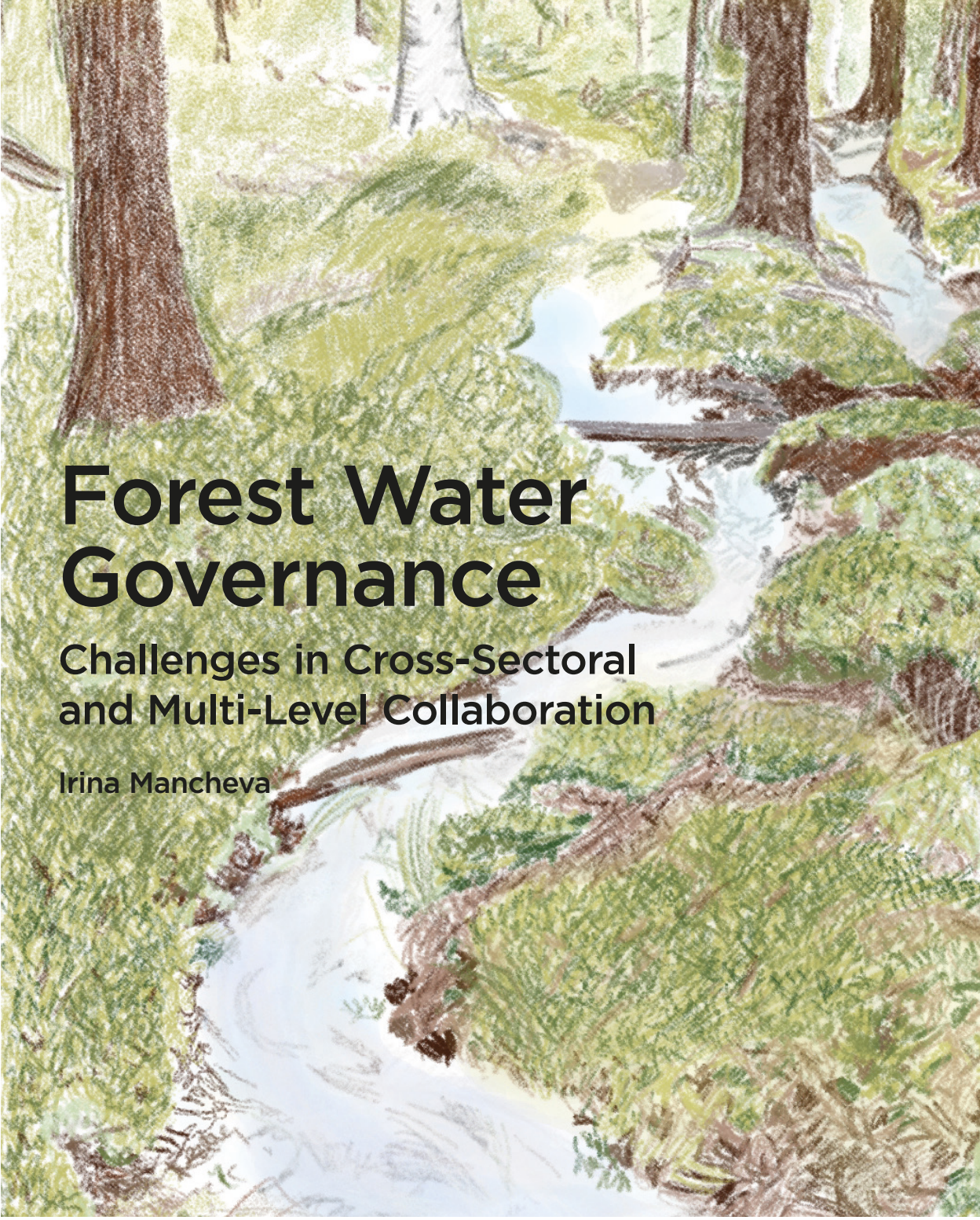

Forest Water Governance

Challenges in Cross-Sectoral and Multi-Level Collaboration

Irina Mancheva

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To my family

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Abstract

Forests and water are highly interconnected with forestry practices negatively affecting forest water. In the last five decades, the Swedish state has enacted multiple policy changes and allocated significant resources towards the implementation of soft policy instruments to alleviate the effects on forest water. The European Union Water Framework Directive has further raised the legal requirements for water protection, including within the forest sector. However, these efforts have largely failed thus far. Forests and water are governed by two separate sectors, each with its own polycentric governance system and policy goals that are often conflicting. The governance mode of these systems is determined by a unique combination of policy instruments and a varying degree of centralisation depending on state involvement. Since governing forest water requires collaboration between the forest and water sector governance systems, it entails interplay between the two systems on different ecological scales. The aim of this thesis is to explore and explain the challenges related to the governance of a resource that requires cross-sectoral multi-level governance and to examine the role of the state in those interactions. The thesis includes a mix of quantitative (survey and aerial photographs) and qualitative (interviews, analysis of documents and meeting observations) research methods for investigating forest water governance across national, regional and local levels. Empirically, it involves four case studies analysing units embedded in the larger case – namely cross-sectoral governance of forest water.

The results show that within the current structure of Swedish forest water governance there is minimal cross-sectoral collaboration, with an exception being at the national level. Regional and local implementation of the outputs produced at national level relies mainly on the forest sector, with little to no coordination with water sector institutions at the regional district or river basin levels. Moreover, power asymmetries between the two sectors are transposed to the collaborative process which affects participants' capacity to influence the governance of forest water. Since the studied cases show that most of the financial resources for forest water protection are provided top-down, the role of the state in initiating and maintaining collaboration is crucial. The thesis confirms previous research findings that water governance requires a more centralised polycentric governance system. Combining polycentric governance (including at the river basin scale) with centralised state-coordination is a potential solution to problems that require cross-sectoral and multi-level governance interplay. Further inquiry into cross-sectoral governance of natural resources could develop a better understanding of how coordination in polycentric governance systems at different ecological scales could be structured to mitigate policy goal conflicts across sectors and institutional levels, thus fostering more effective governance.

Keywords: Forest water; Governance; Cross-sectoral governance; Multi-level governance; Governance mode; Collaborative governance; Natural resource management; Environmental policy; Water Framework Directive

Styrning av skogens vatten: Utmaningar för samverkan mellan sektorer och nivåer

Introduktion

Skog och vatten är starkt sammankopplade i naturen och vissa skogsbruksmetoder har en negativ påverkan på skogens vatten. Under flera decennier har den svenska staten infört olika policies och styrmedel i syfte att förbättra skogsbrukets hänsyn till vatten, och avsatt finansiella resurser för genomförandet av åtgärder. EU:s ramdirektiv för vatten har ytterligare höjt de lagliga kraven för skydd av vatten, även inom skogssektorn. Dessa ansträngningar har hittills dock i stort sett misslyckats med att nå vattendirektivets och Sveriges nationella miljömål. Till stor del används mjuka styrmedel såsom rekommendationer, information och utbildning, och det finns en stark betoning på samverkan som nödvändig för att nå målen. Trots betydande vetenskapliga framsteg i förståelsen om hur skogsbruket påverkar skogens vatten, finns det fortsatt ett forskningsgap vad gäller samhällets styrning och organisation kopplat till skydd av skogens vatten. Skog och vatten förvaltas av två olika samhällssektorer som har olika och ofta motstridiga mål. Varje sektor har sitt eget polycentriska styrningssystem, med många aktörer på flera nivåer. Styrningssystemen kännetecknas av olika typer av styrmedel och är centraliserade till olika grad, beroende på statens engagemang. Graden av centralisering påverkar hur väl styrningssystemet förmår att möta utmaningar och målkonflikter mellan nivåer och sektorer. Eftersom styrningen av skogens vatten kräver samverkan mellan skogs- och vattensektorns styrningssystem medför det ett samspel mellan dessa system på olika skalor i landskapet.

Syfte och frågeställningar

Avhandlingens övergripande syfte är både att beskriva och förklara de utmaningar som styrningen av skogens vatten innebär – en resurs som kräver tvärsektoriell styrning på flera nivåer och mellan två styrningssystem med konkurrerande mål. Teoretiskt utgår avhandlingen från styrnings- och samverkanslitteratur där olika sätt att nå politiska mål analyseras. Fyra forskningsfrågor har väglett avhandlingen: 1) Hur styrs skogens vatten i Sverige? 2) Vilka utmaningar innebär samverkan mellan sektorer och nivåer, hur ser dessa ut i praktiken och hur kan de förklaras? 3) Vilka resultat har den tvärsektoriella styrningen lett till och hur kan genomförandet av dessa främjas? 4) Vilken roll spelar staten i denna styrning?

Forskningsdesign och metod

Avhandlingen omfattar fyra artiklar, där varje artikel utgör en fallstudie som analyserar en mindre enhet inbäddad i det större fallet – nämligen styrningen av en resurs som kräver tvärsektoriellt samspel. Fallstudierna representerar olika nivåer i genomförandet. Att det empiriska fokuset ligger på förvaltningen av skogens vatten i Sverige motiveras av att det representerar ett kritiskt fall av tvärsektoriell styrning mellan två styrningssystem med motstridiga mål. Det valda fallet är kritiskt eftersom det har de mest troliga förutsättningarna för uppkomsten av tvärsektoriellstyrning. Valet av fall underbyggs av tre mer specifika skäl: 1) skogens vatten är en resurs som i stor utsträckning påverkas av aktuella skogsskötselsmetoder; 2) skog och vatten styrs av två olika sektorer (skogsförvaltningen ligger under Näringsdepartementet, medan vattenförvaltningen finns under Miljödepartementet); 3) Sverige har vida produktionsskogar som utgör mer än 2/3 av landarealen och därtill en stor mängd ytvatten vilka påverkas av skogsbruket inom dessa skogar. Fallstudierna har skett på nationell, regional och lokal nivå, där Vindelälvens avrinningsområde utgjort regionalt och lokalt fokus. Även om jag inte är helt begränsad till Vindelälvens avrinningsområde, har det varit utgångspunkt för tre av studierna (artiklarna I, II och III). Jag har använt mig av både kvantitativa (enkät, GIS fotografier) och kvalitativa (intervjuer; dokument; observationer) forskningsmetoder.

Resultat

Tillsammans ger de fyra artiklarna underlag för att dra slutsatser om styrningen av skogens vatten i flernivåperspektiv. Resultaten visar att många av de utmaningar som olika former av naturresursförvaltning traditionellt upplever gäller även för styrning av skogens vatten. Sektorernas konkurrerande och motstridiga mål komplicerar uppnåendet av det gemensamma sektorsövergripande politiska målet att ta hänsyn till, och skydda, skogens vatten. I första artikeln söker vi svar på om de policyförändringar och nya styrmedel som har införts mellan åren 1960 och 2013 för att skydda skogens vatten har lett till konkreta resultat i hur skogsbruket sparar buffertzoner längs vattendrag. Analysen visar att en rad policyförändringar har lett till positiva effekter vid två tillfällen. Den första var i mellan 1970–1980 då skyddet av buffertzoner ökade med 67%, och den andra mellan 1990–2000 då det ökade med 100%. Trots denna förbättring hade endast hälften av alla vattendrag inom skogen en buffertzon år 2013 och det är särskilt de mindre vattendragen som oftast saknar skydd. Att implementeringen av buffertzoner avstannade i utveckling kan bero på att de skogsägare som var villiga att ändra sin praxis redan hade gjort det, medan det kan krävas starkare insatser för att övertyga resten. Med tanke på att det vanligtvis är de små vattendragen som saknar skydd, är det troligt att policyn ännu är tvetydig i praktiken. Vår analys slutar i 2013 och det går därför inte att

utvärdera om de senaste årens ökade användning av mjuka styrmedel i form av utbildningsmaterial som understryker vikten av att skydda mindre vattendrag kan komma att påverka utfallet. Nya riktlinjer från 2018 kan eventuellt förbättra skyddet av dessa vattendrag, men det kan också vara att de mjuka styrmedlen har nått så långt som är möjligt och att hårdare reglering och sanktioner krävs för att öka skyddet ytterligare.

Den andra artikeln i avhandlingen undersöker samverkan på lokal nivå bland enskilda skogsägare kopplat till skog och vatten. Eftersom en majoritet av de viktigaste intressenterna måste vilja samverka för att en samverkansprocess ska initieras, studerar jag här de faktorer som krävs för att samverkan ska initieras på lokal nivå bland individuella privata skogsägare. Studien baseras på en enkät till samtliga enskilda skogsägare inom Krycklans avrinningsområde i Västerbotten. Undersökningen kompletterades med kvalitativa intervjuer med några av skogsägarna och andra intressenter. Trots att det var en social kontext med låg kulturell och värde-heterogenitet i området, visade sig skogsägarna inte intresserade av att samverka för förbättrad vattenkvalitet så länge de inte uppfattar frågan om vattenkvalitet som tillräckligt viktig för att investera resurser i samverkan. Det är också tydligt att informationsspridningen om problemet inte nått de intressenter, dvs skogsägarna, som är avgörande för att samverkan ska påbörjas. Skogsägarna kände dessutom inte att de är beroende av varandra för att lösa problemet och därför inte heller att samverkan behövs. Slutligen saknades även ledarskap, som kunde ha kompenserat för bristen på de andra faktorerna.

Syftet med den tredje artikeln är att utveckla samverkansteori genom att undersöka interaktionen mellan två olika samverkansfora inom samma avrinningsområde med högt ekologiskt och socialt värde, nämligen Vindelälven. Jag använde mig av semistrukturerade intervjuer, policydokument och observationer av styrelsemöten för att undersöka vilka faktorer som kan förklara varför en ny organisation för samverkan inrättades inom ett område där en annan sådan redan fanns. Jag ville också se om de konkurrerade med eller kompletterade varandra med tanke på landsbygdens begränsade resurser. Sist ville jag även se om någon av de två organisationerna adresserade skogsbrukets effekter på vattenkvaliteten i avrinningsområdet. Analysen visar att ett nytt forum för samverkan bildades på grund av att den redan existerande organisationen inte förmådde att förverkliga vissa intressenters förväntningar. Dessutom visar det sig att de två organisationerna inte konkurrerar utan kompletterar varandra. Samtidigt har båda organisationerna i viss utsträckning upplevt maktasymmetrier där vissa intressenter uppfattades ha mer inflytande på organisationernas agenda än andra. Fokus för samarbetet på denna lokala-regional nivå befanns rikta sig mot begränsade problem med konkreta lösningar som är relativt lätta att genomföra, snarare än mot komplexa problem med

lösningar präglade av ekologisk osäkerhet och maktasymmetrier, vilket karakteriserar diffusa vattenföroreningar från skogsbruk.

Den sista artikeln i avhandlingen analyserar en dialogprocess mellan olika aktörer främst inom skogssektorn på nationell nivå. Forskningsfokus ligger på samverkansprocessen och dess legitimitet och hur detta kan påverka implementeringen av utfallet från processen. Samverkansstyrning tillämpas i allt högre grad medan frågor kvarstår angående implementeringen av utfallet från sådana processer, ofta i form av icke bindande rekommendationer. I studien undersöks vilka legitimitetsaspekter som är viktigast för att utfallet av en dialogprocess ska implementeras. Det är en empirisk studie av Dialogen för miljöhänsyn som var lett av Skogsstyrelsen. Jag använde mig av dokumentanalys, observation på ett möte och genomförde intervjuer med deltagare och företrädare för olika organisationer inom skogsbranschen som antingen hade en roll i dialogprocessen eller i genomförandet av dess resultat. Även om den externa legitimiteten kan tolkas som lågt på grund av bristande representation av miljöorganisationer i processen, ansågs den interna legitimiteten för skogssektorn vara hög. Resultaten visar ytterligare på att utfallet från samverkansprocessen har implementerats i stor utsträckning i form av planerings- och utbildningsmaterial i hela Sverige. Implementeringen kan kopplas tillbaka till processens och det använda underlagets höga grad av legitimitet, samt uppfattningen bland intressenter att utfallet är välgrundat och kan uppnå det önskade resultatet på ett effektivt sätt.

