants. They argue that this has harmed the legitimacy of the participatory institutions and possibly also the implementation process of the WFD in the Netherlands.

There are also a number of studies on water governance in Sweden, for example Andersson et al. (2012) studied the impact of the WFD implementation on the local level water management in a catchment in Sweden. The authors conclude that the WFD implementation process has not given attention to already existing collaborations and physical planners have been reluctant to accept the new environmental quality standards, both because they lack definitions but also because they challenge the already existing routine. The study also

indentified the lack of additional resources at the municipal level as a problem when trying to implement the higher levels of ambition resulting from the WFD.

The scientific literature on forest and water governance in Sweden is more limited than the general water governance literature.

Futter et al. (2011) held a transdisciplinary workshop aiming at developing an understanding of the implications of the WFD for forests and forestry in Sweden. Concerns that were raised included the lack of reference to forests in the WFD, concerns over the method for assessing ecological status and the process for environmental assessments, the role of River Basin Districts in the already existing framework in Sweden and a perceived lack of clarity in the legal framework. The authors conclude that the WFD did not seem to take into consideration the unique conditions of Swedish forests and question whether the WFD will help promote sustainable forestry in Sweden.

Keskitalo and Pettersson (2012) analyze the implementation of the WFD in Sweden and conclude that it resulted only in relatively small changes in the substantial law. Looking at the implementation in Swedish forestry the authors found that it is mainly based on developing and improving existing forestry measures, foremost buffer zones, and emphasizing the role of water in relation to these. The study highlights the context dependence and importance of the already existing norms and existing ways of working in the implementation of the WFD. The study also concludes that the determination of buffer zones is context dependent and complex, meaning that in the end the planning stage or the entrepreneurs determine the considerations that will be taken to water.

Sandström et al. (2011) investigate trade-offs between different competing functions from the Swedish forests and how these trade-offs are governed. They foresee an increasing conflict between timber production and water quality in the future as a result of the requirements to enhance water quality in the WFD. They assume this will impact how timber production can and should be conducted. Furthermore, they describe the multi-level governance according to the WFD, and conclude that the local level, being represented by Water Councils with representatives from municipalities, industries, land owners and interest groups, are responsible to develop solutions to local water demands. However, since they are newly established, there are few studies showing their capacity as governance institutions to solve conflicts between multiple functions of forests and water.

In regard to the goal of good ecological status in the WFD, Valinia et al. (2012) discuss the difficulty in defining this using a historical reference condition, as it is subjective and idealized. They suggest an approach to deal with this difficulty and at the same time reach the WFD goal of public participation by recognizing alternative reference conditions based on a combination of knowledge of authorities and local people as well as scientific knowledge.

The focus of previous studies on forests and water governance in Sweden has mainly been in regard to the implementation of the WFD. So far there have been no studies focusing on the whole policy arrangement of forests and water in Sweden, looking at the four dimensions of actors, resources and power, rules and discourses. This study contributes to fill this research gap by doing a mapping of the forest-water issue from the four perspectives in order to provide a broad picture of forest and water governance in Sweden.

3 Theoretical considerations

3.1 The Policy Arrangement Approach

Since the 1990s there have been a number of changes in environmental policies compared to the 1970s and 1980s, observed and described by, amongst others, Arts & Leroy (2006). They describe how environmental policy has become 1) a multi-sector field where responsibilities are shared among many policy domains, 2) a multi-actor field with an increased number of actors involved and changed roles and interrelations between them and 3) a multi-level field, with policies being increasingly transboundary and transnational.

To analyze and understand the new complexities of environmental policies a multi-sided approach is useful, looking at organizational and substantial content (Arts & Leroy 2006, p. 10). The Policy Arrangement Approach (PAA) is a conceptual framework aiming to describe and characterize policy arrangements. This involves defining the policy issue at stake, identifying the actors taking part in policy making and implementation, and the formal and informal rules governing their behavior. (Liefferink 2006, p. 45)

The PAA builds on two central concepts: political modernization and policy arrangements. Political modernization refers to "structural processes of changing interrelations between state, market and civil society, and to new conceptions and practices of governance" (Arts et al. 2006). This means that not only state, but also societal and private actors participate in the political decision making process, often referred to as governance. A policy arrangement is defined as "the temporary stabilization of the content and organization of a particular policy domain at a certain level or over several policy levels". It is suggested that day to day policy processes and interactions between involved actors gradually develop into patterns – a policy arrangement. These policy arrangements consist of substantial and organizational matters as well as their interplay. Furthermore, policy arrangements are the result of both strategic behavior and long-term contextual changes in society and politics. (Arts & Leroy 2006, p. 13)

There are four dimensions of a policy arrangement that are relevant to study in order to understand and analyze it: actors, resources, rules of the game and discourses. The first three deal with the organization of policy arrangements (institutional aspects) and the last one with its content (strategic aspects). Furthermore, the four dimensions are interrelated and a change in one dimension may lead to changes in other dimensions as well. This is symbolized by the tetrahedron (Figure 1). A policy arrangement analysis should include all the four dimensions and their interrelatedness. (Liefferink 2006, p. 47-49)

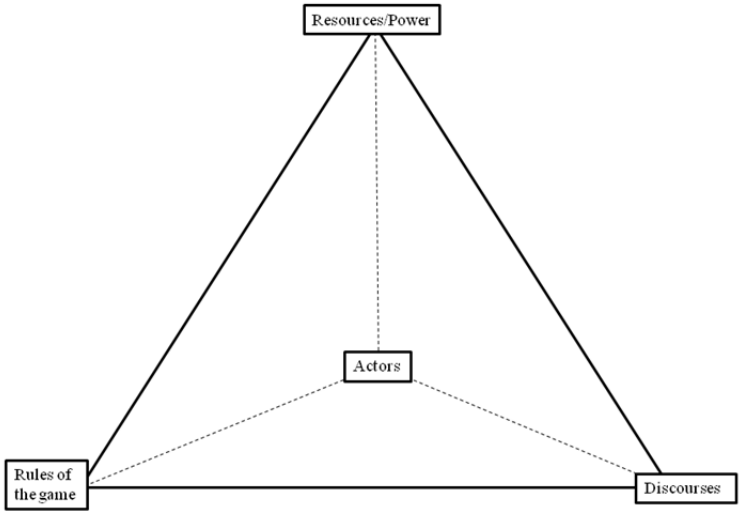

Figure 1. The four dimensions of the policy arrangement approach. Their interrelatedness is symbolized by the tetrahedron. Adapted from Arts et al. (2006).

The PAA builds upon a variety of theories and approaches found in for example sociology and politics. Focusing on the four dimensions of a policy arrangement gives a more comprehensive and dynamic analysis than using an approach which focuses on one or two dimensions, e.g. a discourse analysis or a policy network approach. (Liefferink 2006, p. 47-48) Because the aim of this study was to understand and explain the factors that influence governance of forestry and water, it was useful using a broad approach which can provide a thicker description of the issue.

The analysis can start at any corner of the tetrahedron, but the starting point affects the methodological tools to be used, helps delimit the study and sheds different light on the policy arrangement (Liefferink 2006, p. 49).

3.1.1 Actors

Actors refer to the actors involved in the policy domain and their coalitions (Liefferink 2006, p. 47). This study starts with the actor perspective because it is the most concrete way of getting an overview of the policy arrangement around a given issue; in this case forestry and water, and then the other three dimensions materialize from this. The key is to identify relevant actors and their influence in the policy process. This can be done 'in the field' and by studying policy documents. The actors should be clustered into groups of actors that have similar roles in the policy arrangement. Liefferink (2006) points out that the roles can differ between different cases and suggests the four roles of state, market, interests and experts. Based on the discussion around relevant actors in the forest policy process by Janse (2007), four roles have been identified as relevant for this study, in the context of forest-water governance in Sweden:

1. Authority actors
2. Private forest sector (including forest industry organizations/companies and forest owners organizations, but excluding companies which exclusively work with processing of forest goods)
3. Research
4. Non-governmental organizations (NGOs)

In order to identify the actors it is useful to create a map of actors displaying their influence and roles, see Figure 2. The actors are placed on the map according to which role they have in the policy process and from central to peripheral, where actors closer to the centre have more influence in the policy process. This map provides a good starting point for looking at the relative position of the actors and their power relations, connecting to the dimension of resources and power. (Liefferink 2006, p. 50-51)

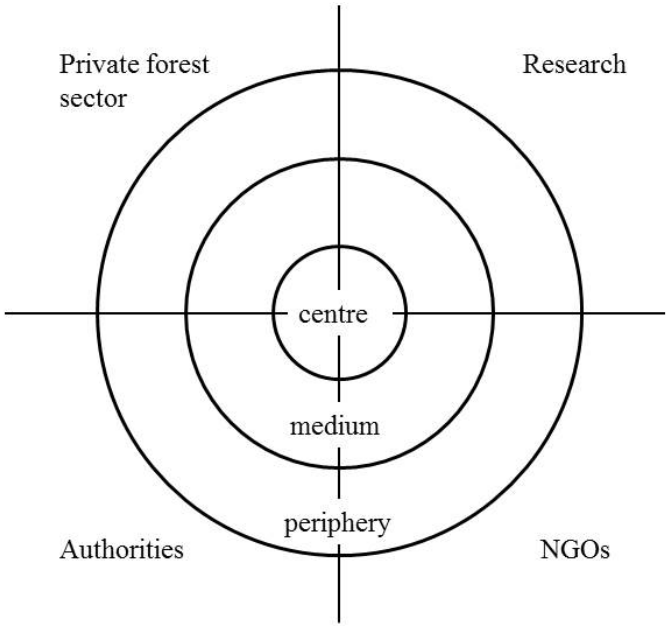

Figure 2. Map of actors displaying their influence, where actors with much influence are regarded as central and those with little influence as peripheral. The map also shows the actors' roles in the policy arrangement. Adapted from Liefferink (2006).