Slutsatser

Avhandlingen visar på en lång rad teoretiska och praktiska implikationer vad avser styrningen av skogens vatten och de utmaningar som uppstår när samverkan mellan sektorer och institutionella nivåer krävs. Inom den nuvarande styrningsstrukturen av skogens vatten finns knappast någon tvärsektoriell samverkan, med undantag för nationell nivå. Den regionala och lokala implementeringen av utfallet från nationell nivå genomförs främst inom skogssektorn med liten eller ingen samordning med vattensektorns olika institutioner varken på regional eller avrinningsområdesnivå. Maktasymmetrier mellan de två sektorerna överförs till samverkansprocessen, och påverkar deltagarnas möjlighet att utöva inflytande på styrningen av skogens vatten. Eftersom de studerade fallen visar att merparten av de ekonomiska resurserna för skydd av skogens vatten kommer från central nivå (EU respektive nationell nivå), visar sig statens roll att inleda och upprätthålla samverkan vara avgörande. Avhandlingen bekräftar tidigare forskningsresultat att styrning av skydd kring skogens vatten där två sektorer är inblandade kräver ett polycentriskt styrningssystem som är mer centraliserat i form av statlig samordning. Att kombinera polycentrisk styrning (inklusive på avrinningsområdesnivå) med

centraliserad statlig samordning kan vara en potentiell lösning på problem som kräver samverkan mellan sektorer och institutionella nivåer. Ytterligare undersökningar av styrning av naturresurser som kräver tvärsektoriell samverkan skulle kunna öka förståelsen för hur samordning kan struktureras för att lindra målkonflikter mellan sektorer och institutionella nivåer i polycentriska styrningssystem på olika ekologiska skalor och därmed främja en mer effektiv styrning.

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Irina Mancheva
Umeå, January 2020

Introduction

Forests and water are two resources of high ecological, economic, and social importance that also are very much interconnected. Trees rely on water for establishment and growth, and those standing closest to water improve water quality and contribute to biodiversity (van Dijk, Hairsine, Arancibia, & Dowling, 2007; Eriksson et al., 2018). At the same time, forests and forestry are high on the political agenda in relation to climate change mitigation efforts (Roberge et al., 2016), bioeconomy development and reaching sustainability goals (Pülzl, Kleinschmit, & Arts, 2014; Johansson, 2016). Today, the demands on commercial forestry from different sectors are growing (Söderberg & Eckerberg, 2013; Lidskog et al., 2018) and as a result, the volume of wood harvested over the last decades also has increased (Hasselquist, Mancheva, Eckerberg, & Laudon, 2019), exposing *forest water* to great pressures. Research has made significant progress in understanding the ecological forest-water interface (van Dijk et al., 2007), as well as the negative effects certain forestry practices have on water quality (Gundersen, Schmidt, & Raulund-Rasmussen, 2006; Eklöf et al., 2014; Futter, Högbom, Valinia, Sponseller, & Laudon, 2016).

However, the forest-water *governance* interface, which requires interaction between separate governance systems[1], has hardly been considered in social science. The few studies that have focused specifically on forest water governance and management emphasise the importance of applying an integrated landscape approach with broad stakeholder and sector inclusion (Eriksson et al., 2018), as well as prioritising water policy goals in relation to other, e.g. forest-climate policy goals, when establishing an effective polycentric, cross-sectoral and multi-level forest water governance system (Ellison et al., 2018). Those conclusions echo Hagberg's (2010), Keskitalo and Petterson's (2012) and Keskitalo's (2015) results from the empirical investigation of the implementation of water policy within the forest sector. They underline the influence of specific sector governance systems on the implementation of policy instruments, as well as the challenges that stem from re-scaling existing (forest) governance systems according to the requirements of the (water) governance systems. The multi-level features of natural resource governance and competing policy goals of different institutional levels further hamper the coordination between institutions in cross-sectoral multi-level governance of forest water (Greenwood, 2013). Examining the

[1] In this thesis "governance system" is used to denote the summary of rules, institutions, social, economic, administrative and decision-making processes and structures that govern a sector ("policy issue" in (Arnouts, van der Zouwen, & Arts, 2012). It includes both "policy arenas" *and* contextual factors such as market systems. In this thesis, policy arena is used to denote the rules, institutions, administrative and decision-making processes and structures that govern a sector in any given governance system or sector (Weiss & Gruber, 1984), as opposed to "policy arena" being a geographically defined space for policymaking (Lubell, Henry, & McCoy, 2010).

governance challenges arising within the forest-water governance interface across institutional levels could bring more understanding on how those challenges could be addressed.

Governance can be defined and understood in various ways. From a policy perspective, governance is a mode of political steering (Treib, Bahr, & Falkner, 2007), or a social function that aims at steering human groups towards desired outcomes (Young, 2013), also "policy goals" (Peters, 2000). A fundamental issue in governance studies is *how* such steering takes place. Different governance modes imply varying degrees of state involvement (Pierre & Peters, 2005) and various roles the state, the market, or networks could play (Thompson, 1991; Baker & Eckerberg, 2014). Decision-making across sectors and policy arenas faces multiple challenges and barriers (Lubell et al., 2010; Feiock, 2013), since specific policy issues, or "sectors", are governed within polycentric systems of multiple, overlapping authorities at multiple institutional levels (Ostrom, 2010; Koontz, Gupta, Mudliar, & Ranjan, 2015). Each sector has its own institutions, and policy instruments and thus its unique governance system (Arnouts et al., 2012). Moreover, different sectors have varying, often conflicting policy goals that may or may not be politically prioritised by the state (Zachrisson & Lindahl, 2013; Söderberg & Eckerberg, 2013; Johansson & Ranius, 2019), leading to potential power asymmetries between those different governance systems and impeding cross-sectoral interplay.

The trend of moving away from traditional democratic structures and systems (Adenskog, 2018), as well as from hierarchical modes of governance, has been going steadily for decades (Rhodes, 1996; Kooiman, 2003; Baker & Eckerberg, 2008c; Arnouts et al., 2012; Pahl-Wostl, 2019). Rising requirements for broad stakeholder representation from which market approaches often fall short (Gieseke, 2019) have made non-hierarchal (Baker & Eckerberg, 2008c; Bäckstrand, Khan, Kronsell, & Lövbrand, 2010) and network, or collaborative (Gieseke, 2019) modes of governance prevalent in environmental governance. This increased use of network and co-governance modes such as collaborative governance for solving complex social and environmental issues by public administrators and governments has spurred significant research interest. Scholars have focused on the initiation, process and type of collaboration (Ansell & Gash, 2008; Margerum, 2008; Emerson, Nabatchi, & Balogh, 2012; Thellbro, Bjarstig, & Eckerberg, 2018), its democratic accountability (Skelcher, 2000; Meadowcroft, 2007), and the distribution of power among actors (Gray, 1989; Purdy, 2012). A large portion of that research and theory-building has focused specifically on natural resource management (Ansell & Gash, 2008; Emerson et al., 2012), including water management and governance (Sabatier, Focht, et al., 2005; Memon & Weber, 2010; Taylor, de Loë, & Bjornlund, 2013; Pahl-Wostl, 2019) and forest management and governance (Brown, 2002; McDougall et al.,

2013; Johansson, 2016; Johansson, 2018). Significant progress has been made in understanding the expected environmental performance of outputs from collaboration (Newig, Challies, Jager, Kochskaemper, & Adzersen, 2018) and their implementation (Koontz & Newig, 2014); as well as the positive social (Sabatier, Focht, et al., 2005) and environmental (Biddle & Koontz, 2014; Scott, 2015) outcomes that collaborative governance may lead to. The challenges and downsides of collaborative governance have also been well-documented (Koontz, 2016; Margerum & Robinson, 2016). Polycentric governance systems with multiple dispersed entities governing a single issue area tend to require significant and costly coordination (Koontz et al., 2015). Accordingly, collaboration and collaborative governance have shown to be significantly costlier than top-down decision-making, while at the same time leading to uncertain environmental consequences and without necessarily guaranteeing improved social outcomes (Till & Meyer, 2001; Thomas, 2013; Bjärstig, 2017). Quite the reverse, collaborative approaches with limited stakeholder inclusion could deepen conflicts and lower trust (Anex & Focht, 2002), as well as cement already existing power asymmetries (Purdy, 2016). Cross-sectoral collaboration between two governance systems with competing, if not conflicting, policy goals could further exasperate those power asymmetries.

The degree of state involvement in polycentric governance systems decides whether they are centralised or decentralised (Morrison et al., 2019), which subsequently predetermines how well-geared they are to meeting the challenges of goal conflicts between levels and sectors. Previous research has hinted that decentralised governance systems are less prepared to face the challenges of cross-sectoral policy conflicts (Sandström, Söderberg, Lundmark, Nilsson, & Fjellborg, 2019) and are ill-suited for addressing complex problems (Morrison et al., 2019) such as diffuse water pollution. Research findings concerning more centralised governance systems are more heterogeneous. On the one hand, polycentric centralised governance systems have been shown to have better capacity for addressing the challenges of cross-sectoral policy goal conflicts (Skovgaard, 2018; Sandström et al., 2019; Morrison et al., 2019). On the other hand, they can be both successful (McCord, Dell'Angelo, Baldwin, & Evans, 2017; Skovgaard, 2018) and fail in meeting the challenges of multilevel coordination (Sandström et al., 2019). These findings raise questions regarding the role of the state in coordinating across sectors and institutional levels, especially in the light of the state's crucial role in prioritising policy goals and coordinating networks in less state-centric governance modes that rely heavily on network interaction (Agranoff & McGuire, 2003; Pierre & Peters, 2005; Baker & Eckerberg, 2014; Zachrisson, Bjärstig, & Eckerberg, 2018).

The European Union Water Framework Directive (WFD) is a policy attempting to achieve cross-sectoral governance of water resources. It stipulates that all

European waters should attain "good status" and that this desired outcome should be reached through a holistic river-basin approach and through stakeholder inclusion in decision-making (Kallis & Butler, 2001). However, merely setting up a frame for collaborative water governance through the WFD does not automatically guarantee the implementation of a holistic and participatory approach in the management of water; nor that WFD goals will be met (Voulvoulis, Arpon, & Giakoumis, 2017), as is evidenced by extensive research in many national contexts (European Commission, 2019). Such national studies of the implementation of the WFD and the institutions it has brought about include Great Britain (e.g. Watson, Deeming, & Treffny, 2009; Benson, Jordan, Cook, & Smith, 2013), the Netherlands (e.g. Warner, Lulofs, & Bressers, 2010; e.g. Raadgever, Dieperink, Driessen, Smit, & Van Rijswick, 2011; van Buuren, Klijn, & Edelenbos, 2012), Norway (e.g. Hovik & Hanssen, 2016), Germany (e.g. Moss, 2004; Albrecht, 2013; Koontz & Newig, 2014) and Sweden (e.g. Lundqvist, 2004; Hagberg, 2010; Keskitalo & Pettersson, 2012). Due to WFD requirements, many of those states have reorganised their water governance systems to accommodate collaboration between sectors. The adoption of water policy goals in other sectors is still among the main challenges both WFD implementation and goal achievement face (Moss, 2004; Voulvoulis et al., 2017; European Commission, 2019).

The reforms that followed WFD implementation in Sweden have raised criticism that, instead of resulting in multi-level, cross-sectoral, holistic water governance, these have led to a multi-layered, fragmented and sectorised administration that lacks both formal steering mechanisms and clear distribution of authority among governance levels (Lundqvist, 2004; Duit, Galaz, & Löf, 2009; CRSWA, 2019). Since the WFD is a framework regulation representing a binding legal instrument with flexible implementation (Treib et al., 2007), its implementation within the forest sector is marked by the governance system logic of the sector (Keskitalo & Pettersson, 2012). Forestry has had a long tradition of being softly regulated. Even though the Forestry Act (1993) puts environmental goals on a par with production goals, it is designed as a frame law that sets only minimum requirements for the forest sector under the so-called "freedom with responsibility" (Appelstrand, 2007). While the Swedish Forest Agency (SFA) has responsibility to issue more detailed guidelines for meeting environmental policy goals, these are mostly recommendations and lack sanctioning mechanisms when not met (Eckerberg, 1987; Sundström, 2009). Since sector authorities are responsible for achieving environmental political goals (Persson, Eckerberg, & Nilsson, 2016) the SFA is responsible for achieving WFD goals in forestry and forest water. Regulation of forest water specifically is of recommendatory character (The Forestry Act, §30). This places forest water governance in-between framework regulation and voluntarism (Treib et al., 2007). In a context where more than 80% of the productive forestland is privately owned (SFA,

2014), the state becomes highly dependent on the will of private actors when attempting to steer towards desired policy outcomes in forest water governance. The inability to accomplish aims without cooperating with others is a prerequisite for applying collaborative governance approaches (Gray, 1989).

Indeed, as far as forest water governance is concerned, previous governance attempts consisting of a mixture of soft policy and market-based instruments have been shown to fail in achieving the desired outcome of comprehensive forest water protection in forestry practices. Despite a number of policy enactments in Sweden geared towards water protection measures in forestry from the 1970s, and an intensification through the 1990s and early 2000s, by 2013 protection of riparian zones along forest water streams had been applied in just 50% of the stream length affected by forestry (see Article I of this thesis). Those outcomes are far from sufficient to meet current Swedish forest-environmental policy, as well as WFD goals. As a result of previous failures in devising efficient policy instruments towards this end, there is an obvious turn towards collaborative processes in addressing forest water issues and thus a co-governance mode in the last decade (Article I). This is not surprising given that the WFD sets the stage for a network, or "collaborative" governance mode, as opposed to a "top-down" or "market" governance mode in water management in EU member states (Kallis & Butler, 2001). It also follows from the insight gained from previous application of top-down down hierarchal steering in environmental protection that has often been met with resistance and therefore proven as an unviable governance alternative (Zachrisson, 2009a; Reimerson, 2015).

Focusing on the governance of a natural resource that requires cross-sectoral interplay could bring understanding on which governance mode and policy instruments should be applied to achieve cross-sectoral and multi-level governance between governance systems with conflicting goals (Söderberg, 2016; Sandström et al., 2019). Moreover, research on different policy arenas and governance systems is needed to gain understanding on the implementation of collaborative governance legislation and the factors that prompt the engagement of different actors and the state in policy processes aiming to reach shared public policy goals (Batory & Svensson, 2019). Given that outputs from collaborative processes are generally non-binding instruments (Koontz & Newig, 2014; Koontz, 2016) and that there might be conflicts between the policy goals of two different governance systems, studying which factors foster the implementation of outputs produced through cross-sectoral interplay could shed light on how those should be designed. Finally, investigating the governance of cross-sectoral resources brings understanding on the interaction of different institutions within the same social-ecological system (Margerum, 2011; Koontz, 2016) and whether institutional overlap in polycentric co-governance modes can compensate for increased transaction costs (Koontz et al., 2015).

Aim and research questions

The overall aim of this thesis is both to explore and explain the challenges related to the governance of a resource that requires cross-sectoral multi-level governance between two governance systems with competing goals. To this end, I focus on forest water governance. Studying governance of forest water provides a suitable case for examining the establishment and maintenance of collaboration from a cross-sectoral, multi-level perspective and in relation to potential goal conflicts between sectors. Studying how this works in practice could unravel questions on how conflicting sectoral governance and management imperatives are dealt with (Smajgl, Ward, & Pluschke, 2016). I analyse cross-sectoral interplay and search for theoretical explanations of how cross-sectoral multi-level governance is achieved or not. I also look at the potential outputs of such cross-sectoral interplay. Such interplay should entail not only collaboration between public and private stakeholders but also collaboration between *two governance systems;* in this thesis also referred to as *cross-sectoral collaboration*. In addressing those questions, I aim at contributing more generally to natural resource governance and collaborative governance literature. Four overall research questions have guided me in this study:

RQ1 How is forest water governance and management addressed in Sweden?

All four articles included in this thesis have an exploratory dimension that investigates policies, institutions and processes, which aim to bring together two policy sectors and their actors, presumably with varying interests and stakes in the governance and management of forest water. The studies were designed so that different institutional levels could be probed and the potential interplay between those levels unravelled.

RQ2 What are the challenges in establishing and maintaining cross-sectoral and multi-level governance and how can they be explained?

This second question investigates the potential hindrances that cross-sectoral and multi-level interplay faces. If cross-sectoral governance over forest water exists, then in what form, what are the factors that help instigate it, and who initiates and designs such processes (see Articles II, III, and IV)? Is there any interplay between sectors and levels (Articles III and IV)? Are there characteristics in the design of the cross-sectoral governance process that can be traced back to the characteristics of the sector that led it (Articles III and IV)? Is there institutional overlap and what are the consequences of it (Article III)?

RQ3 What are the results of the cross-sectoral governance approaches and how is their implementation fostered?

Here the outputs (in the form of policy instruments) produced by the applied governance approaches to forest water are investigated (Articles I, III and IV) and explored if they are implemented (Articles I and IV)? Most importantly, what are the outcomes of the governance of forest water in terms of establishing cross-sectoral and multi-level interplay between governance systems (Articles II, III, and IV), as well as actual change of management practices (Article I)?

RQ4 What is the role of the state in those interactions?

The final question addresses the role of the state in determining the governance mode and policy instruments used to govern forest water (Articles I, II, III and IV)? What is the role of the state as initiator (Article II, III, IV), convenor (Articles III and IV), coordinator (Articles III and IV), financer (Articles III and IV), and implementer (Articles III and IV) of cross-sectoral governance and the outputs it produces?

Outline of the thesis

The thesis is a compilation consisting of an introductory section and four appended studies. In the next chapter, I describe the theoretical framework that links all four studies, through presenting governance, cross-sectoral interplay, and collaborative governance aspects and the more specific theoretical factors that have been explored in each of the four papers. Thereafter, I present the rationale for my choice of case and methods, followed by a more in-depth presentation of the specific Swedish environmental and forest and water governance and management context. In the *Results* section, I briefly present each of the four appended studies and a summary of the main findings. Finally, in the last chapter of this introductory section, I connect the dots between the insights from all four studies and draw conclusions regarding the four overarching questions of this thesis.

Governing forest water: cross-sectoral and multi-level collaborative governance and management approaches

Achieving the desired outcome of good water quality, requires steering human groups towards that outcome and away from "*undesirable outcomes"* (Young, 2013, p.88). In forest water governance, where water is affected by forestry, this means steering forestry actors[2] away from forest management practices that affect water negatively, and towards practices with low to minimum negative effect. Forest water as a resource is affected by forest governance and management but carries the characteristics of water. Therefore, although the empirical focus is on *forest* water, water governance and the findings of water governance literature are of foremost relevance for this thesis. *Governance* denotes the frame of rules and institutions that specific management decisions are made within. Or, as *water governance* is defined by Pahl-Wostl (2015, p. 26):

> *"Water governance is the social function that regulates development and management of water resources and provisions of water services at different levels of society and guiding the resource towards a desirable state and away from an undesirable state. A water governance system is the interconnected ensemble of political, social, economic and administrative elements that performs the function of water governance. These elements embrace institutions as well as actors and their interactions."*

The specific decisions made for concrete and practical aspects of resource allocation, protection, and use are defined in this thesis as *management* (Folke, Hahn, Olsson, & Norberg, 2005; Pahl-Wostl, 2009; Hill, 2013). Those decisions are made within and thus affected by the given governance system of rules and policies.

Governance is realised through different approaches, or so-called "modes", which denominate the different methods applied to reach desired outcomes (Pierre & Peters, 2005; Treib et al., 2007). At a metalevel, governance modes can be classified as "markets, "hierarchies" and "networks" (Thompson, 1991; Pahl-Wostl, 2019). Non-hierarchical and network governance (also co-governance) encompass a diversity of different sub-modes. They can be classified according to the degree of state involvement (Pierre & Peters, 2005; Baker & Eckerberg, 2014), according to the degree of coerciveness of their policy instruments (Treib et al., 2007), or the degree of autonomy (Kooiman, 2003) and "openness" of the

[2] In this study 'stakeholders' is used when denoting actors with an interest or 'stake' in the management of the resources, while 'actors' is used to denote more generally participants, either in the governance system or in the collaborative process.

governance system (Arnouts et al., 2012). Treib et al. (2007) developed a detailed classification through categorising governance modes according to politics, polity and policy. "Politics" governance modes are categorised according to actor constellations in decision-making and their power relations. "Polity" governance modes depend on the system of rules that steer actors and the degree of state and market influence. The "policy" category of governance modes concerns the policy instruments used to steer actors and their actions. The latter category includes four different types: coercion, voluntarism, targeting, and framework regulation; depending on whether the instruments used are binding, as well as whether they entail rigid or flexible implementation. In practice, governance modes are situated somewhere within the spectrum of ideal modes (Baker & Eckerberg, 2008b), depending on the applied steering approaches for accomplishing desired outcomes.

Water governance includes the interaction of many societal sub-systems (Pahl-Wostl, 2019) and is thus heavily influenced by the specific political and social contexts, as has been evidenced also by WFD implementation (Moss, 2004; Pahl-Wostl, Conca, Kramer, Maestu, & Schmidt, 2013). The governance and environmental context can predetermine the choice of governance mode to address an issue (Focht & Trachtenberg, 2005; Everingham, Warburton, Cuthill, & Bartlett, 2012; Ernoul & Wardell-Johnson, 2013). The context can also influence how governance modes and policies are translated and implemented (Hongslo, Hovik, Zachrisson, & Aasen Lundberg, 2016). Contexts determine which stakeholders have power to influence resource management (Galaz, 2006), as well as the degree of trust the participating stakeholders have in each other and in public agencies respectively (Focht & Trachtenberg, 2005; Jin & Shriar, 2013). Importantly, governance systems also determine and shape the political and social context in which they are situated (Emerson et al., 2012; Bressers & Kuks, 2013).

Any shift in governance mode inevitably implicates a process of institutional change (Ostrom, 1990; Zachrisson, 2009a). The establishment of institutions for the management of natural resources generally takes place within an already-established institutional context (Moss, 2004; Lubell et al., 2010), that, among other dimensions, can be more or less hierarchical (Sandström, 2009; Primmer et al., 2015). Governance system changes can be triggered by contextual factors, such as evolving international institutions or the introduction of various steering instruments (Sténs et al., 2016); but they are also formed by actors with different views who can resist the policies and objectives of elites, transform and even reject them (Bevir, 2011). In other words, policies and governance modes not only have implications for the actors and networks who are expected to realise them but also affect and depend on the context in which they are established (Emerson et al., 2012).

Different actors have different preferences regarding governance modes. For example, in forest policy private corporate interests generally prefer flexible and non-binding governance modes, while conservation stakeholders prefer rigid and binding modes (Sténs et al., 2016). Likewise, different sectors have different governance systems with traditions rooted in specific governance modes (Nilsson, Eklund, & Tyskeng, 2009; Lavenex, Lehmkuhl, & Wichmann, 2009). As a consequence, governance modes in the same state can vary according to sector (Arnouts et al., 2012). Applying a cross-sectoral governance approach would therefore require bridging two or more governance systems.

In the last few decades, an ample body of social and political science scholarship has focused on natural resource governance, revealing an immense complexity behind those approaches and the governance systems they are part of (Ostrom, 1990; Sabatier, Focht, et al., 2005; Ostrom, 2010; Visseren-Hamakers, 2015; Hansson-Forman, Reimerson, Sjölander-Lindqvist, & Sandström, 2018; Lindahl, Johansson, Zachrisson, & Viklund, 2018). Albeit rich in its empirical focus and theoretical contributions, natural resource governance literature has focused mostly on single resources, e.g. water, forests, fisheries, etc. As challenging as single resource governance can be, it represents a system with stakeholders and institutions relevant for the governance of one sector, or one policy arena (Weiss & Gruber, 1984; Lubell et al., 2010). Studying the governance of the interface of two interconnected resources, includes examining two governance systems or policy arenas and the potential cross-sectoral interplay between them. In this manner, empirically focusing on the management of a cross-sectoral natural resource, forest water, can significantly develop governance theory and understanding.

Cross-sectoral governance

If policy (e.g. WFD) requirements for an all-encompassing approach to water management across sectors and levels are to be met, all sectors that have an impact or are dependent on water should be included in that governance system (Coenen & Bressers, 2012). In forest water governance that would entail either some overlap between the forest and water *governance* systems, or cross-sectoral interplay in the *management* of forest water. However, finding a way to bridge different governance systems is not always so straightforward. In setting the scene for cross-sectoral interplay, the WFD as framework legislation is legally binding, while at the same time allowing flexibility in implementation (Treib et al., 2007).

Flexibility can be both a blessing and a curse. It allows for context-adapted implementation, where institutions and policy instruments can be chosen and designed to best fit conditions (Baker & Eckerberg, 2008a; Howlett, 2018). At the

same time, flexibility opens the door for different interpretations by sector actors when implementing policy (Treib et al., 2007). A sector in which private corporate actors have formed strong networks with their public counterparts can become to a high degree self-governing and difficult to lead in a direction that is of broader societal benefit (Kooiman, 2003). In cross-sectoral governance, having one sector that is self-governing to a higher extent, and thus more independent from outside influence than the other, can lead to a power asymmetry between the two. One possible manifestation of this asymmetry can be in consensus building, where the less self-governing sector can find it difficult to influence the more self-governing sector, which in implementation can potentially lead to a "blunting" of policy goals. Also, one sector can refuse to acknowledge, implement or comply with the legal instruments governing the other sector (Sundström, 2005). The state's capacity to enforce compliance, as well as to establish cross-sectoral governance, can vary in different sectors, depending on their governance modes in relation to the degree of state involvement (Sundström, 2005; Arnouts et al., 2012; Baker & Eckerberg, 2014). Moreover, if both sectors are "softly" governed and policy implementation depends on networks and public-private partnerships (Pierre & Peters, 2005), so would the established cross-sectoral governance.

The multi-level dimensions

Natural resource issues are governed by multiple nested institutions at different scales (Ostrom, 2010), and finding the correct "fit" for those institutions is an important aspect and precondition for their effectiveness (Young & Gasser, 2002; Folke, Pritchard Jr, Berkes, Colding, & Svedin, 2007). This is valid both in relation to the ecological level, as well as the institutional level. Smaller, confined problems can be adequately addressed at the local level through concrete measures, while more complex problems might need to be handled through policy enactment at the national level (Margerum, 2008). Hence, institutions addressing certain environmental problems should be established at a governance level that corresponds to the ecological boundaries, or scale, of the resource they are managing, as well as to the complexity of the problem they are addressing. The WFD specifies the river basin, or the regional landscape, as the most appropriate ecological and institutional level for the management of surface waters. The implementation of policies at the regional level however, is highly dependent on the financial, knowledge and institutional capacity of the regional level (Berger & Steurer, 2008). Moreover, merely establishing river basin institutions so that they fit the problem scale is not enough. Sufficient institutional interplay between the newly established and existing institutions is a key precondition for them to perform effectively (Huitema & Meijerink, 2014). Furthermore, in cross-sectoral governance of two connected natural resources, there may be both a misfit between the resources' ecological boundaries, as well

as between the two sectors, or the different institutional levels' policy goals (Lubell et al., 2010; Greenwood, 2013).

The management of natural resources includes both a social and ecological dimension. The social dimension refers to the users and to the institutional context, rules and monitoring mechanisms, or the governance system that shapes users' behaviour (Ostrom, 2009; Binder, Hinkel, Bots, & Pahl-Wostl, 2013). The ecological dimension includes the size of the resource system and its predictability but also the attributes of the resource, such as whether it is affected by diffuse pollution, how serious the problems related to it are and whether there is sufficient scientific knowledge about it (Sabatier, Focht, et al., 2005; Ostrom, 2009). Although the number of variables that affect the management of natural resources is immense, not all are relevant in every study but rather depend on the level of analysis (Ostrom, 2007). For example, contextual aspects such as 'policy and legal frameworks' and 'political dynamics and power relations' are important for all levels in the sense that they set the stage and boundaries for public decision-making and action (Emerson & Nabatchi, 2015), especially when analysing the national level. However, they are not necessarily central variables affecting management at the local level among actors who are highly autonomous in their decision-making. Other aspects that are also seen as part of the system context, such as resource conditions and socioeconomic and cultural characteristics (Sabatier, Leach, Lubell, & Pelkey, 2005; Emerson & Nabatchi, 2015) are, on the other hand, of immediate relevance to all levels even the local. Local communities should have the power to influence management, while at the same time respecting the rules of the broader governance system (Watson et al., 2009; Koontz, 2016). To include all possible stakeholders and governance aspects, the institutions that are built within this system need to interplay with institutions and stakeholders from other administrative levels of governance (Dietz, Ostrom, & Stern, 2003). These networks of organisations are meant to come up with plans and recommendations, implement decisions and concrete action, thus fulfilling the state's governance (or managerial) role, while still being governed by the state, or the so called 'governance of governance' (Bevir, 2011). Governance arrangements established within a given area, for example a river basin, are thus driven into a multi-level, cross-sectoral governance process.

Collaborative governance

Network governance that includes actors who represent various public and private interests in multilateral and consensus-oriented decision-making is defined as collaborative governance (Ansell & Gash, 2008). Collaborative governance has become increasingly applied for addressing complex problems that include multiple stakeholders and necessitate cross-sectoral interplay (Emerson et al., 2012; Brisbois & de Loe, 2016; Bodin, 2017). It includes a

multitude of concepts used by the rich scholarship on natural resource management to denote collective action and participatory approaches to natural resource management. Some of the more commonly cited include co-management (Carlsson & Berkes, 2005), integrated management (Born & Sonzogni, 1995; Falkenmark, 2004), ecosystem management (Folke et al., 2004), public-private partnerships (Glasbergen, 2011; Bjärstig & Sandström, 2017), and network governance (Jedd & Bixler, 2015). With the increased application of collaborative governance modes across countries and policy sectors (Emerson & Nabatchi, 2015), so has collaborative governance scholarship advanced. Focusing initially mainly on descriptive analysis (Sabatier, Focht, et al., 2005), collaborative governance literature has grown significantly since the early 2000s, not only in volume but also in complexity (Koontz, 2016). Through both literature overviews and rigorous empirical studies, scholarship on collaborative governance has developed several theoretical frameworks (Sabatier, Focht, et al., 2005; Ansell & Gash, 2008; Emerson et al., 2012; Gieseke, 2019) and typologies of collaborative arrangements, by classifying their many characteristics (Margerum, 2008). Collaborative governance is constituted by a spectrum of governance strategies, which vary according to the level studied and the issues addressed (Margerum, 2008; Eckerberg, Bjarstig, & Zachrisson, 2015). This richness among collaborative arrangements that research studies have unveiled confirms Ostrom's (2007) call for the development of multi-tier frameworks of analyses, which include the multitude of variables, scales and contexts that affect how natural resources are managed. Describing the variation in structure of collaborative institutions, according to context and choices made in design, is an important contribution of collaborative governance research, as it also reflects the adaptive capacity of human institutions (Sabatier, Focht, et al., 2005).

The aim of a collaborative process is to engage multiple actors, representing different interests, to reach consensus on how to address the issue at hand (Margerum, 2008). It involves participatory decision-making processes where the degrees of inclusiveness of interests, collaboration, and delegation of power can vary (Sabatier, Focht, et al., 2005; Newig et al., 2018). Those collaborative processes and structures, hereafter called 'arrangements' or 'processes', can be both with decision-making or recommendatory power, short and long-term. Iteration is a key feature that characterises participatory decision-making processes as collaborative arrangements (Newig et al., 2018), even short-termed (Sabatier, Focht, et al., 2005). They can either be formal – sanctioned through legislation and regulation, or informal – provoked by the necessity to address specific issues and functioning through informal contact and collaboration between stakeholders and institutional levels of governance (Sabatier, Focht, et al., 2005).