3.1.2 Rules of the game

The rules of the game is described by Liefferink (2006, p. 47) as "the rules of the game currently in operation, in terms of formal procedures of decision making and implementation as well as informal rules and 'routines' of interaction". Thus, rules have a strong connection with the actor dimension. Having an actor-based analysis of the rules of the game, focus should be on the rules governing interactions between the involved actors (Liefferink 2006, p. 53).

3.1.3 Resources/Power

Liefferink (2006, p. 47) define resources as "the division of resources between these actors, leading to differences in power and influence, where power refers to the mobilization and deployment of the available resources, and influence to who determines policy outcomes and how". Since this study takes its starting point in the actor perspective the actor's influence in the policy process and power relations between actors is the focus. The actors with power to influence the policy process should be regarded as central actors and those with little influence as peripheral actors, which can be displayed in the actor map (Figure 2).

3.1.4 Discourses

Arts et al. (2006, p. 99) define the concept of discourses as "the views and narratives of the actors involved – in terms of norms and values, definitions of problems and approaches to solutions". Discourses refer to the idea that language and how we talk about and portray something does not simply reproduce reality, but contributes to forming it by framing the way

we comprehend it (Bryman 2008, p. 499-501). This dimension adds to the analysis by grouping actors together according to the views they have about forests and water.

3.2 Research questions

Building on the theoretical background a number of research questions have been identified concerning the forestry and water governance in Sweden. The first set of questions concern the policy level and the second question concerns the management level.

1. How is the policy arrangement of forestry and water interactions designed in Sweden?
   a. Which actors are involved in forestry-water issues?
   b. What are the formal and informal rules concerning forestry-water issues?
   c. What resources/power structures concern forestry-water issues?
   d. What discourses are associated with forestry-water?

2. What discourses are associated with the forestry-water issues on the management level?

4 Empirical design

4.1 Methods

Building on the theoretical framework of the Policy Arrangement Approach, this study takes a qualitative research strategy with a deductive approach (Bryman 2008, p. 21-23), basing on the theories of political modernization and policy arrangements described in the previous chapter. A qualitative strategy, opposed to a quantitative survey, is appropriate since the study aims to understand the governance of forests and water with the starting point of the actors' perspectives and understandings of the issue. The first step of the study aimed at assessing the arrangement on the policy level and entailed a document analysis of government documents and qualitative interviews. The second step consisted of qualitative interviews with people working in practical forest management, aiming at gaining a small insight into the management level.

4.1.1 Document analysis

In order to get a first understanding of the forestry and water policy arrangement, government documents concerning forests and water were analyzed through qualitative content analysis, searching for specific themes (Bryman 2008, p. 529). The documents were analyzed according to the four dimensions of the policy arrangement; what actors are mentioned, what are the formal and informal rules, what resources or power relations are there and what discourses can be found. The documents were chosen based on their relevance for the topic of the study and were identified through government webpage searches. The criteria for selection of documents were to include documents concerning forestry and water management and water consideration in forestry from government authorities. The documents were analyzed using the qualitative software tool NVivo 10, where the information was coded according to the four dimensions and further investigated to find emergent themes. The results provided a first overview of the forest and water issue and increased the researcher's understanding of the four dimensions before conducting the interviews. The results from the document analysis were later used to complement and support the findings from the interviews.

4.1.2 Interviews focused on the policy level

In order to gain in-depth understanding about the four dimensions of the policy arrangement, semi-structured, qualitative interviews were conducted This method was appropriate since it puts emphasis on the interviewees' point of view and how he or she understands and frames an issue (Bryman 2008, p. 436-440).

A snowball sample was made by Swedish Water House (collaborative partner for the study) in their assessment of which actors are engaged in water and forestry issues, which resulted in a list of 123 people from 43 different organizations. This list, coupled with internet searches and input from my supervisor, resulted in a comprehensive list of actors involved in forestry and water issues which was used for the sampling of interviewees. Purposive sampling was used as a strategy to identify interviewees. This sampling approach builds on the idea that the best information is obtained by hand-picking interviewees that are most relevant to the issue being investigated and has privileged knowledge or experience about the topic (Denscombe 2010). In the theory chapter, four different groups of actors were identified as relevant in the policy arrangement, based on Liefferink (2006) and Janse (2007); authority, private forest sector, research and NGOs. Two to five interviewees from each of the four groups were identified, based upon their experience and knowledge about the topic of forestry and water, and ensuring a wide cross-section of actors. The number of interviews was decided beforehand to

be around 10-15 to be feasible within the scope of the study, but the goal was to keep interviewing people until saturation was reached, i.e. no new information was gained.

The interviews were conducted over the phone in order to save time and keep research costs down. Generally for qualitative interviewing, face-to-face interviews are recommended over phone interviews since it is believed to give more in-depth answers and the interviewer can observe body language and how the interviewee respond physically to the questions. However, there is some evidence suggesting that answers provided in a face-to-face situation compared to over the phone are not that different and, furthermore, phone interviews provide large benefits in terms of cost- and time savings, making the method highly efficient in relation to the large volumes of data that can be collected. (Bryman 2008, p. 457-458)

The interviewees were contacted via email with an invitation to participate in the study and a short explanation of the purpose of the study and confidentiality and privacy issues (Appendix 1). The email was followed by a phone call after a couple of days, to see if the interviewee agreed to participate in the study, as well as to offer an opportunity to ask questions. Contact had already been established with some of the interviewees at a previous seminar on the topic of forests and water arranged by SWH.

The interviews consisted of questions aiming at gaining information connected to all four dimensions of the policy arrangement (Appendix 2). The first part of the interview consisted of questions concerning the interviewees' view of the topic of forestry and water in Sweden. This aimed at understanding the discourses among the actors. The second part of the interview concerned the actors and networks. The third part of the interview concerned the rules and resources/power. The questions concerning resources/power focused on relational power, coalitions and influence over policy outcomes.

4.1.3 Interviews focused on the management level

To find out more about water consideration on the management level in the private forest sector, semi-structured qualitative interviews with people working in practical forestry was an appropriate method. This aimed at getting an insight to how practitioners frame and understand the issue and get their point of view. Since this is only a small part of the essay a small number of interviews was conducted. Based on the description of the process that leads up to a practical forestry operation made by Andersson et al. (2013), combined with the results from the policy level interviews, three different roles with the possibility to influence water consideration on the ground in forest management were identified as relevant; (1) the forest management plan maker who makes the higher level forestry plans, (2) the operational planner who makes the operational plan for the forestry operation, for example a clear felling of an area, which is forwarded to (3) the forest machine operator who conducts the forest operation on the ground. To save time and keep research costs down, the interviews were conducted over the phone.

4.1.4 Data analysis of the interviews

The interviews were audio recorded and transcribed in full. The transcriptions were analyzed to address the research questions, using the qualitative software tool NVivo 10. In NVivo, the transcripts were coded in order to structure the information and find emergent themes answering the research questions. The first step of the coding consisted of coding the transcripts according to the four dimensions of the policy arrangement, making sure all information about actors, resources/power, rules and discourses was grouped together respectively. The second step of the coding consisted of going through all the information

gathered under each of the four dimension codes, one by one. In doing so, emergent themes (for example a discourse or actor interactions) were extracted from the text and sub-nodes were created as the coding went on, gathering all information related to one emergent theme in one place.

4.1.5 Ethical considerations

Ethical considerations and the moral integrity of the researcher are important aspects of ensuring the research process and -findings are trustworthy and valid (Hesse-Biber & Leavy 2011). Informed consent is one of the most important procedures when conducting a study including human subjects (Bryman 2008; Hesse-Biber & Leavy 2011), and the most relevant consideration for this study. The first contact with the respondents was made by sending an email containing information about the researcher, the purpose of the study, the respondent's role, confidentiality, the organization behind the study and the intended use of the study. The second contact was made by phone after a few days, offering the respondent opportunity to ask any questions about the study. A second step of ensuring ethical consideration is taken is by protecting privacy and confidentiality of the respondents. This is ensured by not revealing their identities, but only referring to them by which actor group they belong to.

4.1.6 Reliability and validity

By adapting the concepts of reliability and validity used in quantitative research, the quality of qualitative research can be assessed. Building on Bryman's (2008, p. 376-381) examination of different stances to assessing qualitative research, the following components were considered: *reliability* referring to the potential of replicating the study at a later occasion and gaining the same results, *internal validity* referring to how credible the findings of the study are and *external validity* referring to the possibility to generalize the findings to other contexts.

When conducting qualitative interviews there is a risk that the interviewee does not understand the questions posed by the interviewer and that the interviewer misinterprets the answers or makes subjective interpretations. In order to enhance the reliability of the study, the following actions were taken:

i) A test interview was performed (not included in the sample), after which the interview guide was modified making sure the questions were clear and understandable.
ii) A thorough description in the methods chapter of the procedures taken in conducting the study and the interview guide attached as an appendix.