In collaborative governance public, private and non-profit stakeholders form networks to govern an issue across institutional levels and jurisdictions (Sabatier, Focht, et al., 2005; Ansell & Gash, 2008), also named polycentric governance (Koontz et al., 2015). Polycentric governance systems can be categorised as centralised or decentralised, depending on the degree of state involvement and coordination (McCord et al., 2017; Sandström et al., 2019; Morrison et al., 2019). They include multiple nested institutions and in general have shown to lead to environmental outputs of higher quality (Newig & Fritsch, 2009), and may govern social and environmental problems successfully given that there is ample communication between the multitude of agencies that are involved (Ostrom, 2010). Accordingly, with sufficient communication, several collaborative arrangements with different aims can delegate functions to each other, depending on their expertise and capacities, and spur the creation of networks (Margerum, 2011). Moreover, such networks between sectors can lower the transaction costs of cross-sector collaboration (Feiock, 2013). However, collaborative governance can also have the opposite effect. Since the institutions of new governance modes are overlaid on existing ones, the establishment of collaborative governance in practice can lower cooperation between institutions and policy areas, as well as increase transaction costs (Lubell et al., 2010). The performance of river basin institutions specifically has shown to be dependent on institutional interplay in the form of communication and coordination with existing institutions (Huitema & Meijerink, 2014). When applying polycentric and network governance the benefits, such as increased institutional adaptation, should outweigh the costs of coordination (Koontz et al., 2015).

When focusing on cross-sectoral collaboration, Bryson, Barbara, and Stone (2006, p.44) define it as*: "(...) partnerships involving government, business, nonprofits and philanthropies, communities, and/or the public as a whole."* In this definition "cross-sectoral collaboration" is interpreted as between public, private and non-profit sectors, rather than as between *governance systems*. In this thesis, cross-sectoral is viewed in relation to the governance of forest water, and thus signifies the collaboration between the water and forest sectors and their governance systems. Given the complexity associated with governing environmental issues that often span across administrative and sectoral boundaries (Eckerberg & Joas, 2004), even single natural resource governance includes collaboration between a multitude of stakeholders and institutions on various institutional levels (Dietz et al., 2003) and between multiple sectors (Hardy & Koontz, 2008; Emerson et al., 2012). Governing across sectors (and thus between governance systems) entails an even more complex web of interactions and collaboration between institutions, public and private actors and organisations, and across sectors and institutional levels.

Many attempts have been made to group collaborative approaches according to their different characteristics (Koontz, 2016). Margerum (2008) developed a typology through a comparative study of 36 collaborative arrangements where he distinguishes between three archetypes within a spectrum: action, organisational and policy collaborative arrangements. The different types of collaborative arrangements function typically at different institutional levels. They all aim at achieving social and environmental outcomes (also "change" in Margerum, 2008) through reaching an agreement on different kinds of "outputs" (Sabatier, Focht, et al., 2005) or "intermediate outcomes" (Emerson & Nabatchi, 2015). Action collaborative arrangements function primarily at the local level and focus on concrete measures such as restoration of disturbed natural environments. They are composed mostly of stakeholders who represent themselves and are active in the implementation of the outputs of the collaboration. Organisational arrangements function most often at a higher level than the local, consisting of stakeholders who represent organisations, rather than themselves, and agree on management plans and programmes. The third type – policy collaborative arrangements – function at the highest administrative levels because their aim is to agree upon new or revised policy and recommendations (Sabatier, Focht, et al., 2005; Margerum, 2008, 2011; Koontz & Newig, 2014; Emerson & Nabatchi, 2015). I have returned repeatedly to Margerum's (2008) typology particularly in two of the studies that comprise this thesis (Article III and IV), but it has also been central for the whole study and in designing the research across governance levels.

In summary, collaborative governance is a frame of rules and structures at different institutional levels that consists of networks between various public, private and civic actors involved in multilateral and consensus-oriented decision-making, which influence the processes and structures for public decision-making and management. The structures for decision-making that function within such a frame are here called collaborative arrangements (or "collaborative processes"). They can function at one or several institutional levels, but importantly, if the governance approach is to be considered as *cross-sectoral,* then there must be some degree of interplay between two or more sectors at one or more institutional levels. Collaborative arrangements can be both formalised and informal, and the outputs they produce can be both binding and non-binding.

Given that cross-sectoral collaborative governance between policy arenas is the theme for this whole thesis, the nature of cross-sectoral collaboration at various administrative levels is investigated in all the included articles. The ambiguity surrounding the effects of establishing a collaborative cross-sectoral governance mode, led my research interest in Articles III and IV. In the former, I address the aspect of institutional interplay and its potential positive and negative effects on cross-sectoral governance, while in the latter I focus on the legitimacy of a cross-

sectoral collaborative process and whether that affected the implementation of its non-binding outputs (see Table 1).

The initiation of collaboration

Initiating collaboration can be driven by different needs. The need to persuade actors with decision-making power to apply a common management approach within given boundaries can be one example (Appelstrand, 2012; Lazdinis, Angelstam, & Pülzl, 2019). Collaboration and stakeholder engagement in the decision-making process can also aim at achieving increased policy acceptance and compliance by actors on whom effective implementation depends (Sandström, 2009; Newig et al., 2018). Most importantly, in governing a cross-sectoral resource such as forest water, collaboration might aim at engaging both governance systems and encouraging interplay between them.

Since collaboration requires time and resources while the outcomes are often uncertain, establishing collaborative governance and management approaches and persuading actors with decision-making power to voluntarily step into collaboration is not always easy. Collective action (Ostrom, 1990, 2009) and collaborative governance (Ansell & Gash, 2008; Emerson et al., 2012) scholarship has recognised numerous factors that are important for self-organisation and initiating collaboration. Some are contextual and connected to the broader social, economic and political context in which the collaborative process is situated, whereas others are connected to the narrower specific social-ecological system context, such as the river basin (Sabatier, Leach, et al., 2005; Ostrom, 2009; Emerson et al., 2012). Contextual factors only, such as top-down initiated policy and legislation promoting collaborative governance, are generally not enough in initiating collaborative processes. Rather, collaboration is often initiated in synergy with other factors such as existing institutional traditions of cooperation, leadership and sufficient financing (Benson et al., 2013; Koontz & Newig, 2014; Mattor & Cheng, 2015; Eckerberg et al., 2015). Some of those are also dubbed as "drivers" or factors which trigger collaborative processes (Emerson et al., 2012). Therefore, it is important to investigate both "system context" conditions and specific "drivers" when investigating the initiation of collaborative processes (Emerson & Nabatchi, 2015). Aspects connected to the natural resource, such as the nature and severity of the problem, predict actors' likeliness to step into collaboration (Sabatier, Leach, et al., 2005; Ostrom, 2009), as collaboration is more likely to be initiated over environmental issues that are found to be complex and perceived as severe (Sabatier, Leach, et al., 2005). However, to consider collaboration as a viable option, actors should not perceive the problem as so severe that they do not feel they have a chance of addressing it through their actions (Ostrom, 2009). Users' economic dependency on the resource also increases their inclination to self-organise to resolve common problems (Ostrom,

2007, 2009). To do so, they need knowledge not only about the environmental system as such, but also how the governance of that system affects them (Ostrom, 2009, 2010).

Interdependence – an awareness by actors that they cannot accomplish their aims if they act alone (Sabatier, Focht, et al., 2005; Emerson et al., 2012; Zachrisson & Lindahl, 2013) – is considered among the drivers that prompt collaboration. It can be a realisation that not collaborating can have potentially negative consequences but it can also be a realisation that an opportunity, or a win-win would be missed (Emerson et al., 2012; Thellbro et al., 2018). Likewise, the occurrence of a substantive negative (e.g. crisis) or positive (e.g. grant funding) incentive, whether external or internal, can also drive forward the establishment of collaboration (Emerson et al., 2012). Uncertainty about the problem at hand and the outcomes of potential solutions is considered also to be a driver of collaboration, as responsibility is distributed among more stakeholders (Emerson et al., 2012). Finally, a leader can be a driving force behind the initiation of collaboration, compensating for the absence of other initiating factors (Ostrom, 2009; Emerson et al., 2012; Eckerberg et al., 2015).

Collaborative arrangements are rarely purely top-down or bottom-up but rather combinations of both. Leadership can either stem bottom-up from the community, or be enacted top-down by the state (Koontz & Newig, 2014; Zachrisson et al., 2018). In top-down initiated collaboration, governmental agencies have more influence over the agenda and procedures, including the breadth of representation of interests (Koontz & Newig, 2014; Eckerberg et al., 2015). Top-down financing has been a traditional policy instrument utilised by the state for establishing co-governance modes at the local and regional institutional levels (Baker & Eckerberg, 2008b). Top-down financing also generally comes with certain requirements regarding the design of the process and prioritisation of aims. Thus, through financing collaborative arrangements, the state can both influence which types of collaboration are established, as well as their issue focus and functioning (Borgström, Zachrisson, & Eckerberg, 2016). Moreover, top-down financing has been shown to play a central role in the initiation of bottom-up collaboration, particularly of the "action" type (Eckerberg et al., 2015). However, funding bottom-up collaborative arrangements without setting requirements can be problematic, if the state does not have proper mechanisms for ensuring rules of fairness. Given that, private actors are not bound to the same extent as authorities by procedures, rules, and by the necessity to achieve outcomes, which are useful for the whole community; bottom-up arrangements initiated by private stakeholders tend to address small-scale problems that fulfil their own interests (Aukes, 2017).

Organisations and individual actors might weigh in all the above-mentioned aspects before making a strategic decision on how to pursue their interests and whether to invest their time and resources in participating in collaborative processes (Lubell, Gerlak, & Heikkila, 2013; Newig et al., 2018). In addition, to be willing to step into collaboration and perceive that their participation is meaningful, actors have to believe that they will be able to actually influence decision-making and that they will not be manipulated by participants that are more powerful (Purdy, 2012; Newig et al., 2018). Importantly, if actors feel their interests are already represented in another venue, they are less likely to want to get involved themselves (Newig et al., 2018). With those aspects in mind, when investigating the existence of cross-sectoral governance interplay I designed the study so that each article probes different levels of governance (see Table 1). In Article II, I empirically tested factors connected to the initiation of collaboration among individual forest owners. Although not the central theme, the initiation of collaboration was also touched upon in Article III in connection to the establishment of two collaborative arrangements in the same area, and in Article IV in relation to the state's role in designing a collaborative cross-sectoral approach at the national level (see Table 1).

Participation and legitimacy of governance processes

Several aspects of the design of a decision-making process determine whether the process and the outputs it produces are to be considered as legitimate. For example, stakeholder inclusion and stakeholders' capacity to participate and influence decision-making determines the "openness" of a decision-making process (Sandström, 2009; Eckerberg et al., 2015; Bjärstig & Sandström, 2017; Newig et al., 2018) and affects procedural legitimacy (Kronsell & Bäckstrand, 2010). There is a difference between designing a "closed vs. open" co-governance system (Arnouts et al., 2012) and an "inclusive" one (Newig et al., 2018). Co-governance is established when it is necessary for governmental and non-governmental actors to work together to achieve a common aim. In closed co-governance systems or arrangements, it is only the very few essential actors that are included in generally rigid structures, while open co-governance can potentially include all those interested and impacted by decisions in more flexible forms of governance (Arnouts et al., 2012). Although a co-governance system or a collaborative process might be open to all interested actors, certainly less resourced actors are still at a disadvantage compared to others. Actively seeking out potential participants among interest holders, as well as compensating them for the cost of participation, can lead to more inclusive representation (Newig et al., 2018).

Participation is among the aspects, together with effectiveness and legitimacy, underscored by the WFD as important (EU WFD 2000/60/EG) in substituting a

fragmented with a holistic policy approach to water management (Howarth, 2005). Yet finding a balance between those three dimensions is not straightforward and constitutes a dilemma (Lundqvist, 2004) where scholarship has specifically recognised the complexity behind diversified stakeholder participation. For example, opening up a decision-making process for a broad representation of interests has been considered a way of reaching environmentally sound decisions (Dryzek, 2013) but this depends on which actors and interests are included. When the decision-making process is opened up to multiple interests, this can have the effect of "waking up sleeping dogs" through raising awareness on the potentially adverse effects that decisions can imply. Environmental interests can consequently be both over- or under-represented, which affects legitimacy in the views of actors with diverging interests. Moreover, certain actors can hold veto power on end decisions that favour environmental outcomes (Newig et al., 2018). Thus participatory decision-making processes can, as with environmental outcomes, have unintended negative social outcomes, such as eroding trust and triggering new conflicts (Anex & Focht, 2002; Newig et al., 2018).

Similarly, limiting participation can have both negative and positive effects on the collaborative process and the implementation of outputs. On the one hand, limiting the participation of certain stakeholders can lead to a deepening of conflicts and the destruction of trust (Anex & Focht, 2002). If the excluded actors are with decision-making power, or "agents of change" (Margerum, 2008), then excluding them can potentially limit the implementation of the outputs (Sabatier, Focht, et al., 2005; Margerum, 2008). Moreover, if private and community actors are expected to implement decisions without being included in a collaborative process for developing the policy, there is a risk that the government gains control, while losing accountability and legitimacy (Watson et al., 2009). Therefore, it is important that state authorities carefully consider how open and inclusive a governance system and decision-making process is designed, as it can both lead to more reflective decisions, as well as generate more conflict and disintegrate the collaborative process (Emerson et al., 2012).

Moreover public involvement in decision-making, albeit leading to more publicly acceptable outputs, has shown to be twice as costly as decision-making without public involvement (Till & Meyer, 2001; Thomas, 2013). In the light of economic constraints and increased demands on governments for decreasing public expenditure (Emerson & Nabatchi, 2015), as well as hard-to-prove positive environmental outcomes (Koontz & Thomas, 2006) the additional costs for applying collaborative approaches can be hard to argue for. Therefore, it is important to be able to link collaborative policymaking approaches to implementation (as investigated in Article IV) and changes in practice (as investigated in Article I) (see Table 1).

The legitimacy of decision-making processes also depends on perceptions of fairness (Karlsson-Vinkhuyzen & Vihma, 2009), which are affected by process design. A process with high deliberative quality where decisions are made through an unconstrained dialogue between equal individuals is likely to be considered as fair (Innes & Booher, 1999; Kronsell & Bäckstrand, 2010). Power asymmetries have shown to be a significant barrier to collaborative processes (Sullivan, White, & Hanemann, 2019) as certain actors, even when included, can have limited influence on the process and decisions made (Michels, 2016; Purdy, 2016). Community representatives specifically have been shown to lack the same influence as governmental and corporate representatives (Baker & Eckerberg, 2014; Brisbois & de Loe, 2016), which can lead to the production of outputs that, despite being labelled as collaborative, are not legitimate. For example, in collaborative arrangements for water management, commercial interests with an important economic role can lower ambition levels when addressing environmental issues (Galaz, 2006). As already mentioned, these asymmetries can be further worsened in cross-sectoral collaborative governance by power asymmetries that stem from differences in how self-organised and autonomous each of the two sectors are (Kooiman, 2003). Here governmental actors can serve an important function in ensuring that power imbalances between sectors and participating actors are levelled out as much as possible and that all views are equally considered (Purdy, 2012; Brisbois & de Loe, 2016). This includes making sure that all perspectives are heard during deliberation and thoroughly considered in the final decisions (Purdy, 2012). Participants' accountability for the decisions they make is also part of procedural legitimacy and part of that accountability is hierarchical – in relation to the state (Jedd & Bixler, 2015).