In order to enhance the internal validity of the study, the following actions were taken:

i) A mix of snowball and purposive sampling, ensuring interviews were conducted with relevant actors with knowledge and experience of the field.
ii) Triangulation in terms of using more than one method, i.e. interviews was complemented by document analysis to gain higher confidence in the findings.
iii) Recording and transcribing of the interviews ensuring all information, tones and expressions were captured.
iv) Comprehensive and methodical data analysis using the data software NVivo 10.
v) Use of the theoretical framework in analyzing the data, ensuring consistency.

In order to enhance the external validity of the study, the following actions were taken:

i) A thick description of the context of the study (foremost the background chapter), enabling the reader to judge the transferability to other contexts.
ii) As much description of the sample of interviewees that could be given without compromising the confidentiality.

4.2 Materials

4.2.1 Description of sample: document analysis

Three documents and two regulations were analyzed in the document analysis. Two documents were derived from the Swedish Forest Agency:

- Andersson, E. et al., 2013. Målbilder för god miljöhänsyn. En delleverans från Dialog om miljöhänsyn (~Target images for good environmental consideration. Part delivery from the Dialogue on environmental consideration). Rapport 5 2013., Jönköping.
- Swedish Forest Agency, 2010. Vattenförvaltningen i skogen (~The water management in the forest). Meddelande 1 2010, Jönköping.

One document derived from a Water Authority, represented an example of a management plan for a water district. In this document, only the parts relevant to forests and water were analyzed, since much of the plan concerned other areas where no interactions with forests were mentioned.

- Länsstyrelsen Västmanlands län. (2009). Förvaltningsplan Norra Östersjöns vattendistrikt 2009-2015 (~Management plan for the North Baltic Sea water district 2009-2015).

4.2.2 Description of sample: policy level interviews

Following the purposive sampling method, the person who was interviewed from each organization was someone who was working with forests and water and/or environmental consideration on a higher level in the organization. In the NGO group, environmental non-governmental organizations (ENGOs) were deemed to be the most relevant in this context. Accordingly, two ENGOs were interviewed and the group is referred to as ENGO instead of NGOs in order to be more transparent to the reader. Table 2 provides a sample overview.

Table 2. The respondents for the interviews on the policy level

	Authority	**Private forest sector**	**Research**	**ENGOs**
Number of interviewees:	3	5	2	2
Description of interviewees:	1 person with insight in forestry and water issues from a ministry 2 persons responsible for forests and water at two different authorities	1 representative for a forestry interest organization 1 representative for a forest owners interest organization 1 representative from a forest owners association 2 representative from forestry companies	2 scientists working with forestry and water, representing two different institutions	2 experts at two different environmental non-governmental organizations

4.2.3 Description of sample management level interviews

The interviewees consisted of one person each from the 3 roles identified above; (1) a forest management plan maker who makes the higher level forestry plans in a private forest owners' association, (2) a operational planner who plans the forestry operations in a large forest company and (3) a forest machine operator who conducts the forestry operation on the ground and works as an entrepreneur for a number of companies in northern Sweden.

5 Results

This chapter presents the results from the two parts of the study. The first part contains the results on the policy level from the document analysis and the policy level interviews. It is stated in the text if the results are derived from the documents or the interviews or both. The results are presented according to the four dimensions of the policy arrangement. However, many times there is a considerable overlap between these dimensions as they tie to and impact one another. The second part of this chapter presents the results from the management level interviews.

5.1 Actors

The interviewees were asked about which actors are involved in forest-water issues, who is a key actor in driving or influencing the issue and who they interact with. The first question resulted in a list of actors containing 47 organizations or groups of actors (Table 3).

In particular in the group of the private forest sector many different actors were mentioned as being relevant in regards to forest and water issues. Many respondents did not specify the actors, but referred to the private forest sector in general. The actors that were mentioned are companies who own or manage forestland, forest owners associations and private forest sector interest groups. Also, three types of actors who can influence the issue of forests and water in practical forest management were mentioned; wood buyers, forestry planners and forest machine operators.

In the group of the authorities many actors from the national level were mentioned, all forest authorities and many authorities from other sectors, e.g. environment and water. At the European level the EU was mentioned, foremost as influencing through the WFD. At the international level the Convention on Biological Diversity and the Nagoya Protocol were mentioned as drivers of the relevance of forest-water issues in Sweden.

Research actors were foremost the Swedish University of Agricultural Sciences (SLU) and the Forestry Research Institute of Sweden, but also Stockholm International Water Institute was mentioned as an actor involved in forest-water issues. NGOs are mainly representing environmental issues, but also outdoor and recreation groups were mentioned. The certification organizations FSC and PEFC were also mentioned as influencing the issue.

Table 3. The actors or actor groups involved in forest-water issues that were mentioned by the respondents, divided into four actor groups. Actors that were only mentioned by one respondent are marked in italics

Authority	Private forest sector	Research	NGOs
All Party Committee on Environmental Objectives	Bergvik Skog	*Cifor*	Forest Stewardship Council (FSC)
County Administrative Boards	Federation of Swedish Family Forest Owners (LRFS)	Forestry Research Institute of Sweden (FRIS)	*International Standards Organization (ISO)*
Geological Survey of Sweden (SGU)	Forest machine operators	*Royal Swedish Academy of Agriculture and Forestry (KSLA)*	Outdoor-/Recreation groups
Ministry of Rural Affairs	Forestry planners	Stockholm International Water Institute (SIWI)	Programme for the Endorsement of Forest Certification Schemes (PEFC)
Ministry of Environment	Forestry Sector Water Council	Swedish University of Agricultural Sciences (SLU)	*Swedish Sámi Association*
Municipalities	Holmen		Swedish Society for Nature Conservation (SSNC)
National Property Board	*Mellanskog*		Water conservation groups
SamVat	Norra skogsägarna		*Water Footprint Network*
Swedish Agency for Marine and Water Management (SwAM)	*Norrskog*		World Wide Fund for Nature Sweden (WWF)
Swedish Environmental Protection Agency (SEPA)	SCA		
Swedish Forest Agency	Stora Enso		
Swedish Meteorological and Hydrological Institute (SMHI)	Sveaskog		
Water Authorities	Swedish Forest Industries Federation (SFIF)		
Water Councils	Södra		
EU	Wood buyers (Virkesköpare)		
CBD/Nagoya	Swedish federation for forest machine operators (SMF)		

5.1.1 Key actors

On the question of which the key actors are, 5 different actors or actor groups were identified, when including the actors that were mentioned by 2 or more respondents; the private forest sector, World Wide Fund for Nature Sweden (WWF), the Swedish Forest Agency, the Swedish Agency for Marine and Water Management (SwAM) and researchers. This is based solely on the interview data, since this could not be inferred from the document analysis.

All the respondents regarded the **private forest sector** as a key actor as they are the ones who can impact the end result in the forest. Different actors paid attention to different parts of the private forest sector. Most respondents talked about the companies' and the forest owners' responsibility to make sure they have adequate policies and guidelines on how to manage water and an ability to convey this to the entire organization.

"The ones who can really do something is the forestry sector themselves, their own policies and guidelines and assessments, making sure routines are followed. If that works a lot happens, they have great impact."
-Authority

Others discussed the role of the forestry planners at different levels, and how they impact the end result in the forest by making forest management plans and planning forestry operations, which in the end serves as information for the entrepreneurs when they go out in the forest. If these plans are not adequate that will impact the entrepreneurs' ability to do a good job.

"I think education for wood buyers and planners has been missed, they are a middle link in the chain before the entrepreneurs go out and do their job. They do the planning of the harvesting and if they don't make a good plan, the machine operators have pretty poor prerequisites to do a good job."
-Authority

Other actors, like for example a researcher, regarded entrepreneurs as key as they are the ones practically impacting forest-water when they are performing forestry operations, like for example logging.

"One of the key actors are the entrepreneurs, the ones who are actually doing the harvesting, they are really the ones who are able to minimize the impact on the environment."
-Researcher

Another actor identified as key by many interviewees is **WWF**, who has been working with the forest and water issues. WWF was regarded as having focused particularly on forests and water, in contrast to other actors, like Swedish Society for Nature Conservation, who was regarded focusing on broader issues like biodiversity, where forest and water is only a side aspect.

"The ENGOs have more focused on the biodiversity issues, the species issue, with the exception of WWFs work with water which has been constructive."
-Private forest sector

The **Swedish Forest Agency** and **SwAM** were mentioned as key actors by all groups except the ENGOs. They were regarded important because of their formal responsibilities as government agencies, having the formal power for using regulatory instruments and being responsible for implementation. The Forest Agency was also mentioned as important because they have been working with the forest-water issue for a long time.

"The Forest Agency has been driving the issue during a long time, which has contributed to an increased focus on the issue."
-Researcher

Researchers dealing with forest and water interactions were considered important by actors from the private forest sector and the ENGOs. They described the role of researchers as relevant as they can find new ways to improve processes. Beyond the role of providing new information and insight, researchers are in this particular issue regarded as a bridge between forestry and conservation practices and the private forest sector.

"Science is an important actor that needs to bridge the gap between practice and the private forest sector, and also conservation practice. There is still a remarkable gap between these actor groups I believe."
-ENGO

Actors that were mentioned as important by one respondent were the civic society in large, the County Administrative Boards and the Water Footprint Network. Many respondents found it difficult to single out one key actor and meant that a combination of actors influence the issue, and the influence takes place at different levels as well, from regulatory or policy influence to the influence on the ground in forestry operations. An authority actor meant that environmental organizations can drive the issue, authorities can create policies and use regulatory instruments, but that the private forest sector are the ones who can actually influence the issue through their practices. Further, it was suggested that although the private forest sector has a huge influence on what happens on the ground, the basis for how they perform forestry is influenced by all other actor groups. One respondent mentioned the combination of science, authorities and the private forest sector as key.

"The combination research, authorities, SwAM and the Forest Agency that is, and forest owners and forest companies I think is the most important."
-Private forest sector

5.1.2 Summary actors

The findings concerning the actor dimension show that multiple actors (public, private and civil), at multiple levels and from multiple sectors are involved in the forest-water issue. To summarize the actors involved, they are presented in an actor map (Figure 3). This displays all the actors mentioned in the interviews according to their role, the key actors and if mentioned by many respondents or only once, indicating their importance in the forest-water issue.

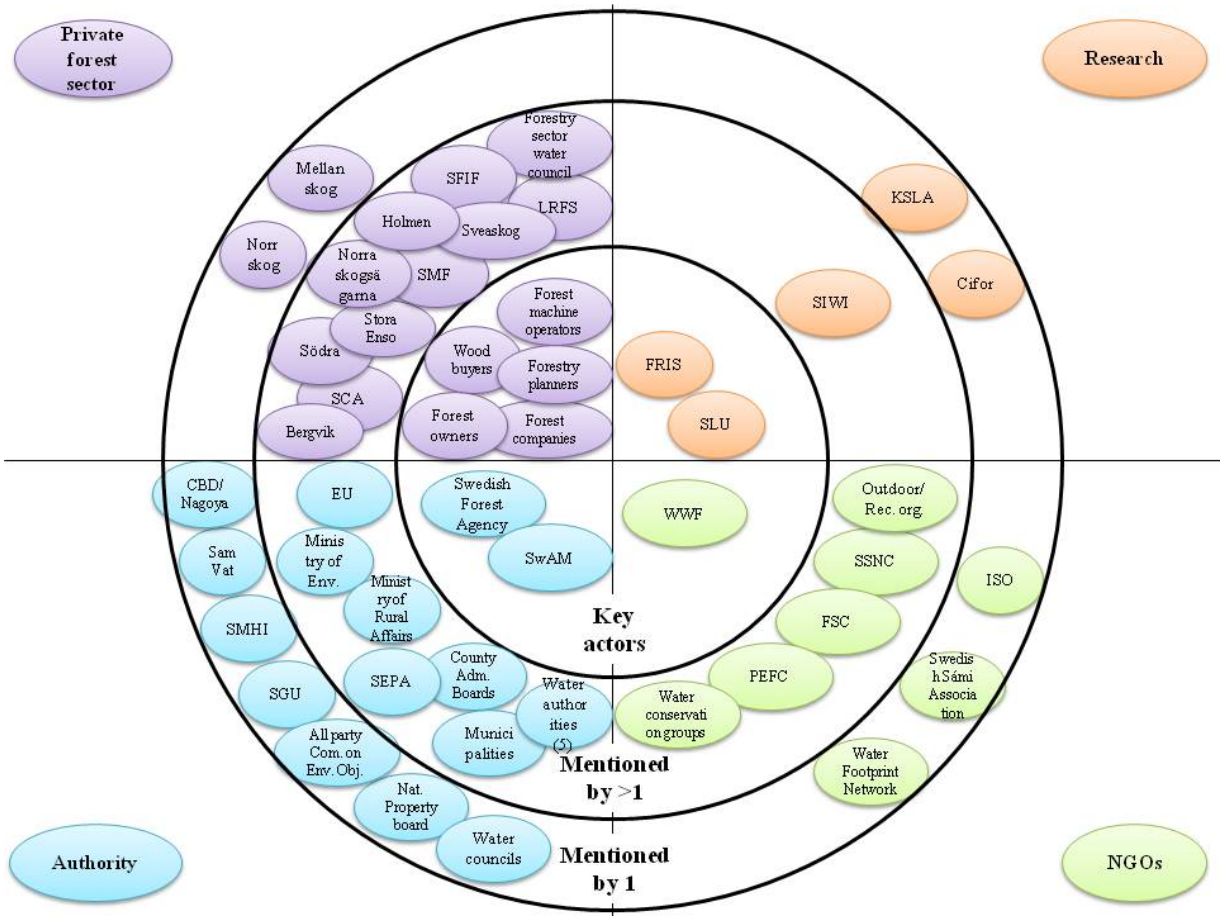

Figure 3. By using the actor map presented in the theory chapter (Figure 2), the identified actors are displayed according to their role and the key actors are displayed in the centre circle, the actors mentioned by two or more respondents in the middle circle and the actors mentioned by one respondent in the third circle.

5.2 Rules of the Game

5.2.1 Actor interactions

Based on the results about the different actors involved and key actors being regarded as a network of actors; routines of interaction between the different actors become highly relevant. The interviews and the document analysis clearly showed that there are many forms of interactions both within and between actors in the different actor groups.

Authority actors interact with each other and most other actors. There is a perception that the interactions between authorities are not entirely smooth, where the authorities mentioned are the Forest Agency, the County Administrative Boards/Water Authorities, SwAM and the Swedish Environmental Protection Agency (SEPA). Some respondents perceived that there are struggles over the responsibility and power over forest and water issues between authorities. One interviewee mentioned that it seems like some issues fall in between the County Administrative Boards and the Forest Agency, where they do not know who is responsible and consequently the issue is neglected. Differences of collaboration between the different authorities were perceived, e.g. one interviewee mentioned that the Forest Agency and the Water Authorities seem to work more closely and have been driving the issues together, whereas SwAM has not been as involved, maybe due to lack of resources. It was also mentioned that the contacts between SwAM and the Water Authorities could be improved.

"One notices sometimes that there are conflicts over who should have power over a certain issue, should it be the Forest Agency or the County Administrative Boards, should it be the Forest Agency or SEPA."
-Private forest sector

Interactions across different actor groups were identified both in the document analysis and the interviews. The Forest Agency initiated the *Dialogue about environmental consideration in forestry*, where one group worked on soil and water. The actors involved in this working group on soil and water were the Forest Agency, Bergvik skog, SCA, Södra, Norra skogsägarna, SwAM and Bottenhavet's River Basin District. This shows public-private interactions in the forest and water issue. It furthermore shows that authorities from different sectors have been involved in this interaction.

The interviewees talked about a number of private initiatives regarding forests and water that have been undertaken in recent years, of which several have been done by many actors in cooperation. *Skogsbrukets vattenråd* (~The forestry sector's water council) was initiated by the private forest sector and includes a number of public and private actors from the forestry sector, for example the Federation of Swedish Family Forest Owners, Swedish Forest Industries Federation, Sveaskog, the Forest Agency and The Forestry Research Institute of Sweden. The water council has developed an industry-wide policy for how to avoid rutting. One actor talked about that this initiative, where many actors were brought together to develop a common view on how to solve problems, served as inspiration for how the Dialogue about environmental consideration was formed. Furthermore, the actor believed that the formulations in the rutting policy served as a base for the formulations about rutting in the prescriptions and advice to the Forestry Act.

Within the private forest sector, the large forest companies (SCA, Sveaskog, Bergvik skog and Holmen were mentioned in the interviews) are undertaking a project called the *Management school*. Through this project all who work operatively in some way, for example with harvesting or planning, has to go through a web-based educational program, including a part on forests and water. Another private initiative is the private forest owners associations' educational campaign *Skogens vatten* (~The water of the forest) where small-scale private forest owners learn about forest-water ecology, management etc.

WWF together with the state-owned forest company Sveaskog initiated a project called *Levande skogsvatten* (~Living forest waters), which also involved many other actors, like forest companies, County Administrative Boards, the Forest Agency and SLU. The project developed a 'tool box' for water consideration in forest management with a specific 'blue classification' in the forest management plans, where the water should be classified according to its value and incorporated into the forest management plan. This is an example of a public-private-civil interaction concerning the forest-water issue, including actors from all actor groups.

An example of a private governance network not including public authorities is the FSC forest certification processes, providing a platform where many different actors interact. One actor talked about the ongoing dialogue in FSC regarding the Swedish forestry standard, where the water issue has been raised and will be negotiated.

5.2.2 Freedom under responsibility versus detailed regulations

The main finding from the interviews concerning formal rules were that there are different views between actors on what type of regulations are needed for regulating environmental consideration in forestry, including consideration to aquatic environments. There was a clear division between actor groups; the authorities and the private forest sector perceive forest use and forestry best regulated through soft regulations with freedom under responsibility, with for example information and education as soft policy instruments, much as is the case today (Appelstrand 2012). They argue that freedom under responsibility bears longer than detailed regulations, because it creates more acceptance and engagement among the forest owners and perceive the existing regulations as sufficient. In contrast, ENGOs see the need for more hard regulations, with more detailed regulations on environmental consideration in forestry. They perceive that forestry is not living up to the environmental considerations that should be taken and that this needs to be solved through a new forestry legislation. It was also mentioned that a problem is the lack of possibility for sanctions if regulations in the Forestry Act are not followed and that there are no court rulings based on the Forestry Act.

Many formal rules, both hard and soft, referring to forest and water interactions were described in the documents; the Swedish Forestry Act, The EU Water Framework Directive and the Water Quality Management Ordinance, the Dialogue about environmental consideration in forestry and the Environmental Quality Objectives. These are described in the background chapter.

5.2.3 Summary rules of the game

The actors interact with each other in different networks based on dialogue and learning effects. Furthermore there is a struggle between different authorities concerning responsibility and power. There are different perceptions among actors as to whether hard or soft law is needed to regulate forestry. Today there is hard law, for example the prescriptions about water consideration to the Forestry Act and the Water Management Ordinance, but as well soft law, for example the Dialogue about environmental consideration specifying the environmental consideration that should be taken in forestry and the Environmental Quality Objectives.