Process legitimacy, both of internal (participating in the process), as well as external actors (Kronsell & Bäckstrand, 2010), including those expected to implement the outputs, affects the implementation of outputs (Reed, 2008; Pahl-Wostl et al., 2013; Raitio & Harkki, 2014; Johansson, 2016; Newig et al., 2018). The design of processes and aspects regarding their legitimacy are explored more closely in Articles III and IV, with Article IV also examining the impact of process legitimacy on output implementation.

The implementation of outputs from collaborative processes

To achieve political and societal goals, public policymaking uses a mix of different policy instruments that determine both the type of decision-making process, and the acceptance, implementation and compliance with the policy (Bressers & O'Toole Jr, 1998; Newig et al., 2018; Howlett, 2018). The choice of instruments, whether they are legally binding and whether their implementation is rigid or flexible, determines the governance mode and vice versa (Treib et al., 2007). Choosing a collaborative governance mode predetermines the use of

collaboration in decision-making for reaching consensus on policy goals and policy instruments. Collaboration in itself also can be considered a policy instrument, which aims at getting support for policy implementation (Bjärstig & Sandström, 2017).

Policy implementation has been defined in various ways. Some scholars include the actual and perceived outcomes the policy leads to, or the actual and perceived impact on the problem at hand in the implementation process, as well as potential revisions of the initial decision (Sabatier & Mazmanian, 1980; O'Toole Jr, 2000). In this thesis, I define implementation as the process that comes between the decision on a certain output being made and it being transformed into action (O'Toole Jr, 2000). Implementation, in other words, denotes the "intermediate outcomes" (Emerson & Nabatchi, 2015) that follow consensus and lead to the transfer of outputs. They can come in the form of educational programmes and material, management plans, rules of conduct or other tools that aim at introducing the agreed-upon outputs in practice (Margerum, 2008). Resources are crucial for the implementation process to be successfully structured and for supporting or altering certain behaviours (Sabatier & Mazmanian, 1980).

A substantial portion of the research on collaborative approaches was initially explanatory and focused on inputs and processes, rather than on evaluating the outcomes that collaboration has led to (Thomas & Koontz, 2011). Outcomes signify the impacts from the implementation of the governance and management decisions, and can be environmental, e.g. water quality improvement; social, e.g. increase in social capital in the form of new networks (Sabatier, Focht, et al., 2005), and/or economic, e.g. increased economic opportunities for the community (Bjärstig, 2017). With time, scholarship has linked increased participation in decision-making and collaboration to socioeconomic advantages, such as learning, reduction of conflicts over time, grant leveraging, more progressive policy output, and the creation of human and social capital (Bingham, 1986; Wondolleck & Yaffee, 2000; Sabatier, Focht, et al., 2005; Focht & Trachtenberg, 2005; Ulibarri, 2015a; Koontz, 2016; Bjärstig, 2017). Eventually those types of outcomes may lead to an enhanced governance context that increases trust and reinforces the collaborative process and its institutions (Sabatier, Focht, et al., 2005; Emerson et al., 2012).

However, the ability of collaborative governance to attain positive *environmental* outcomes has been questioned and even contested by many authors (Koontz & Thomas, 2006; Stern & Dietz, 2008; Gerlak, Heikkila, & Lubell, 2013; Newig et al., 2018). Indeed, with few exceptions (Biddle & Koontz, 2014; Scott, 2015), the potential success of collaboration in reaching environmental outcomes has shown to be difficult to assess. This is not least because of the long time it takes from implementing measures to witnessing ecological improvement, and the inability

to isolate all other potential factors that could have affected the environment (Sabatier, Focht, et al., 2005; Koontz, 2016). Instead, research has either focused on environmental outcomes as perceived by various actors, often those who are responsible for the projects (Sabatier, Focht, et al., 2005; Bjärstig, 2017), or on the amount of outputs produced and/or implemented as proxies for outcomes (Sabatier, Focht, et al., 2005; Ulibarri, 2015b; Koontz, 2016). Measuring perceived environmental outcomes risks a distortion of results by the so-called "halo effect". Actors who were part of the process can evaluate the outputs and outcomes from collaboration much more positively, while local actors who favour outcomes that are not yet achieved can evaluate the collaborative arrangement negatively despite it achieving other positive outcomes (Leach & Sabatier, 2005; Sabatier, Focht, et al., 2005; Thomas & Koontz, 2011; Koontz & Newig, 2014). Using outputs as proxies for environmental outcomes is also not without risks. Environmental problems are marked by complexity and uncertainty (Eckerberg & Joas, 2004; Sabatier, Focht, et al., 2005), which makes it difficult to predict what effects certain measures will have. Outputs aiming at achieving positive environmental outcomes can fail and even have unintended negative effects (Thomas & Koontz, 2011; Bjärstig, 2017). Nonetheless, in cases when collaborative arrangements fail to achieve the specific environmental improvement they were set out to reach, they can still lead to positive *social* outcomes through strengthening trust and social capital among collaborating actors (Sabatier, Focht, et al., 2005; Bodin, 2017).

Given that only implemented policy can lead to change, one way to measure the effectiveness of governance processes is through investigating whether the outputs they have produced have been implemented in practice (Koontz & Newig, 2014). Although still saying little about the expected environmental effects, this approach assesses the process. Collaborative policymaking is mostly of recommendatory character (Lubell et al., 2010; Koontz & Newig, 2014; Newig et al., 2018) and therefore implementation and compliance is dependent on actors' acceptance of the policy (Newig et al., 2018). Once the decisions are implemented in planning material and management tools, they can affect the management practices of implementing organisations and potentially lead to their change (Vedung, 2016). The extent of implementation of outputs in implementing organisations' own plans and documents is explored in Article IV, while change in practice is what we examined in Article I. In the latter, we specifically examine the application of protection zones near streams in clear cut forested areas. In that manner, Article I took this study one step closer to establishing whether forest and water policy change in a period of 50 years has led to any changes in practice in terms of improved management forest water from an environmental policy perspective.

The role of the state

The concept of water governance combines top-down governmental involvement with bottom-up self-organisation (Bressers & Kuks, 2013) and is therefore a combination of hierarchical and co-governance (Kooiman, 2003). In collaborative (co-)governance modes the state delegates or at least shares much of its responsibilities with networks (Kooiman, 2003; Pierre & Peters, 2005; Arnouts et al., 2012). The more independent a governance mode is from state involvement, the more crucial the state's role is in prioritising policy goals or coordinating networks (Agranoff & McGuire, 2003; Pierre & Peters, 2005; Baker & Eckerberg, 2014). In cross-sectoral network governance, since different sectors, or policy arenas, have different goals (Lubell et al., 2010), the state's role in prioritising between those goals and coordinating between the different sector networks is decisive (Agranoff & McGuire, 2003; Margerum, 2008). Moreover, the state has an important role in not only coordinating between institutional levels of governance but also in implementing policy at the regional and local levels through legislation, the implementation of strategies, and funding (Baker & Eckerberg, 2014). The state sets the stage for collaboration through the creation of collaborative institutions, rules and through allocating resources and, although in different ways, the state plays an important role in both top-down and bottom-up initiated collaboration (Margerum, 2008).

Indeed, studies on collaborative and participatory approaches in Sweden (Eckerberg et al., 2015; Bjärstig & Sandström, 2017; Zachrisson et al., 2018) and how they have affected the Swedish forestry model (Appelstrand, 2012; Widman, 2016) have shown the important role that state authorities play in soft-steering modes of governance and in the different phases of decision-making processes. Public officers can play a key role in the initiation and design of a collaborative process (Sabatier, Leach, et al., 2005; Johansson, 2016; Silveira, Junier, Hüesker, Qunfang, & Rondorf, 2016; Zachrisson et al., 2018; Thellbro et al., 2018), as well as in sustaining the process of collaboration (Margerum, 2011; Sullivan, Williams, & Jeffares, 2012; Sevä & Jagers, 2013; Morse, 2014; Zachrisson et al., 2018). The establishment of collaborative approaches for resource management in sparsely populated rural areas particularly might put a heavy load on certain individuals to represent community interests in multiple collaborative arrangements (Eckerberg et al., 2015; Bjärstig & Sandström, 2017). This can lead to the establishment of pro forma participatory decision-making approaches and affect the legitimacy of the collaborative arrangement (Kronsell & Bäckstrand, 2010). Public agencies and state financing have shown to be important in mitigating those impacts (Eckerberg, Zachrisson, & Mårald, 2012; Bjärstig & Sandström, 2017; Newig et al., 2018). The state also plays an important role in the implementation of the outputs from collaboration and monitoring compliance (Gerlak & Heikkila, 2006; Margerum, 2008; Koontz & Newig, 2014), and public

officers affect the implementation of policy through their personal norms and values (Winter, 2012; Sevä & Sandström, 2017). However their capacity to influence is generally more limited in collaborative, participatory approaches as compared to top-down hierarchical governance (Sevä & Jagers, 2013). The state and public officers also participate in the re-evaluation of policies to see if they have attained their goals (Vedung, 2016).

Authorities can also level out power asymmetries between different types of knowledge, making sure that all types of knowledge are considered in decision-making, e.g. scientific expertise, bureaucrats' expertise on policy relevance, as well as experience-based and local knowledge of stakeholders. In doing so, the state also ensures that a relatively 'neutral' knowledge base, free of self-serving bias, is used for making decisions (Mansbridge, 2014).This is important for two reasons. Firstly, including a broad representation of sources of knowledge in the process of collaboration, while balancing between the sources according to relevance to the issue-at-hand, can lead to enhanced legitimacy (Innes & Booher, 1999; Bäckstrand, 2003). Secondly, collaborative processes considered by participants as not making full use of their expertise and knowledge are less effective in their decision-making and implementation due to hampered information-sharing and mistrust (Biddle, 2017).

Coordination is key in collaboration (Porter & Birdi, 2018) and the state can play an important coordinating role in, for example, knowledge dissemination of between stakeholders and organisations. Knowledge-sharing and learning are of crucial importance in natural resource governance and social-ecological system management as they allow actors to think out strategies for addressing the problem at hand, as well as to understand environmental feedback and adapt governance institutions (Ostrom, 2009; Pahl-Wostl, 2009; Koontz et al., 2015). Knowledge about the problem at hand can determine actors' capacity to meaningfully participate in the process of collaboration (Özerol & Newig, 2008; Bressers, Bressers, Kuks, & Larrue, 2016). The state can see that information and knowledge are shared equally among and between participants and not used for strategic purposes leading to power asymmetries (Bressers et al., 2016). The state can also play an important role in coordinating and sharing information between institutional levels. This is an important aspect of natural resource governance, since the lack of linkages between levels can result in knowledge produced at one level not reaching other levels where changes in governance are required for achieving desired outcomes (Koontz et al., 2015), and can also hamper institutions' adaptability (Boer & Bressers, 2011). Keeping in mind that the increased costs of sharing information are one of the barriers to cross-sectoral decision-making (Feiock, 2013), providing those linkages would be expected to be a state priority if cross-sectoral collaboration is a desired policy goal.

All 4 articles investigate to a different extent the role of the state in the initiation and design of collaboration, as well as in the implementation of outputs from collaborative processes (see Table 1). The state's role in designing the governance frame and the cross-sectoral interplay between governance systems is also investigated as it affects procedural aspects of collaborative process.

Research questions	Articles	Analytical focus
How is forest water governance and management addressed in Sweden?	I	Policy changes in a period of 50 years: the introduction of specific policy instruments for forest water protection
	II	Collaboration between forest owners and/or other actors in the management of forest water at the local level
	III	The management at regional (river basin) level and if the presence of cross-sectoral interplay
	IV	The design of a collaborative process at national level with actors representing different sectors
What are the challenges in cross-sectoral and multi-level governance and how can they be explained?	II	The initiation of collaboration between actors with decision-making power at the local level
	III	The interplay between two governance arrangements in the same area, their overlap and competition over resources
	IV	Establishing a cross-sectoral collaborative process with high procedural, source-based and substantial legitimacy, producing outputs with input from all relevant institutional levels
What are the results and how is their implementation fostered?	I	Actual change in management practices
	III	Stakeholder perception of effectiveness of two collaborative arrangement in the same area, cross-sectoral and multi-level interplay within the two arrangements
	IV	The implementation at national, local and regional institutional level of outputs produced by a cross-sectoral collaborative process at the national level
What is the role of the state?	I	The state's role in choosing between various policy instruments that determine the governance mode
	III	The role of the state in initiating, financing, maintaining (cross-sectoral) collaboration. The state's role as coordinator between institutional levels (vertically) and arrangements (horizontally)
	IV	The role of the state in designing a cross-sectoral collaborative process so that legitimacy and implementation of its outputs are fostered

Table 1 Summary of factors analysed in study, according to analytical focus

Research design and methods

According to my overall research aim, I designed the research as a case study of the governance of a cross-sectoral resource. Forest water was chosen as it is an example of a resource that requires multi-level governance and management across governance systems, allowing me to gain in-depth understanding on how governance functions between levels and sectors, as well as what the outputs and outcomes of that interplay may be. Previous research on governance and the choice of policy instruments has shown that context is of particular relevance for the implementation of EU Directives (Moss, 2004; Keskitalo & Pettersson, 2012; Arnouts et al., 2012; Bressers et al., 2016; Voulvoulis et al., 2017). By carrying out a single case study, instead of studying only isolated variables, I have the opportunity to study a phenomenon and the contextual conditions and factors that affect it (Flyvbjerg, 2006; Yin, 2014). A case study research design can help answer descriptive questions (Yin, 2014) regarding the governance mode; exploratory questions (Yin, 2014) regarding the potential interplay between governance systems; as well as analytical (explanatory) questions (Yin, 2014) regarding the challenges of such interplay and the effects on management practices. Designing the research as a single embedded case study comprised of four sub-cases studies (see Figure 1), allows me to focus deeper on specific theoretical aspects of governance in each sub-case (Yin, 2014).

An embedded case study

Each article represents a case study analysing a smaller unit embedded in the larger case (2011; Yin, 2014) – namely forest water governance. The overarching case study and the smaller embedded studies can be regarded as different levels of conceptualisation, as in Sartori's (1970) ladder of abstraction. The lower down the ladder we investigate, the more specific factors we can study (Sartori, 1970; Mair, 2008). This connects also to the macro- (politico-constitutional), meso- (interactions between state and society) and micro- (societal) levels of analysis (Meadowcroft, 2007). For example, Article I mainly investigates the wider governance context in the form of policy (macro) and the societal effects of that policy (micro). It also touches upon specific governance processes and state-society interactions (meso). Article IV investigates the design of a cross-sectoral governance process where the state interacts with societal actors (meso) and the effects of those interactions (micro), the implementation of outputs by actors. In embedded case studies it is important to return to the larger unit of analysis and the findings of the embedded cases must help answer the questions of the overarching case study (see Table 2). For example, the findings in Article IV help answer questions regarding the challenges in establishing and maintaining cross-

sectoral multi-level governance and the role of the state (RQ2 and RQ3), as well as the results of that governance and their implementation (RQ4).

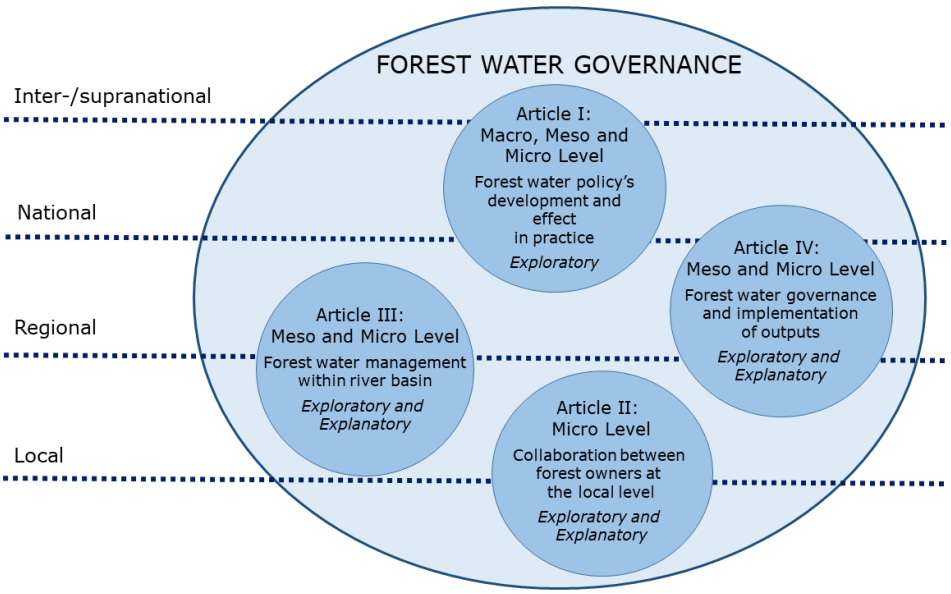

Figure 1 Placement of the units of analysis that are embedded in the single case study of forest water governance, according to institutional levels

The co-authored Article I is the first embedded study, which explores forest water policy development in Sweden and evaluates its effects on management practices. It is a combination of an analysis of past and contemporary policy and GIS map analysis of the Krycklan Catchment study area, located in the Vindeln River basin in north Sweden (Figure 3), and its analytical aim is testing theory. We assessed national and international policy development and its potential effect on management practices at the local catchment level. We also used national statistics about forest harvest and formally protected riparian buffers via either 'habitat protection areas' or 'nature conservation agreement' in Sweden from the SFA's statistics database for a comparison between observed changes of management practices at catchment level with the national level. In Article II, I focused on the micro (local) level within the boundaries of the Krycklan Catchment, to find out whether individual forest owners collaborate in forest water management and which factors could foster such collaboration. The analytical aim of Article II was testing theory. Article III had the aim of developing theory and was a case study of the meso level; interplay between two collaborative arrangement in the same geographical area – the Vindel River basin (to which Krycklan belongs), which also explored cross-sectoral governance and management. The analytical aim in Article IV was to develop theory and the

embedded case study's focus was on an ongoing cross-sectoral collaborative process at the (national) meso analytical level, and the implementation of its outputs at all governance levels (micro analytical level). I present a summary of the methods and materials used for each study in Table 2.

Choice of case: Forest water governance in Sweden

The empirical focus of forest water governance in Sweden was chosen as it was expected to represent a critical case of cross-sectoral governance between governance systems with conflicting goals. A critical case is defined by Flyvbjerg (2006, p. 229) as "(…) having strategic importance in relation to the general problem". It is chosen as the "most likely" case to confirm or falsify propositions and hypotheses (Flyvbjerg, 2006, p. 231) about cross-sectoral governance between two governance systems with competing policy goals. Three reasons qualify this choice: 1) Because of the interconnectedness of forests and water, forest water is a resource that is affected by forestry practices; 2) In the chosen context, forests and water are governed by two separate sectors (forest governance is within the realm of the Ministry of Enterprise and Innovation, while water governance in the Ministry of Environment); 3) The chosen context has a vast territory covered by productive forests and an ample amount of surface water within those forests, which is affected by forestry practices (Laudon et al., 2011; Eklöf et al., 2014; Lidskog et al., 2018). The chosen case is critical because it has the most likely preconditions for the emergence of cross-sectoral governance: "If cross-sectoral governance is/is not present in this case, it will be/will not be present in any (or only few) cases"[3].

The Vindel River Basin and the Krycklan Catchment

Although not entirely restricted to the Vindel River basin, I have used the social-ecological system of the Vindel River basin as a point of departure for three of the studies that comprise this thesis (Articles I, II and III). There are several reasons behind this choice. Firstly, even though it is a tributary of the regulated Ume River downstream, the Vindel River is one of the four national rivers in Sweden that remain unregulated. It represents an area of high ecological value, which is part of the EU Natura 2000 network of nature protection areas (Gardeström, Holmqvist, Polvi, & Nilsson, 2013).

The Krycklan catchment lies within the Vindel River Basin and is part of the Krycklan Catchment Study area in northern Sweden, which has been subject to extensive research and documentation of its hydrology and water quality over the last 30 years. It is a typical catchment dominated by Swedish forests managed for

[3] In the words of Flyvbjerg (2006, p. 230) "If it is not valid for this case, then it is not valid for any (or only few) cases."

production forestry. The forests are managed by a combination of private individuals as well as forest companies (Laudon et al., 2013).

Figure 2 The Vindel River basin is of high ecological and social value

Much of the forested territory surrounding the Vindel River is not protected and is regularly exploited through traditional harvesting methods that have shown to have substantial effects on water quality (Laudon et al., 2011; Eklöf et al., 2014; Futter et al., 2016). The river remains unregulated because of an intense environmental campaign in the early 1960s that was one of the first environmental protest movements in Sweden (Vedung, 1978). Public interest in the river basin is still high, proof of which being the many past and ongoing restoration projects in the area, some aiming at mitigating the effects of previous exploitation for timber floating (Gardeström et al., 2013).

The Ume and Vindel River Water Council was initiated top-down as an immediate response to WFD implementation, as opposed to many examples from southern Sweden where bottom-up water organisations at river basin level have existed since the 1950s (Lundqvist, Jonsson, Galaz, Löwgren, & Alkan-Olsson, 2004; Franzén, Hammer, & Balfors, 2015). This is of relevance when analysing the interplay between two collaborative arrangements in the same area in Article III. The Vindel River basin is therefore a fruitful case for studying the institutional

design concerning forest water management at the regional (river basin) level (see Article III), because its biodiversity and socio-ecological importance draws to the management processes a variety of actors from different sectors and with competing aims.

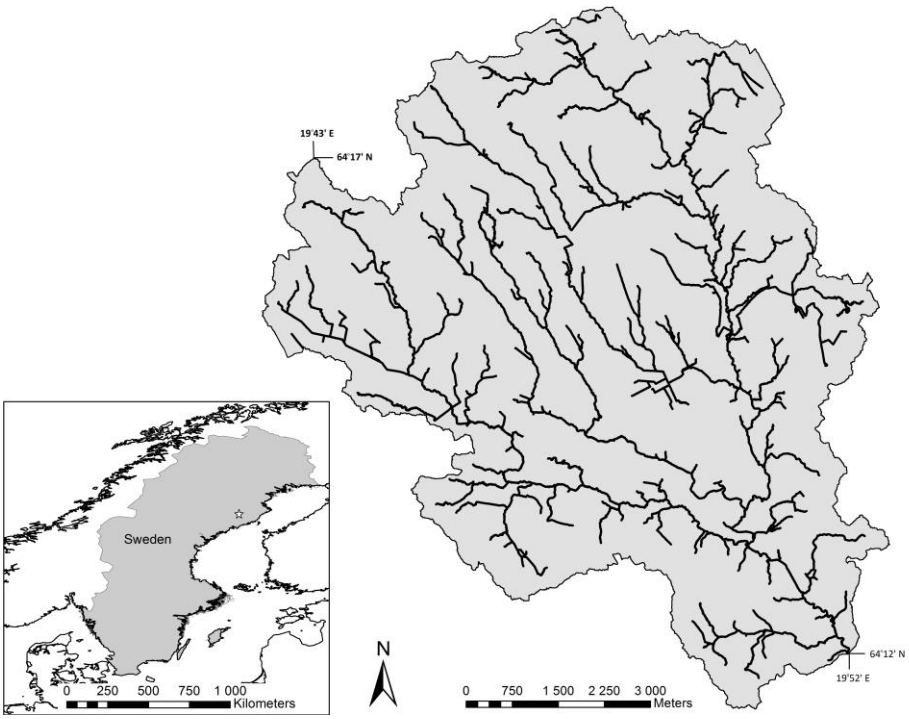

Figure 3 Location map of study area in northern Sweden. The star on the inset map shows the approximate location of the detailed map. The detailed map displays the outline of the Krycklan Catchment as well as streams that flow year-round (perennial streams). Latitude and longitude of the Krycklan Catchment are also noted. Map: Eliza Maher Hasselquist

Research methods

Quantitative methods

Aerial photographs

In Article I we used aerial photograph interpretation of the Krycklan Catchment Study Area in northern Sweden (Figure 2), which is a typical Swedish catchment dominated by forests and forestry. We looked at potential policy impacts on forestry practice, where the protection of riparian buffers was specifically chosen because it has a significant impact on forest water quality and is relatively easy to assess through aerial photo interpretation. One aerial photograph was

interpreted for each decade from 1963 to 2013 (a time-period of 50 years) and the boundaries of new clear-cuts were delineated in GIS (geographical information system). To evaluate whether protection zones were left near streams in the new clear-cuts, a stream network was developed for the catchment through modelling surface flow (see Ågren, Lidberg, & Ring, 2015 for specifics). We also measured the length of forest ditches, as ditching is closely tied to forest water quality, and compared protection zone and ditching data with national level data. We categorised the streams and for each stream size category, we summed the total length of stream affected by new clear-cuts. We then calculated the proportion of length of each of these stream size categories with a given buffer type (> 10m, < 10m, none). To support our results, we also used the publicly available national-scale data, quantifying forest clear-cuts and drainage ditching over time and riparian buffer zones formally protected in nature conservation agreements.

Descriptive statistics and test of association

In Article II, I investigated the factors that could instigate collaboration over forest water management at the local level through a survey of all private individuals who own forestland in the Krycklan Catchment (85 individuals). The response rate was 54% (N = 46). Although 46 responses is a low count in itself, it is the response rate for the entire case population and not a sample of it (Agresti & Finlay, 2009), and lies above 50%, allowing for certain generalisations about overall conditions within the area. My first aim with the survey was to investigate whether the forest owners were already collaborating or interested in collaborating with other stakeholders. In addition, I examined variables that are deemed crucial for the initiation of collaboration, such as the existence of leadership in the area, forest owners' perceptions of forestry and water protection, and their knowledge on the effects of forestry on water (see previous chapter). I analysed the responses through descriptive statistical methods, as well as by looking for association between different variables.

Qualitative methods

Policy analysis

I used several qualitative methods of data collection and analysis in this thesis. In the first study, we carried out a policy analysis for the same 50-year period that we analysed aerial photographs. We examined what policy instruments were introduced in Sweden between 1963 and 2013. This included legal and regulatory instruments; economic incentives and disincentives; market-based instruments such as certification; and 'soft steering' mechanisms such as education, information and advice. I also analysed policy documents in Articles III and IV. In the former, I analysed all available meeting protocols of the Ume and Vindel River Water Council and the statutes for its formation and aims as well as those

of the Vindel River Fishing Association. In Article IV I analysed a total of 19 documents, including two SFA reports on the implementation of the outputs of the collaborative process – the Strategic Objectives (SFA 2016; 2017), published Strategic Objectives, referrals on the Strategic Objectives, as well as plans, statutes and policies of implementing organisations that are available online.

Open-ended interviews

I used qualitative in-depth, open-ended interviews in Articles II, III and IV. In Article II, I interviewed eleven key stakeholders with the aim of complementing the statistical data and obtaining a more diverse and detailed picture. The interviewees can be categorised as two types: individual forest landowners and other stakeholders. The forest landowners were purposively selected (Bryman, 2008) from the Krycklan area, according to the size of their property, as well as to the presence of water sources (streams). Together with a forest ecologist, we looked for streams that form the borders of the property and the neighbouring landowner, or that run through several properties and therefore require certain interaction between neighbouring owners in order to be efficiently managed from a water quality perspective. Out of the eight forest owners of properties that we identified as particularly interesting, one forest owner from the area was already interviewed in connection to his role within the Krycklan Fishing Management Area, and three more agreed to be interviewed. In addition, at the onset of the research one representative of the Swedish Forest Agency, one fishing advisor who has a leading role within the Ume and Vindel River Fishing Council, and one leader of a completed restoration project within the Vindel River basin were interviewed to map the state of collaborative water governance in the area.

In Article III, I heavily relied on open-ended interviews that lasted between 15 minutes and an hour. I interviewed in total 13 key stakeholders: eleven from the collaborative arrangements that function in the river basin and two representatives of the indigenous communities in the region who do not participate in either of them. This was to uncover the reasons behind the establishment of the second collaborative arrangement and investigating how interviewees evaluate both arrangements. I started by interviewing the heads of both arrangements who are responsible for the administrative work. I then purposively sampled additional interviewees either theoretically – according to the interests they represent in the arrangements or through snowball-sampling (Bryman, 2008; Ritchie, Lewis, Nicholls, & Ormston, 2013). I strived to include different positions and the perspectives of diverse interest holders. I derived my questions from a questionnaire used in earlier research investigating the link between collaboration and sustainability (Bjärstig, 2017). I asked interviewees about the initiation of collaboration, the issues it addresses, the process, representation of interests, influence of different stakeholders on the process and outputs, type of outputs produced and perceived outcomes from it.

In Article IV, I carried out a total of 16 open-ended interviews with process participants, organisers and one NGO representative, and 22 short semi-structured telephone interviews with implementing organisations. The telephone interviews were included to get a more recent account of the developments in the implementation of the Strategic Objectives. Moreover, since "(…) archival data can be subject to their own biases and shortcomings" (Yin, 2011, p. 12), I wanted to avoid relying too strongly on the SFA reports that may include data or interpret it with certain bias. I conducted the short interviews with implementing organisations from all possible categories within the forestry sector. I surveyed all four forest owner associations, five large forestry companies (SCA, Bergvik, Sveaskog, Holmen, Stora Enso), the Swedish Association of Forestry Contractors, all three Regional Sawmill Associations, as well as between two and four sawmills from each region that were recommended by the associations, according to how many actual forestry practices they carry out. The interview questions consisted of: have you heard of the Dialogue Process and Strategic Objectives; do you use them in your everyday forestry practices; what sort of quality evaluation programmes, planning documentation, educational packages, etc. do you have; from your perspective, do the Strategic Objectives prescribe a reasonable level of nature consideration?

Meeting observations

In both Articles III and IV, I conducted so-called "direct observations" of meetings (Yin, 2011). My aim was to acquire a deeper understanding of meeting procedures and how different stakeholders interact (Ritchie et al., 2013). In Article III, it was important to apply the same types of methods for both studied arrangements so that I could compare them (Bryman, 2008). In both cases I used my own deliberate interpretations of what I observed (Yin, 2011) based on the studies' theoretical assumptions.

In all of the applied qualitative methods I have used what Yin (2011) calls a "case study protocol" comprised of the research questions and the theoretical framework used to answer them. This helped break down the research questions into sub-questions and variables that could inform either the interview manuscript, or the information I sought in the document and meeting analysis. I applied several methods of research in all studies with the aim of triangulating my results (Yin, 2011). In that manner I have tried to avoid the pitfalls of applying only one method of data collection and analysis or failing to survey a breadth of interest and position holders, since that could tint the studies' results (Sabatier, Leach, et al., 2005; Bryman, 2008).

Case study generalisability

With this study I aim at general theoretical contributions and at filling research gaps within governance literature through investigating theoretical assumptions based on previous research literature and unravelling fine-grained details in complex causal relations. Case studies, when carefully selected, allow for analytical generalisations which is the foremost strength of this research design (George, Bennett, Lynn-Jones, & Miller, 2005; Yin, 2011; Ragin & Amoroso, 2011). This is especially true for critical case studies, as they allow for theoretical generalisations in the sense that "If it is valid for this case, it is valid for all (or many) cases" and "If it is not valid for this case, then it is not valid for any (or only few) cases" (Flyvbjerg, 2006, p. 230).

In that manner, the study could also speak more widely than to just a Swedish audience alone since conclusions are made on a theoretical and analytical level. Still, some of the aspects of the chosen case can be found in other contexts. Examining the governance of a resource governed by two separate softly regulated governance systems with conflicting goals, could contribute to theoretical assumptions about how such cross-sectoral governance could be designed and implemented in similarly regulated sectors in other contexts. Since the Swedish societal context is one of a historically high level of trust in public institutions (Kumlin & Rothstein, 2005; Ervasti & Ervasti, 2008), theoretical assumptions based on the results could be examined with empirical material from societal contexts of lower trust to examine whether the same mechanisms work and how.