5.3 Resources and Power

The results concerning resources and power focus on relational power, coalitions and influence over policy outcomes. The results in this section are based on the interviews where four examples of power were identified.

One authority interviewee reported that the All Party Committee on Environmental Objectives suggested a new forestry regulation in their interim report to the Government in 2013. This suggestion entailed more detailed regulation on environmental consideration in forestry, for example about water consideration and buffer zones. The interviewee meant that the suggestion received a lot of critique from the referral bodies and the Government chose not to implement it, referring almost completely to the Forest Agency's Dialogue about environmental consideration, meaning that this soft law is more efficient, ensuring the participation from forestry rather than having strict regulations. Furthermore, the interviewee perceived the Government's decision as being in line with what the private forest sector had advocated. The interviewee suggested that this means that the private forest sector got their will through, but that it also puts pressure on them to show that they can live up to the environmental considerations specified in the "target images" resulting from the Dialogue. The interviewee meant that the Dialogue control station in 2017 will be a critical point where the private forest sector must live up to the expectations or measures will be taken. What kind

of measures that would be was not mentioned. This testimony indicates the traditional powerful position held by Authorities making regulations concerning forests and water, and directing the control station in 2017.

However, the power of the authorities seems to be limited by the willingness of other actors to accept that power. One example mentioned in the interviews is that the outcome of the Dialogue process did not go as far regarding the environmental considerations as the authorities wanted, because the private forest sector were not willing to agree to include these considerations. According to the interview, the private forest sector had much influence on the outcome of the Dialogue process and very much influenced the outcome. The involved authorities accepted this influence by following this line of argument. Thus, in this process the relational power of the private forest sector is demonstrated as they build a powerful public-private coalition with the authorities. However, the interview indicated that the authorities might need to act in a more powerful way in a possible continuation of the Dialogue process.

"The government agencies want to go further than what the forest companies are willing to do. I mean if you ask the forest companies if anything will be different after the Dialogue, if there will be more [environmental] consideration taken, I would guess they say no. Maybe they will do things differently, but they will not take more [environmental] consideration."
-Authority

The third example of power identified in the interviews was the positive impacts of the WFD on the ENGOs ability to push their agenda concerning water issues in forestry forward. The ENGOs meant that the WFD pushed the Swedish legislation forward and raised water as an important issue, making it easier for them to gain support for their ideas. Accordingly, the ENGOs have gained relational power from the WFD as a regulatory instrument coming from outside Sweden.

"The WFD has been a good tool for the environmental movement to lean on when talking environmental consideration and ecological status."
-ENGO

The fourth example also concerns the impact of the WFD on the national level. The implementation of the directive led to the establishment of 5 river basin districts with a County Administrative Board as Water Authority in each district. The Water Authorities have been given responsibility for decisions and SwAM has been given the responsibility for implementing the directive. The Forest Agency reports to the Water Authorities, showing a clear hierarchy. Accordingly, the implementation led to new actors, leading to new resources and power over the forest-water issue.

5.3.1 Summary resources and power

Power to influence forest-water issues was demonstrated through four examples. The authorities have power to decide over hard law and the private forest sector has power through good linkages to the forest authorities and having access to resources. The WFD led to new authorities gaining resources and power and as well gave power to ENGOs to drive their agenda, e.g. about water consideration in forestry.

Connecting to the actor map in Figure 3, we can see that the actors demonstrated here as having power to influence forest-water issues corresponds to the actors considered being key actors by the respondents, except for researchers.

5.4 Discourses

Resulting from the interviews and the document analysis, this section starts with the overall discourses about forests and water, highlighting the major drivers for the intensifying discussions about forest-water and ending with explaining the discourse coalitions that emerged.

5.4.1 Forest and water is a relevant issue which is relatively conflict free

Both the document analysis and the interviews clearly showed that forests and water was regarded a relevant issue. Forestry was perceived by all respondents and in the documents as a land use which impacts water, foremost in terms of quality and biodiversity. All respondents found the issue of forestry and water relevant. Forestry activities, especially rutting caused by logging operations, inadequate buffer strips and ditching or cleaning of ditches, were seen as having an impact on water and the aquatic environment in terms of water quality, biodiversity and habitats, acidification, mercury, eutrophication and water flows. In contrast, water quantity was not perceived a problem in the Swedish context.

"If forestry is performed in a careless way there is potential for severe negative effects on water quality."
-Researcher

The respondents did not perceive any large conflicts concerning forestry and water. They discussed the issue as not being as polarized as the debate about forest biodiversity and protected areas, where there is often opposing positions between environmental and production interests. Many respondents believe that there is a common view among different actors on what needs to be done to protect aquatic environments while practicing forestry.

As reasons for non-existing conflicts concerning forestry and water, interviewees mentioned that the ENGOs have focused more on biodiversity issues and that the forestry sector has taken responsibility for the issue. One authority actor meant that increasingly a common understanding has been reached as people from different organizations have had the opportunity to meet and share experiences at conferences and through different initiatives concerning forests and water. Furthermore, the interviewee meant that a positive factor has been that people have felt a drive among many actors concerning this issue. There was a common view across the actor groups that it is important to aim at creating acceptance and a common understanding among all actors to move the issue forward in a constructive way. Some meant that the Dialogue project has led to a common understanding or will help to do so. This concerns the dimension of actors as well, connecting to the actor interactions and the initiatives concerning forests and water described in the actor section.

I don't find that there are particularly big differences in opinions about water and what one should and should not do."
-Private forest sector

One ENGO actor was of the opinion that there is still a difference in perception of reality. This interviewee meant that the private forest sector is not taking full responsibility for its impact on water. The interviewee gave the example of a forest-water conference where the interviewee perceived that a representative from a private forest sector interest group focused on positive aspects of forestry on water and did not adequately recognize the negative aspects. However, the interviewee perceived the problems concerning forestry and water as relatively easier to solve than other issues. In contrast, the document analysis and responds from other

interviewees indicate that forest companies and -owners are strongly committed to the issue and take responsibility through different initiatives (e.g. the forestry sector's water council and the private forest owners' campaign described in the previous section about rules of the game).

"The conflicts have decreased over time since the forestry sector have dealt with the issue and made it clear that 'yes, we are aware of this responsibility...'".
-Authority

5.4.2 The WFD put water on the agenda

Most interviewees as well as the analyzed documents state that the EU Water Framework Directive (WFD) put focus on and raised the issue of forests and water on the agenda in Sweden. Some interviewees meant that water consideration has always been a part of forestry, but the water issues have gained increased attention after the WFD. The ENGOs regarded the WFD as a catalyst and a tool for the environmental movement to lean on in discussions about environmental consideration.

"Water has always been a part of the environmental consideration, but the WFD has put focus on the issue."
-Private forest sector

Some actors from the private forest sector and research did not see many changes resulting from the WFD. They talked about the issue growing and being debated for a long enough time, enough knowledge being gathered and the water issue being something that is embedded in the general societal consciousness. Water as something that engages people was mentioned several times in the interviews, especially by the respondents representing non-industrial private forest owners.

"At some point there is enough information and discussion around an issue so something happens, and that happened around 2 years ago."
-Private forest sector

Resulting from the interviews and the document analysis, the Forest Agency's environmental consideration assessments was also identified as increasing the focus on water consideration in forestry. The assessments have shown that environmental consideration taken adjacent to water has not been adequate. Other drivers of the issue mentioned in the interviews were international and Swedish debates on forest and water issues, the environmental objectives system from 1999, the environmental goal in the Forestry Act of 1993, the large storm events in 2005 and 2007 and discussions about climate change.

"The Forest Agency's environmental consideration assessments put the finger on damages on soil and water, particularly the rutting issue."
-Authority

5.4.3 Two discourse coalitions: Detailed regulations versus Freedom under responsibility

Concerning how regulations for forestry and water should be formed, two major narratives crystallized in the interviews. The first one tells that there is a need for a new forest legislation with more detailed regulation concerning how forestry should be practiced and how environmental consideration should be taken in forestry, including consideration to aquatic environments. The second one tells that freedom under responsibility works better than

detailed regulations and that the problem is not legislation, but interpretation and implementation.

"We want to see a forest legislation that puts higher demands on water consideration in forestry."
-ENGO

"The problem is not the regulatory framework in itself, but interpretation and implementation, because I know that there is potential for improvement there."
-Authority

"Because water is so much in focus in the sector, there is a need to support and push that forward. Detailed regulations risk impeding the sector responsibility. Everything can always be better, but the fundamental principle of freedom under responsibility bears longer than detailed regulations."
-Private forest sector

The two narratives are represented by different actor groups, connecting this with the actor dimension. The first narrative of a new forest legislation with more top-down steering is represented by the ENGOs. The second narrative of bottom-up steering and satisfaction with existing legislation is represented by authorities and the private forest sector, thus representing a discourse coalition.

In contrast to the finding that all interviewees experience the forestry and water issue fairly conflict free and that all agree finding an understanding and common ground is important, there is a divide in fundamental beliefs. The ENGOs agree that forestry and water issues are relatively easier to solve and that finding a common ground is important, but their fundamental position is that forestry needs more detailed regulations concerning environmental consideration in order to reach the different environmental objectives. So despite the fact that they experience forestry and water as less problematic than other forestry issues, their position is that the environmental considerations in forest management needs to be expressed in more detail in the regulations. On the other hand, the private forest sector holds the fundamental position that freedom under responsibility and bottom-up steering is the best approach to reach the objectives. This can be exemplified by the two actors that are the furthest apart in this regard;

"The influence of the civil society must be strengthened"
-ENGO

"The property rights must be protected."
-Private forest sector

These two actors have fundamentally different approach to ownership rights and who should decide over the land and the forests. The ENGO argues that they respect the ownership rights, but believe that civil society's rights to the land need to be strengthened. This indicates a position that is willing to weaken the ownership rights. On the other hand, the actor from the private forest sector argues strong ownership rights as the most important issue, putting the land owner's rights to the land in the first room.

5.4.4 Implementation on the ground is a problem

There are different narratives when it comes to regulation, but there is agreement among most actors when it comes to the narrative of lacking implementation of water consideration into practical forestry. This narrative was also found in the document analysis. The narrative was not expressed by a majority of the interviewees from the private forest sector although they all agreed that issues with rutting and buffer zones exist in relation to forest management. Many respondents indicated that the implementation on the ground is not adequate, despite many educational efforts on water considerations involving entrepreneurs, forest owners and forestry planners. In this narrative knowledge becomes an important issue. For example, interviewees from the ENGOs see a disconnect between the knowledge of the forest owner/company and the entrepreneur regarding considerations to the aquatic environments, where the latter performs the activities on the ground. Furthermore the narrative on the lack of implementation refers to the high economic pressure on the entrepreneurs, making it difficult for them to take the time for environmental considerations. An authority actor perceived the knowledge within the forestry companies/organizations as high regarding buffer zones and how to avoid rutting, but that it has not successfully been implemented into the entire organization.

"The level of knowledge is high, but it fails in practice."
-Authority

A few interviewees as well as the documents state that, even though much knowledge about the aquatic environment has been developed over time, there is still a lack of scientific knowledge about forest hydrology and the relationship between forestry activities and the consequences on the aquatic environment, especially on the larger scale.

5.4.5 Summary discourses

It was revealed from the interviews that there is an overall agreement across all actor groups that the WFD raised the issue of forests and water on the Swedish agenda and that forestry and water is a relevant issue, which is relatively conflict free. Furthermore, actors have a common understanding of the problem and believe that everyone wants to take consideration to water in forestry practices, but implementing water consideration on the ground is a problem. However, two conflicting narratives concerning forestry regulations were found, where the ENGOs advocate more detailed steering with more regulations concerning environmental consideration in forestry, whereas the authorities and private forest sector advocate freedom under responsibility and soft steering mechanisms.

5.5 Discourses resulting from the management level interviews

The main narrative among all three management level actors was that water is an increasingly important issue that needs to be considered in forest management. One respondent explained that the forest and water issue gains relevance as there is a lot of focus on water issues in general in forestry right now and that a lot is written about it in for example forestry magazines. Furthermore, the interviewee meant that it is important that the forestry sector acts and show that they take the issue seriously in time, instead of being accused of not acting later on. One respondent agreed that the issue is of great importance and that there has been more and more focus on water lately. Another respondent meant that water consideration is becoming more and more relevant because of the fact that the easiest stands have been harvested in the past and now they have to harvest the places that are wetter and more difficult, resulting in more damage to soil and water compared to before.

"There is a lot of focus on water issues right now and a lot is written about water issues, damages on soil and damages on water... It feels like it is an important issue."

Furthermore, the interviews showed that the increasing attention to water issues are accompanied by more detailed information in the operational plan on where and how water consideration should be taken. However, one interviewee noted that this is much dependent on the client (forest company/owner). Particularly the smaller ones do not include this to the same extent. It is also dependent on the level of knowledge or interest of the planner, as the interviewee meant that the quality of the operational plan varies and sometimes the judgments made by the planner are inadequate. Another issue mentioned is the communication between the higher level planner and the operational planner, where information does not always seem to be transferred properly. Furthermore, one interviewee pointed to the problem when companies have too few stands available in for harvesting, making it hard to adjust which stand to harvest according to weather conditions.

"There has been a big change in the operational plans, at least from the big client we have. Before we had to make our own decisions, now there are careful notes of where there is water and consideration is needed, bridges are needed."

Another issue raised is who should bear the cost of taking consideration to water in the forestry operations. Inevitably, building bridges for crossing streams and taking care near the water will take longer time and the interviewee means that the client ordering the felling should be the one bearing the cost, but that this is not always the case.

"The clients say water consideration is allowed to cost, but that is a truth with modification. They are not always prepared to pay...sometimes there is a conflict as to who should bear the cost."

5.5.1 Summary of the discourses resulting from the management level interviews

All three levels of practitioners (forest management planner, forestry planner and machine operator) viewed the issue of forests and water as relevant. Issues related to the quality of the operational plan were perceived as an impediment to achieving adequate water consideration.

5.6 The interplay between the dimensions

The results of this study have been presented according to the four dimensions of the policy arrangement. However, it is important to stress that, as the theory suggests, the dimensions are interrelated and change in one dimensions may lead to changes in other dimensions (Liefferink 2006). This sections aims to highlight the interplay between the findings of this study. Figure 4 shows the four dimensions in the tetrahedron, as presented in the theory chapter, with the main results and their interplay added.

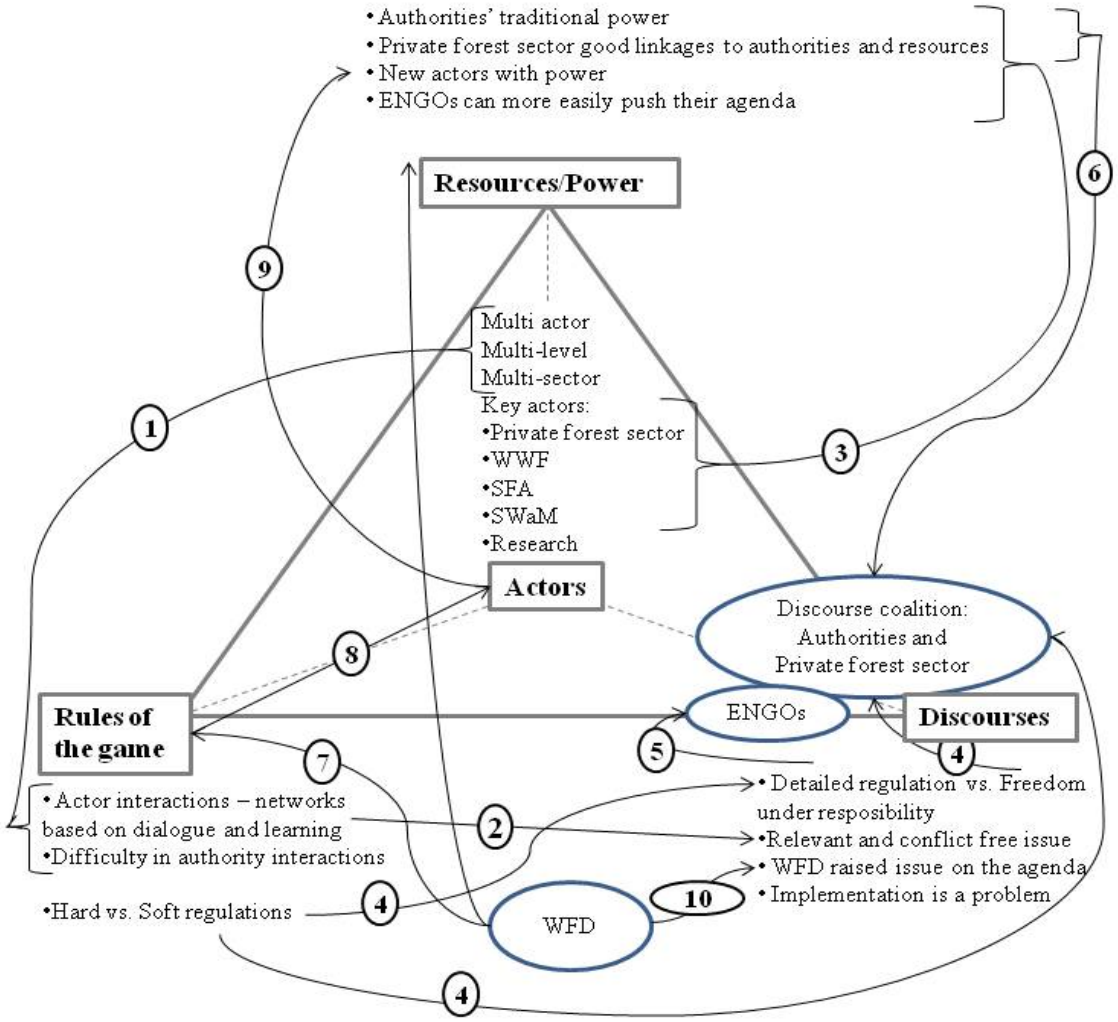

Figure 4. The main results of the study and their interplay.