Another contextual factor concerns forest water governance within a context where most of the forestland is privately owned. Having a large share of privately-owned forests by individuals is not unique to Sweden. For example, in Finland 60% of the forestland is owned by individuals (Similä, Pölönen, Fredrikson, Primmer, & Horne, 2014), while in the US 56% of forests are privately owned, 36% by families or individuals (Snyder, Butler, & Markowski-Lindsay, 2019). This contextual aspect could be of theoretical relevance and raise understanding on how a collaborative approach could be applied in a context of fragmented ownership and decision-making power. It also has implications for practitioners through shedding light on how management practices of private landowners with decision-making power could be influenced.

Article	**Case Study**	**Research question**	**Use of theory**	**Method**	**Material**
I	Descriptive and exploratory Area: Sweden, Krycklan Catchment	Does policy affect forestry practices?	Steering through policymaking and different types of policy instruments	Policy Analysis Mapping of the application of stream protection zones	10 Policy documents Aerial photographs
II	Exploratory and explanatory Area: Krycklan Catchment	How can collaboration over forest water be instigated among individual forest owners?	Contextual factors and drivers that spur collaboration	Statistical analysis Open-ended interviews	Survey to all forest owners (85) in the area (N=45) 11 interviews with key stakeholders
III	Exploratory and explanatory Area: The Vindel River basin	How do collaborative arrangements interact and do they compete with or complement each other?	Analytical typologies of collaborative arrangements and interplay	Open-ended interviews Policy analysis Observations	13 interviews with key stakeholders, analysis of statutes, 15 policy documents and meeting protocols; two meeting observations
IV	Exploratory and explanatory Area: The National Level (Dialogue Process)	Which factors enhance the implementation of the outputs from collaborative processes?	Legitimacy and policy implementation theories	Open-ended interviews and short telephone interviews; policy analysis, observation	38 Interviews with key stakeholders, analysis of 19 documents and meeting protocols; one meeting observation
Summary of empirical material for the whole thesis:				62 interviews; one survey; 43 documents; three meeting observations, aerial photographs	

Table 2 Summary of applied methods and used materials in each article, according to research questions.

Background: Forest and water governance in Sweden

Forests and water are two natural resources with high social and ecological value. Some of their characteristics are shared, whilst others are distinctive. Forests are valued in connection to biodiversity, significance for economic development and recreational opportunities (Bostedt & Mattsson, 1995; Stens et al., 2016; Eriksson et al., 2018), as well as for the provision of water security (Foley et al., 2005). Similarly, surface water is important for biodiversity and provides recreational opportunities. Access to clean and/or plentiful water in connection to sectors such as agriculture and energy, is not only economically important but also of environmental and social significance (Poff et al., 1997). Forests are non-mobile and take a relatively long time to regenerate (Chesson, 2000), while surface water is mobile and its system dynamics are unpredictable (Ostrom, 2009).

What are the effects of forestry on water?

Figure 4 An example where forestry machinery was driven across the stream without building a temporary bridge. The created tracks increased the risk of erosion and export of suspended solids and mercury (Ring et al., 2018). Photo: Eva Ring

Forest management significantly affects water quality and dynamics, since forests are of crucial importance to the water cycle (Gundersen et al., 2006; Futter et al., 2016). For example, clearcutting – a common management practice in Sweden –

is a source of diffuse pollution. It increases runoff and the concentration of nitrogen and mercury in surface waters (Eklöf et al., 2014; Futter et al., 2016; Sponseller et al., 2016). The use of heavy machinery and driving through or close to surface water may cause deep rutting (see Figure 4) and deliver sediment directly to nearby streams and lakes (Ring et al., 2018). This severely intensifies the negative impacts on water quality and aquatic biodiversity (Eklöf et al., 2014; Kuglerová, Jansson, Ågren, Laudon, & Malm-Renöfält, 2014). Drainage of forested wetlands through ditching and ditch-maintenance for increased timber production has a profound impact on water quality in downstream waterways (Hasselquist, Lidberg, Sponseller, Ågren, & Laudon, 2018). Despite many positive developments, mercury contamination are among the challenges European Union waters still face in regards to non-point source pollution (EEA, 2018). The complexities of diffuse pollution of water is among the driving forces behind the implementation of the EU WFD (Kallis & Butler, 2001). For this study, it is important to underline that the forest and water sectors have different and often competing policy goals (Söderberg & Eckerberg, 2013; Roberge et al., 2016; Lindahl et al., 2017; Johansson & Ranius, 2019). Having competing goals significantly complicates the cross-sectoral collaboration (Lubell et al., 2010) required to reach WFD goals.

One way to minimise the negative effects these forestry practices have on water quality is through protecting riparian forests and minimising operations in them (Ring et al., 2017). Riparian forests filter water, sediment, and nutrients transported from upslope areas, thus regulating the nutrient loading to the aquatic system (Gundersen et al., 2006; Kuglerová et al., 2014). That is why we chose to focus on the application of riparian zones when investigating the impact of policy on water protection in Article I.

Implementation of the European Union Water Framework Directive

The WFD was adopted by the European Parliament and the Council of Ministers in 2000, and the European Commission made responsible for monitoring and follow-up on whether the goals are met within the specified timeframes. It was enacted in Swedish national legislation in 2004. The WFD calls for a holistic approach to water management to attain the goal of "good status" of European surface water. If WFD goals are to be reached, then diffuse pollution of surface waters and all human activities (including forestry) that contribute to it should be addressed. In that manner, the implementation of the WFD sets the stage for collaborative approaches to water governance, forest water included. Since forests and water are two separate sectors governed by two policy arenas, addressing holistically the effects forestry has on water would require a cross-sectoral approach. It demands "(…) cooperation and coherent action (…)" at EU,

state and local level and further stipulates three types of participation of the public and users before decision-making: *information* about river basin management plans; *consultation* in the development of plans to address issues; and *active involvement* in "(…) the production, review and updating of river basin management plans." (EU WFD 2000/60/EG). The WFD therefore stipulates participatory decision-making processes that grant participants influence over decisions (Kallis & Butler, 2001; Newig et al., 2018). The WFD further defines the river basin as an appropriate level for effective water management (EU WFD 2000/60/EG) which, depending on the institutional context of Member States, could require reforms of varying depth and intensity (Moss, 2004; Voulvoulis et al., 2017).

According to the European Commission's Fitness Check (2019), the WFD has been successful in setting up a water governance frame in the European Union based on water ecological scales, such as river basins, as opposed to administrative borders. The observed slow-down of water status deterioration and reduced point-source pollution has also been attributed to the WFD. However, this rescaling and reorganisation of the water administration has not been enough to achieve the WFD's main goal – good status for all waters – with only half of all European water bodies having attained it. The report confirms the previous research findings (Moss, 2004; Voulvoulis et al., 2017) that the difficulty of integrating water goals in other policy areas is among the main hindrances to achieving better results.

Water Administration

The river basin approach aims to restructure water management according to ecological boundaries. Since water does not recognise political-administrative borders, water governance demands a holistic type of approach that stretches beyond such borders (Pahl-Wostl, 2019). With the implementation of the WFD in Sweden, management responsibilities were shifted towards regional river basins and district levels in an attempt to make water management multi-level and cross-sectoral (Lundqvist, 2004). The country was divided into five water regions, consistent with five major marine districts: Bothnian Bay, Bothnian Sea, Northern Baltic Sea, Southern Baltic Sea, and Skagerrak and Kattegatt. Five Water Authorities were created to manage the corresponding districts, each of which included the County Administrative Boards from the region, with one being set as responsible for decision-making and coordination (Franzén et al., 2015). The Swedish Agency for Marine Management (SwAM) mainly provides expert input and guidelines to the Water Authorities. The Swedish Government formed the SwAM in 2011, and thereby removed the national level water administration coordination from the Swedish Environmental Protection Agency (CRSWA, 2019).

The Water District has its own decision-making body called the Water Delegation (Board of Governors in Lundqvist, 2004). It includes representatives of public and private organisations, who are appointed by the government for three-year periods and has regular meetings several times per year. During those meetings they discuss and decide on Water Management Plans and on environmental quality norms and measures. Each Water Delegation has its own Reference Group, which is comprised of various stakeholders including so-called municipal level "water politicians". The reference group has the task of supporting the Delegation with advice and feedback on how to better include all issues that are of importance for the water management of the area (Vattenmyndigheterna, 2018).

In each water district, Water Councils were formed by the state at regional level according to river basins, to serve as fora for deliberation. The Water Councils include relevant stakeholders within the river basin and are, albeit top-down initiated, expected to represent a bottom-up perspective to water management. Water Councils lack decision-making power but come up with recommendations for the management of the river basin, which are considered and decided on by the Water Delegation (Lundqvist, 2004; Eckerberg et al., 2012; Franzén et al., 2015; Matti, Lundmark, & Ek, 2017). According to Water Council representatives, one significant problem concerning the Councils' capacity to perform the ambitious tasks delegated to them is that their role and tasks are not clearly stipulated. Furthermore, the Councils are perceived to be underfinanced and much of their work, including network building, relies on volunteer effort on behalf of their members (Eckerberg et al., 2012). A study on Water Council participants in all of Sweden concluded that the aspect of participation that is embedded in Water Councils may be a hindrance to increasing compliance with the WFD (Carlander, von Borgstede, Jagers, & Sundblad, 2016). This indicates that current collaborative arrangements in Swedish water management might be inefficient for reaching the stipulated water management goals.

The governance shift after WFD implementation did not include the provision of clear division of power and steering mechanisms, and resulted in a water administration that has been criticised for being ineffective and lacking external legitimacy and policy cohesion (Duit et al., 2009; Söderberg, 2016; Matti et al., 2017). Even though the central government has considerable authority in the Swedish context, in contrast to examples of federal states (Sørensen, Lidström, & Hanssen, 2015), governance is highly focused on municipal self-governance (Keskitalo, 2015). The 290 municipalities play a significant role within water management, mostly through their responsibility for drinking water and overall water quality (Lundqvist, 2004; Franzén et al., 2015). Still, however, municipalities were largely marginalised in the governance system after WFD implementation (CRSWA, 2019). Neither were the Fishing Management Areas'

Associations, which also have a long history at the local level, explicitly included at the onset. They are interest-based member organisations consisting of landowners, and thus fishing-rights' owners, which manage most Sweden's water sources (Olsson & Folke, 2001). The participation of Fishing Management Areas in management structures varies according to river basin and Water Council.

As in other EU member state-contexts (Newig, Schulz, & Jager, 2016), the river basin approach to water administration in Sweden was not fully achieved. The established institutions were frail with weak connections between each other and between institutional levels. Most importantly for this study, water management has been criticised as being largely detached from the efforts of other sectors to attain environmental sustainability goals (CRSWA, 2019).

Addressing Forest Water Management

Forest water is the responsibility of the forest sector under the so-called 'sector responsibility' (see also Article I). The Swedish Forest Agency (SFA), operating at national, regional and local level, controls what practices are performed within the forests through their authorisation of different forestry activities, in accordance with the Forestry Act (1993). The regional and local offices of the SFA are mainly responsible for field inventories, contact with forest owners and site visits. Although some of the officers are located in regional offices, the administration of the SFA is centralised. Thus the forest sector has a polycentric governance system that because of the SFA's important coordinating role is of centralised nature (Sundström, 2009). When the SFA was assigned by the Swedish government to analyse the need for revision of laws and policy to achieve WFD aims, it recommended only soft, non-legislative measures, in accordance with existing forestry regulation (Keskitalo & Pettersson, 2012). As a consequence, forest water management and attaining forest water quality goals in Sweden relies on soft policy instruments (e.g. certification and recommendations) and commercial forestry's willingness to comply (Sundström, 2005; Keskitalo & Pettersson, 2012). When looking at forest water management, one should keep in mind Sweden's long tradition of corporatism (Lindvall & Sebring, 2005). Although facing an economic decline since the late 1980s (Persson et al., 2016), commercial forestry on the one hand and bureaucrats and politicians on the other, have maintained their close collaboration in policymaking (Eckerberg, 1987; Bjarstig & Keskitalo, 2013). After the Forest Act (1993) made production and environment goals equal, authorities have tried to mitigate the inherited conflicts by steering stakeholders with conflicting interests into network governance structures (Sundström, 2005). As a consequence of corporatism and a network governance mode, the forest governance system in Sweden is a combination of a minimum level of binding (Johansson, 2016) and non-binding legislation, and voluntary certification that lack coherence,

complicating coordination when implementing environmental goals (Johansson & Keskitalo, 2014). Forest governance, and thus forest water management, is dependent on private actors, since more than 50% of Swedish forests are privately owned (Swedish Forest Agency, 2014).

There has been a positive shift since WFD implementation. Water management and protection focus has shifted from protection of water sources with high ecological value, to a more all-encompassing water management strategy, which includes water sources assessed as of lower ecological value and of lower water quality (Andersson, 2014, p. 9). The SFA, in consultation with the SwAM, was assigned to develop policy instruments to reach good forest water quality (Andersson, 2014). This attests to the positive role the WFD played in recognising the need to apply a broader perspective when approaching the problem of water management (Andersson, 2014). In addition, myriad forest water environmental projects have been initiated after WFD implementation. The SFA is project leader and co-financer of one of the larger – Grip on Life. It amounts to EUR 15 million, 60% of which is financed by the EU. The implementation of the WFD also spurred interest and engagement among commercial forestry. Since then, the Forest Owners Association in Southern Sweden participates in 40-50 Water Councils in southern Sweden. Around 2010, commercial forestry started its own Water Board (hereafter Forest Water Board) as a reaction to the implementation of the WFD and to follow national policy and practice developments related to water. The Forest Water Board's work led to the forest sector's research institute reviewing existing research on terrain driving and its effects on forest water. Its report resulted in a sector-wide policy for terrain driving in 2012 (Article IV). However, SFA reports (Claesson et al., 2016; Eriksson & Högvall Nordin, 2017) and research (see Article I) reveal quite slow progress within the forest sector in implementing forest water protection measures in practice. There is also a mismatch between the definition of water bodies and most surface water in the forest, which hampers the implementation of environmental objectives for water quality (Andersson, 2014).

Overview of appended papers

Article I

In Article I we aimed at investigating whether forest and water policy historically has influenced forest-water protection measures. Improving water quality has become a prioritised environmental issue in Sweden as in the rest of the EU, not least because of the implementation of the WFD. Yet the relationship between the enactment of new water policies and their effect on forest management is largely unknown. We combined policy analysis with aerial photo interpretation, with the aim of comparing policy activity to forestry practices in the 50-year period. Our results showed a relationship between policy making and steering through both 'hard' and 'soft' policy instruments and the gradual implementation of forest water protection in Sweden, where the forest sector has clearly improved the protection of streams over the period studied. Around 65% of all streams affected by forestry had some sort of riparian buffer protection by 2013 as compared to about 15% in 1975. However, measured by stream length protection, the picture is somewhat less impressive. Only 50% of the stream length affected by forestry was protected by 2013 and, while 90% of large streams had buffers, small streams lacked a buffer approximately 65% of the time.

There were two distinct step changes in implementation over the studied 50-year period. The first corresponded to the implementation of the 1974/1979 Forestry Act with associated changes in practice detected with a little time lag in the 1980s. The second step was a doubling of >10m riparian buffer implementation from the 1990s–2000s, corresponding to the adoption of multiple environmental protection policies in the 1990s and early 2000s, including the 1993 Forestry Act, establishment of voluntary certification schemes (FSC and PEFC), the introduction of the National Environmental Quality Objectives, the Environmental Code, and the WFD. It is unclear which of each of these policy instruments was most important since they were introduced subsequently around the same period. We did however, also observe a plateauing of >10m buffers at 50% and a decrease in <10m buffers after 2000. This tendency could be a consequence of forest owners willing to change their practice having already done so, because of the "soft steering" approach through education and study circles. "Hard regulation" accompanied by sanctions could be required to increase protection further.