Starting in the middle, (1) the multi actor, -level, and -sector character of the actors involved connects to the rules of the game, where it was found that there are many forms of interactions between these actors. It also connects to the result that there are difficulties in the interactions between involved authorities. The actor interactions in the form of networks based on learning and dialogue connects to (2) the discourse on the issue being relevant, which is why many initiatives are taking place. Also the initiatives provide platforms for actors to meet and discuss, which was mentioned as a reason for why the issue is relatively conflict free. The key actors, except for researchers, were the same actors as the ones found having power to influence the forest-water issue (3), strengthening the result that these are influential actors. Continuing with the differing opinions as to whether forestry is best regulated through detailed regulations or soft steering mechanisms (4), the dimension of rules connects to the discourses, where a discourse coalition between authority actors and the private forest sector was found, and the ENGOs held a contrasting view (5). This coalition connects to the power dimension (6), where these two actor groups were found to have a powerful coalition in the Dialogue process. The multi-level influence of the WFD is demonstrated having an influence on all the four dimensions. The implementation of the directive in Sweden led to new rules in the form of the Water Quality Management Ordinance (7), which led to new actors (8) with resources and power over the forests and water (9). It also led to the issue of forests and water being raised on the Swedish agenda (10).

6 Discussion

The aim of this study was to understand and explain the existing governance framework around forestry and water in Sweden. Based on the policy arrangement approach, the study's research questions focused on the actors involved, the formal and informal rules, the resources and power structures and the discourses related to forestry and water in Sweden. Furthermore, the study looked at discourses on the management level.

This chapter will start by a summary of the key findings concerning each research question. Secondly, it will discuss the main findings and consider them in the light of existing research. Furthermore, the chapter will address the methods used and the limitations of the study. The chapter ends with suggestions for future policy making, recommendations for further research and a concluding section.

6.1 Key findings

Looking at forest and water governance in Sweden from the perspective of the four dimensions of the policy arrangement provided an overview of the issue, mapping the most relevant actors, rules, power dimensions and discourses, as well as their interplay (Figure 4).

- The findings concerning the actor dimension show that multiple actors, at multiple levels and from multiple sectors are involved in the forest-water issue. The private forest sector, WWF, the Swedish Forest Agency, SwAM and researchers were considered key actors.

- The key actors, except researchers, were also the ones found having power to influence forest-water issues. The authorities have power to decide over hard law and the private forest sector has power through good linkages to the forest authorities and having access to resources. The WFD led to new authorities gaining resources and power and as well gave power to ENGOs to drive their agenda.

- The actors interact with each other in different networks based on dialogue and learning. Furthermore, there is a struggle between different authorities concerning responsibility and power. There are different perceptions among actors as to whether hard or soft law is needed to regulate forestry. Today there is hard law, for example the prescriptions about water consideration to the Forestry Act and the Water Management Ordinance, but as well soft law, for example the Dialogue about environmental consideration and the Environmental Quality Objectives.

- There is an overall agreement across all actor groups that the WFD raised the issue of forest-water on the Swedish agenda and that forests and water is a relevant issue, which is relatively conflict free. Furthermore, actors have a common understanding of the issue and believe implementing water consideration is a problem. However, two conflicting narratives concerning forestry regulations were found, where the ENGOs advocate more detailed steering, whereas the actor coalition of authorities and private forest sector advocate freedom under responsibility.

- At the management level, all three levels of practitioners (forest management planner, forestry planner and machine operator) viewed the issue of forests and water as relevant. Issues related to the quality of the operational plan were perceived as an impediment to achieving adequate water consideration.

6.2 Discussion of the findings

6.2.1 Cross-sectoral, multi-level and multi-actor process

This study shows that the forestry and water issue in Sweden is a cross-sectoral, multi-level and multi-actor process. Looking at the identified actors involved in the forest-water issue, an important finding is that actors come from different sectors, i.e. forestry, environment and water, showing that forestry and water is a cross-sectoral issue. This is supported by the theory about environmental policy being a multi-sectoral field, described in the theory chapter (Arts & Leroy 2006). However, the private sector actors were exclusively forestry actors. This might result from the focus of the study on forestry, setting limitations for which actors the interviewees considered involved in the issue. Other private sectors that could have been expected to come up are for example hydropower and agriculture, as their operations tangent forest-water.

The study also points to multi-level influence resulting from the EU WFD, leading to changes in all four dimensions clearly showing that the WFD has influenced the forest-water issue in Sweden (Figure 4). The implementation led to the new Water Management Ordinance, but this seems to have induced only a small change in the rules concerning forest-water, which is in line with the findings of Keskitalo and Pettersson (2012). They note that a large proportion of the implementation is directed towards creating a new administrative setting for water management. This is reflected in this study as well, pointing to the new actors (i.e. the Water Authorities and SwAM) with resources and power. Furthermore, the WFD led to an increased focus on the issue and discursive power to the ENGOs. They could easier push their agenda on environmental considerations to water in forestry with the WFD in their back, thus gaining relational power.

The key actors were identified by asking the interviewees who they believe are most influential and who drives the forest-water issue. The answers ranged from the actors who are considered influential because they can affect the issue directly on the ground through management, to the authorities who have formal responsibilities concerning the issue. Interestingly, the Government or the ministries were not mentioned as key actors even though they could be seen as very influential on policy outcomes. A reason for this might be that the interviewees foremost were considering actors that are more involved in the day to day work on forest-water issues and are more visible. This might also be the reason why the EU is not considered a key actor even though they were regarded as having a large impact on the forest-water issue in Sweden through the WFD. Forest certification has been highlighted as an important market-driven instrument for implementing environmental consideration in Swedish forestry, which is more far-reaching than the law (Keskitalo & Pettersson 2012). This was highlighted by a few interviewees in this study as well. However, despite this, certification organizations were not mentioned as key actors in influencing and driving the issue of forestry and water. This could be interpreted like perhaps the certification standards concerning forest-water are not that much more far-reaching than other policies, i.e. the "target images" and the private forest sector rutting policy, thus not being perceived as being a key driver.

Actors from private, public and civil actor groups, as well as networks of different kinds of actors, were regarded as highly relevant and influential. This links back to the theory about political modernization referring to new conceptions and practices of governance. All actors agree that finding a common understanding is important to move issues forward. Most actors also believe that there is a common view on the forest-water issues, gained through meetings, dialogue and knowledge building. However, an ENGO does not share this view, and still perceive a difference in perception of reality. Basing on the results of the study, an important

actor group to include in the policy making process are researchers. They can be important not only for information, but also for justifying arguments and in this way bridging possible gaps between actors. They received acknowledgement as being key actors from both the ENGOs and the private forest sector, and therefore can provide accountable expertise. Researchers can act as 'bridging organizations', playing an intermediary role. This function has been proven important in managing natural resources in complex governance systems, as they can provide for example accountability, expertise and mediation (Cash et al. 2006).

6.2.2 Conflicting views on regulation

One main finding that ties all the dimensions together is the coalition between the authorities and the private forest sector, and the conflicting position held by the ENGOs (Figure 4). The coalition between the authorities, where the authorities involved are foremost the Ministry of Rural Affairs and the Forest Agency, and the private forest sector was demonstrated through their cooperation in the Dialogue process and their common view on forestry regulations. They perceive that forestry is best regulated through soft regulations whereas the ENGOs advocate a new forestry legislation with more detailed regulations (hard law) concerning the environmental considerations in forestry.

It is not surprising to find this coalition since the Swedish forest policy has a long tradition of consensus seeking and cooperation between forestry and state actors (Hysing 2009). In the coalition the authorities are a very powerful actor in a traditionally powerful position. The state has been shown to hold a central position in forestry policy governing in Sweden (Hysing 2009). For the private forest sector, having a powerful partner is a good situation for being able to influence policy outcomes. However, it has been pointed out by an authority interviewee that the private forest sector needs to deliver positive results on the fulfillment of environmental consideration goals based on the Dialogue process, otherwise "measures will be taken". What these measures are is not known, but considering the pressures from environmental groups to have stricter regulations on environmental consideration in forestry that might be an option close to hand.

6.2.3 Participatory policy making

The results of the study points to the relevance of multiple actors and the fact that there are differing interests and opinions among them, implying that a governance process with broad participation is needed, including private, public and civil actors and basing on consensually agreed goals. Literature on governance highlights the importance of participatory policy making as a model for involving concerned actors and creating an understanding for and a more solid implementation of policy outputs (Appelstrand 2002). Participation can be seen as a prerequisite for acceptance of law and decisions, i.e. legitimacy (ibid.). Appelstrand (2002) argues that authorities may be accused of favoring some interests over others, but that this is less likely to happen if the decision-making process is broad and participatory. This could be relevant in this case where a coalition between authorities and private forest sector was found and ENGOs hold a contrasting view.

The study shows that multi-actor and multi-sector governance already takes place, for example through the Dialogue about environmental considerations in forestry, which includes public and private actors across sectors. These processes are more bottom-up and build on the idea of dialogue and learning instead of hierarchical top down instruments (regulations). Thus, there have been participatory approaches, but implementation is still highlighted by all actor groups as lacking.

6.2.4 Authority coordination and cooperation

It has been shown that the division of responsibilities between authorities is not always clear. According to Valinia et al. (2013), the five Water Authorities shall coordinate work at local and regional levels, as well as cooperate with actors on a national level, but there has been confusion as to who should do what. Furthermore, it has been suggested that the WFD implementation at the supra-regional level (the five Water Authorities) may cause a disintegrative process between land-use planning and water planning (Andersson et al. 2012). This was touched upon in the interviews in this study as well, as some actors believed that it is not always clear which authority is responsible for an issue and that there are struggles over power and responsibility between authorities. The authorities that were mentioned in this context were foremost the Forest Agency, the County Administrative Boards/Water Authorities, SwAM and SEPA. These issues point to a need for developing the coordination and cooperation between authorities.

6.2.5 Management level

The policy level analysis showed that there is concern over a lack of implementation of consideration to water in practical forestry and three levels of practitioners were identified as having the potential to influence water on the ground through forest management. The management level interviews showed that among all three levels of management practitioners there was recognition of water consideration as being important. This is supported by the findings of Keskitalo and Pettersson (2012) who found that many who work with water consideration perceive it as fun and important and Olsson (2009) who found that there are positive attitudes towards forest freshwater ecosystems among actors in the forest sector. Since there were only three interviews undertaken at the management level in this study it is not possible to draw any general conclusions from this. The results indicate that the work undertaken by the private forest sector and others to reach out with the importance of water consideration to the entire organization and also to the entrepreneurs has been successful. However, one interviewee pointed to some issues that might impair the implementation process of water consideration, namely the quality of the operational plan they receive and the level of knowledge and interest from the operational planner, the communication between planners at different levels, the cost and the amount of stands available for harvesting. Thus, according to this interviewee not all planners have adequate knowledge or interest in the issue, which can probably be true for some people within the other groups of practitioners as well. The findings are in line with the findings of Keskitalo and Pettersson (2012) who interviewed private forest sector representatives, showing that implementation of buffer zones largely depends on the operational plan that the entrepreneur receives.

6.3 Discussion of the use of theory and methods

The study shows an example of how the theoretical framework of the policy arrangement approach can be used to create an overview of a policy issue. With a focus on the actor dimension, the theory allowed exploration of the four dimensions. However, understanding all four dimensions of a governance arrangement is a large scope and it was not possible to go in-depth into the four dimensions. Rather, the framework allowed for a broad overview and assessment, highlighting some important issues. It proved useful taking the tetrahedron described in the theory and displaying the main results and highlighting how they are interrelated. This made the results clearer and provided support for my conclusions.

The number of interviews undertaken in each sub-group and the characteristic of the sample can decrease the validity of the findings in the study. The aim was to conduct interviews until saturation was reached. I believe this was reached for all the groups except the authorities. In

the authority group, where one ministry and two government agencies were interviewed, a broader sample might have provided more insights to the interactions and views on the governance arrangement, especially since there are many authorities from different sectors involved in the issue. However, time limitations restricted the number of interviews conducted.

The person chosen for the interview was intended to be someone within the organization who had experience and insights to forest-water issue. This was not a problem in most cases were relevant persons were easily identified. However, in the case of the ministries it was difficult finding someone who was working on this specific issue. Furthermore, some of the interviewees give answers that are more based on their own opinions, e.g. researchers, whereas others provide answers representing their organization's view, e.g. ENGOs and private forest sector actors, especially the ones representing the interest groups. This is reflected in the data as the ENGOs and the private forest sector interest groups are the ones giving the clearest stand points, whereas other actors are a bit more nuanced.

6.4 Suggestions for future policy making

Relating to the conflicting views on regulation found in the interviews, in the continuing policy making process three possible scenarios crystallize:

1. *Basing on soft steering mechanisms* like participation, dialogue and information. Advantages of this approach are that consensus (ideally) is reached between many actors and the policies gain a legitimacy (Appelstrand 2002). Furthermore, it can be seen as a way to enhance the information and knowledge on environmental matters (ibid.). The disadvantages include lack of legal sanctions impeding the implementation and problems with legitimacy, if the process and resulting policies are seen as window dressing and (Abbott & Snidal 2000). Furthermore, if certain stakeholders are left out democratic participation may be compromised (Appelstrand 2012). Basing on the study's results, this way of regulating forestry is preferred by the authorities and the private forest sector.

2. *Basing on the Government deciding on hard laws*. Advantages of this approach are the preciseness and authority for interpreting and implementing the law, the need to implement it by all and the possibilities to measure and evaluate implementation (Abbott & Snidal 2000). Furthermore, the laws are legitimized by being made by representative politicians. Disadvantages include that the laws might miss important perspectives and acceptance from the ones who are to implement them (Appelstrand 2002). Basing on the study's results, the ENGOs prefer these kinds of regulations for environmental consideration in forestry.

3. *Basing on a mixed approach which builds on hard law that is consensually agreed upon.* This approach combines the advantages of the other two approaches, resulting in hard law which is accepted by all. Through participation, laws that have high legitimacy can be formulated, leading to a more solid implementation (Appelstrand 2002). This refers to Habermas' idea of deliberative democracy, combining dialogue and legislation (Kleinschmit et al. unpublished work). This approach provides an opportunity to bridge the differing views on regulations between the actors and could benefit from the advantages of both the other two approaches.

6.5 Recommendations for further research

The study provides an overview of the process of forest and water governance in Sweden. One interesting point agreed on by all actors, was the lack of implementation of water consideration in practical forest management. This is despite the broad agreement among the interviewees that the private forest sector has made a lot of efforts in this area. Interesting areas for continuing studies are the actual impacts of different private and private-public initiatives on water management in forestry and assessing if they have led to a difference in practice. This study took a small look at discourses at the management level indicating recognition of the importance of water consideration among practitioners, but also some potential issues in implementation. This could be an interesting area for continuing studies. Another interesting area for future studies will be following the process of the Dialogue about environmental considerations in forestry after the control station in 2017 and see if implementation has improved and if not, how the process will unfold.

6.6 Conclusions

Forest and water governance in Sweden is impacted by multiple actors, at multiple levels and across sectors. Most actors perceive there is a common view on forest and water issues, but some actors mean there are still different perceptions of reality. Furthermore, there are two conflicting views among the actors concerning regulations and all agree that implementation is lacking. Research organizations were highlighted as key actors by both ENGOs and the private forest sector, and could hold an important role as bridging organizations providing accountable expertise. Furthermore, the multi-sector governance environment points to a need for developing the coordination and cooperation between authorities involved in the forest-water issues. On the management level, the study indicated an acknowledgement of the importance of water consideration. Further research on the implementation of water consideration in forest management would provide valuable insights in where to focus continuing efforts concerning forestry and water in Sweden. Based on the results of this study one option to follow up in the continuing policy making process are the participatory processes. The involvement of multiple actors with differing interests and building on consensual goals could lead to a more solid implementation of policy outputs. One approach could be to follow the ideal of deliberative democracy. The Forest Agency's Dialogue groups, broadened to include a higher number of environmental organizations, could focus on deliberating on consensually agreed upon goals which can be transformed into regulations. This could be a potential way of over passing differing views on regulations.

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Appendices

Appendix 1

Hej …,

Jag heter Emma Berglund och är jägmästarstudent på SLU. Jag skriver just nu mitt examensarbete om vattenfrågan i skogsbruket. Som en del i mitt arbete vill jag genomföra kvalitativa intervjuer med ett antal relevanta aktörer, däribland dig i din roll som ……..

Syftet med examensarbetet är att kartlägga hur svenska aktörer ser på och arbetar med vattenfrågan i skogsbruket. Jag skriver uppsatsen i samarbete med Swedish Water House och arbetet kommer resultera i en rapport samt publiceras på SLU:s portal för examensarbeten.

Intervjun kan genomföras via telefon eller personligen, beroende på vad som passar dig bäst. Intervjun tar cirka en timme och innehåller frågor om din organisations syn på och arbete med skogens vatten. Din medverkan är konfidentiell och varken ditt eller din organisations namn kommer publiceras.

Din medverkan är väldigt värdefull för mitt arbete och jag skulle verkligen uppskatta den. Fundera gärna på detta över helgen så återkommer jag till dig via telefon inom en vecka och om du är intresserad kan vi boka in en tid för intervju. Om du har några frågor eller funderingar är det bara att du ringer eller mejlar mig!

Vänliga hälsningar,
Emma Berglund

Appendix 2

Interview guide

1. Could you start by telling me a little bit about your role at... and how you have come in contact with water in forestry?

Discourses

2. Where do you see the most important interconnections between forestry and water?

3. Do you think the topic of forests' and forestry's impact on water is relevant in the Swedish setting?

4. Where do you gain your knowledge and understanding about the forest and water interactions and problems?

5. When do you think the forest and water issue became relevant in Sweden? Was there a specific event that turned the understanding or raised awareness?

6. Do you think that the relevance of the forest and water topic (e.g. the new water management, the environmental consideration in the forestry act...) results from international concerns or do you think it is a generic problem in Sweden?

7. How are Swedish efforts on water management in forestry compared to other countries'?

Actors

List of actors:
Forest owners
Forest companies
Ministry of Rural Affairs
Ministry of Environment
The Forest Agency
The Swedish Environmental Protection Agency
The Swedish Agency for Marine and Water Management
Water Authorities
ENGOs
Scientific experts

8. Can you think of any additional actors relevant to the forest and water issue?

9. Can you rank the actors according to who you think is driving/influencing the issue of forest and water in Sweden most?

10. Who do you work with?

11. Who do you think others are working together with?

12. Do you think there are conflicts regarding forests and water between actors?

13. Has this changed over time?

Rules and Resources (instruments)

14. What laws, rules and policies do you consider as relevant to the forest-water situation in Sweden, at the national, European and international level?

15. How do you value the following rules and regulations concerning their efficiency in managing water in forestry?
    - Environmental consideration in the Forestry Act
    - The requirement for good status according to the Water Quality Management Ordinance (based on the WFD)

    - The "target images" concerning water and forests
    - The Environmental Quality Objectives related to water and forests

16. How else could water management in forestry be supported (other types of instruments)? Economic instruments (subsidies)? Certification? Monitoring and assessment?

17. Do you think there is a need to change existing rules and regulations concerning water in forestry? In what direction? And at what political level; EU, national, local?

18. Is there anything I haven't asked about, which you think I should have?

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