Article II

In Article II, I examined which factors facilitate the initiation of collaboration among individual forest owners with decision-making power in forest management. Since Swedish legislation regarding how forestry should take water

quality into account is largely recommendatory, and 50% of Swedish forests are owned by individual private owners, everyday decision-making concerning forest and forest water management largely rests with these individual landowners. This fragmentation of decision-making necessitates a collaborative approach to forest water management between forest owners within catchment areas if an all-encompassing approach is to be achieved, based on river basin management and by including all interested stakeholders in the governance of water resources as called for by the WFD. According to collaborative governance literature, there are several key preconditions for the initiation of collaboration. I investigated those factors by both sending a survey to the whole population of individual forest owners in the Krycklan Catchment and interviewing key stakeholders.

The results suggest that regardless of top-down initiated efforts to reduce the negative effects of forestry on water through information and appeals for collaborative management, stakeholders at the local level are unwilling to step into collaborative initiatives when certain factors are missing. Moreover, despite low belief and cultural heterogeneity it does not suffice on its own in instigating collaboration between individual forest owners. The diffusion of information about the problem and the existence of stores of social capital in the form of networks and trust proved to be of importance if stakeholders are to want to collaborate. The most crucial factors for spurring collaboration however, proved to be the perception of the problem as important and the realisation that stakeholders are interdependent on each other for reaching their goals, and thus must collaborate. If all the previous factors are missing, then leadership also becomes crucial, as it could compensate for their absence by investing in spreading information and bridging social capital. If government authorities want collaboration to be initiated, then they should take responsibility for securing and diffusing scientific knowledge about the issue at hand, its severity and the need to collaborate for its resolution, as well as the responsibility for bridging social capital.

Article III

In Article III I aimed at advancing collaborative governance theory by investigating the interaction between two different collaborative arrangements within the same forested area of high ecological and social value in the Vindel River basin. The interaction between collaborative arrangements that exist within the same geographical area is an understudied aspect of collaborative governance. On the one hand, numerous collaborative arrangements within the same geographical area could place a heavy workload on certain stakeholders and potentially increase transaction costs. On the other hand, collaborative arrangements with different aims and thus of different types – policy, organisational or action arrangements – could also have a positive effect through

the creation of networks and the delegation of functions between each other. Firstly, I investigated which factors could explain the establishment of a new collaborative arrangement within an area where one already existed. Then I explored whether the two arrangements compete, or if they complement each other. Finally, I examined if any of them addresses the effects of forestry on water in the river basin. I used semi-structured interviews, analysed policy documents and observed board meetings of the two collaborative arrangements to answer the research questions.

The analysis revealed that the new collaborative arrangement was formed because the existing arrangement did not materialise certain stakeholders' expectations. The newly established arrangement was formed from the bottom-up by local anglers who mobilised top-down provided funding. It focused on implementing concrete measures. The existing top-down established arrangement focused instead on information sharing and had a very small budget. The results did not indicate that the two collaborative arrangements competed but rather that they complemented each other through providing different types of fora and focusing on different types of issues. The newly established organisational/action collaborative arrangement presented those stakeholders most interested in on-the-ground action with the appropriate venue, while freeing them from the organisational/policy arrangement that did not match their aims. Both arrangements experienced power asymmetries as certain stakeholders were perceived as having more influence on their agenda. The focus for collaboration at this local-regional level was found to be on limited problems with concrete and more feasible solutions, such as fish migration, rather than on the complex problems with solutions marked by ecological uncertainty and power asymmetries, such as diffuse pollution from forestry.

Article IV

In Article IV, I investigate process factors that could explain the broad implementation by the forest sector of outputs from a collaborative dialogue process at the national level. Previous literature has argued that the legitimacy of a decision-making process and its outputs is of crucial importance for their acceptance and implementation by actors. Legitimacy can be divided into several components. *Procedural legitimacy* concerns mainly the process of decision-making, how inclusive it is and whether participation is on equal grounds, as well as if there is accountability. *Source-based legitimacy* is about the information and knowledge on which the decisions are based. Legitimate sources of knowledge include expertise, bureaucratic knowledge and local, indigenous knowledge. Finally, *substantive legitimacy* denominates the perceived effectiveness of the outputs, whether they place a fair burden on various actors and whether there are resources for their enactment. I studied the Dialogue for

Nature Consideration in Sweden through document analysis, observation and 38 interviews with participants and representatives of implementing organisations. I found that the outputs from the collaborative process, the Strategic Objectives (despite having only recommendatory power and being non-binding) were implemented to a very high degree in educational and planning tools all over Sweden.

The results show that both process participants and implementing organisations considered the dialogue process and the outputs it produced as having high procedural, source-based and substantive legitimacy. This was largely due to the SFA making sure that there was a broad representation of interests, that an unconstrained dialogue was facilitated and that different sources of knowledge were considered when producing the outputs. While external legitimacy could be construed as low because of deficient representation by environmental NGOs, internal legitimacy for the forest sector was deemed to be high. Process legitimacy showed to be of key importance for forest actors to effectively implement the outputs since they perceived them to be their "own". Given that the Dialogue Process was initiated and coordinated by the SFA, the state played a crucial role in designing the process in a manner that fostered legitimacy.

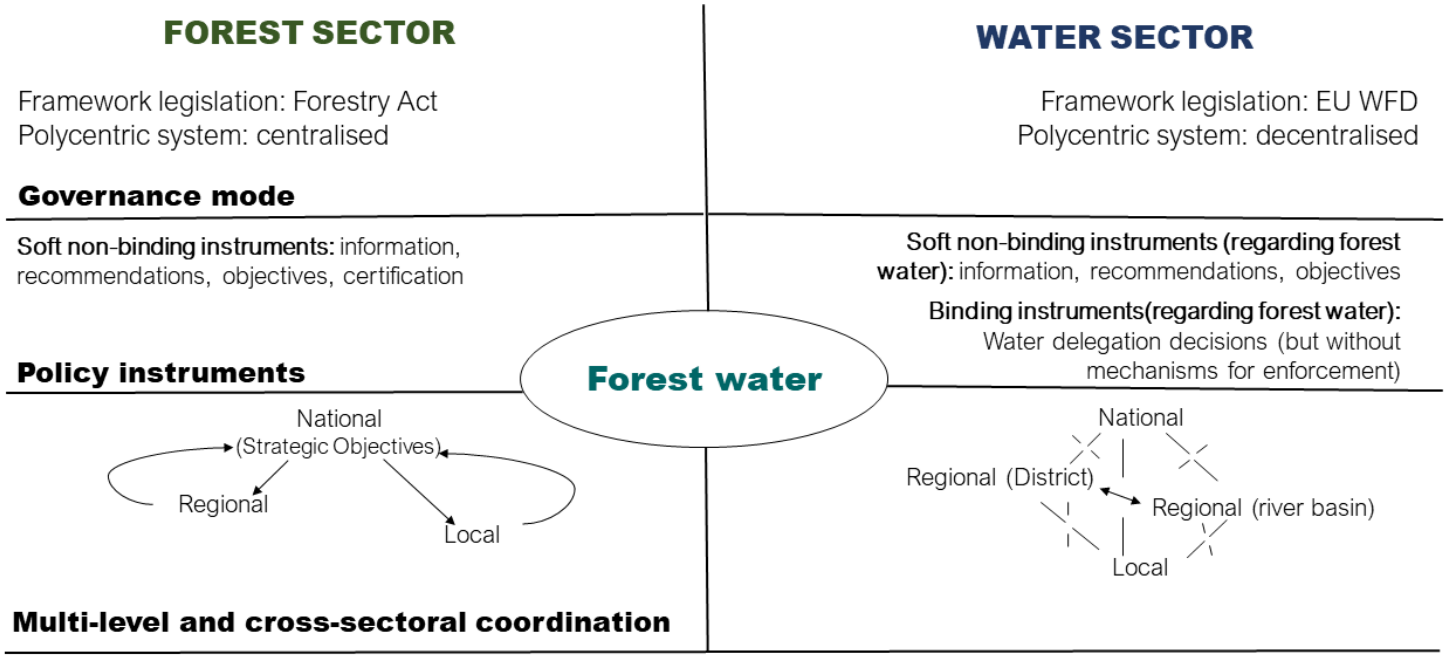

Figure 5 Differences and similarities between the two sectors, including governance mode, policy instruments, type of polycentric governance system, and connections between institutional levels.

The challenges of cross-sectoral multi-level governance and the role of the state

The overarching aim of this thesis was to study governance that requires interplay between two sectors, representing two different governance systems and multiple institutional levels. The four articles together investigate forest water governance across national, regional and local levels and demonstrate that many of the challenges that environmental governance traditionally experiences (Eckerberg & Joas, 2004; Ostrom, 2009; Koontz et al., 2015) are valid and even further amplified when governing a cross-sectoral resource. The analysis shows how the sectors' different modes of governance, with competing and conflicting goals of the governance systems, further complicate the achievement of a common cross-sectoral policy goal (see Figure 5).

Challenges in cross-sectoral governance

To start with, the results indicate that the forest and water governance systems function for themselves, with little cross-sectoral interplay between them (see Figure 5). The water administration that was established after the implementation of the WFD has unclear terms of authority, responsibility and accountability (Lundqvist, 2004) and lacks central steering and coordination (CRSWA, 2019). Thus, the water sector is both highly polycentric and *decentralised*. Water management decisions are made at the regional district level after consultation with the regional river basin level. Although those decisions are binding policy instruments, there is no authority to enforce them within forest water governance. The results confirm previous findings that decentralised polycentric governance systems are ill-suited for addressing complex problems (Morrison et al., 2019) such as the case of diffuse water pollution, and experience significant challenges with conflicting goals with other policy arenas (Sandström et al., 2019).

The forest sector has traditionally functioned under the so-called "freedom with responsibility" (Appelstrand, 2007) and can be largely characterised as self-governing (Sundström, 2009). A high degree of self-governance is one obvious challenge for establishing cross-sectoral interplay (Kooiman, 2003). Since the governance systems of both sectors are polycentric and steered through framework legislation, the initiation of cross-sectoral interplay is dependent on the sectors themselves. It becomes unlikely that any sector will take upon itself the weight of initiating and coordinating interplay, and it easily can fall between the cracks as a political priority. However the forest sector, although polycentric and governed through a combination of framework regulation and voluntarism (Eckerberg, 1987; Sundström, 2005; Appelstrand, 2007), in contrast to the water

sector, still represents a *centralised* polycentric governance system (Sundström, 2009). This is mainly due to the important role the SFA plays in coordinating, monitoring and evaluating forestry practices. This centralised nature of the forest governance system is advantageous for interaction between policy arenas (Sandström et al., 2019) and has aided the establishment of cross-sectoral interplay.

The articles in the study reveal that cross-sectoral interplay was established at the national level with the Dialogue Process. However its scope was limited, both in regards to aims, as well as cross-sectoral interplay (Article IV). Article IV shows that the forest water governance process at the national level had both limited aims and limited stakeholder representation, with a predominance of the forest sector. Those results indicate that despite state efforts to design an inclusive process with representation from several sectors relevant to forest water governance, the cross-sectoral nature of governance at the national level is limited and interplay across sectors is weak. Keeping in mind the traditional separation of responsibilities in Sweden according to sectors, and that forest water is the forest sector's onus, the limited representation of the water sector in decision-making points to a power asymmetry between the two sectors.

In general, both sectors are experiencing their own implementation challenges. The water sector has been criticised for being weak in implementing the WFD and generally messy and uncoordinated (Lundqvist, 2004; Duit et al., 2009; CRSWA, 2019). The forest sector has also struggled over decades with reaching environmental policy goals. Although multiple soft policy instruments have been added over time, the sector is still quite far from taking forest water protection into account in daily management practices (Article I). As far as the implementation of the outputs from the Dialogue Process are concerned, they have penetrated to the regional and local levels mainly within the forest sector alone. This reveals that even the implementation of the outputs from that governance process is limited in its cross-sectoral nature.

Challenges in multi-level coordination

The structural organisation of the forest and water sectors leads to limited connections and coordination of forest water governance between institutional levels (see Figure 5). Given the way in which the water sector is organised and financed, it lacks the institutional capacity to establish and coordinate governance between multiple levels, let alone across sectors. The linkages between the two regional levels (district and river basin) may be functioning, but the linkages with the national level that could have led to centralised implementation and coercion are broken. Although the achievement of environmental and WFD goals is monitored, since there are no sanctions if goals

are not achieved, there are no disincentives to boost cross-sectoral interplay. The linkages with the local level are also broken both for the regional and national level (see Figure 5), pointing to failings in multi-level coordination.

The forest sector that is responsible for forest water, does have the institutional capacity to organise cross-sectoral interplay *and* coordinate between institutional levels. Since the SFA played the coordinating role, cross-sectoral interplay naturally was established at the national level. The results in this specific case contradict previous research findings that centralised governance systems fare poorly with multi-level coordination of policy goals (Sandström et al., 2019) and confirm the belief that more hierarchical governance systems enable coordination between levels (Skovgaard, 2018). The results further show that in the case of forest water governance, the water sector is neither successful at coordinating between institutional levels, nor across sectors, confirming previous research claims about decentralised governance systems (Sandström et al., 2019; Morrison et al., 2019). Water management at the regional (river basin) level organised by the water sector did not include the forest sector (Article III). This can be interpreted as a weakness, since the WFD does emphasise the importance of applying a holistic water management approach at the river basin level (Kallis & Butler, 2001). However, since *forest* water is in the domain of the forest sector, and the centralised SFA is mainly responsible for forestland and not for water bodies, the river basin level is not an ecological scale of relevance to the sector. Similarly, commercial forestry organised its own Forest Water Board at the national level and published its own internal policy on terrain driving in connection to forest water. Neither public nor commercial actors from the forest sector have an ecologically-grounded reason, or institutional capacity, to organise cross-sectoral governance at the river basin scale, or at any other scale relevant from a water-centric perspective.

Another explanation for the forest sector's absence in regional water management could be that regional and local forest sector actors might have felt already sufficiently represented in the forest water governance process at the national level (Newig et al., 2018). This can potentially make participation in the management at local and regional level unnecessary. Indeed, interviewees did note that the National Dialogue Process could have potentially included the standpoints of actors from all levels and sectors (Articles III and IV) and thus covered all aspects that regional or local management. However, results indicate that this is not the case in practice. The representation of institutional levels within the Dialogue Process was limited, with most process participants representing larger commercial forestry organisations and central government authorities. Interviewees from the forest sector also voiced their concerns that the outputs agreed upon in the process at national level are quite broad and not context-specific, indicating that the need for local and regional cross-sectoral

interplay might not be exhausted. Regional and local environmental circumstances vary throughout the country. For example, ditching and ditch cleaning is more broadly applied in southern than in northern Sweden. Despite those geographical variations, there was no obvious interaction between regional water management within the Vindel River basin and the forest water governance process at national level. Although interviewees claimed that hands-on knowledge concerning regional and local specifics was also included in the process of deliberation, implementing organisations criticised the outputs as being too general and unspecific. This points to quite limited use of the claimed multi-level knowledge input (Article IV).

Despite the fact that the implementation of the WFD has led to an increase in awareness of the forest-water interface in the Swedish forest sector, as well as to significant learning and knowledge accumulation (Andersson, 2014), the studies show little evidence of coordination of knowledge between levels. Articles II and III indicate that the transposition of local and regional knowledge to the national level and the multi-level coordination of knowledge is limited. In a span of almost three years (Articles II and III), knowledge gaps regarding the forest-water interface were observed at both regional and local level among actors who potentially have an important role in forest water governance and management. Individual forest owners claimed they had little knowledge on how to consider water when performing forestry operations and did not seem to perceive water quality as a problem they face, despite having to find "better waters" outside their properties to fish in (Article II). This lack of multi-level coordination of knowledge might have hampered forest water issues from being addressed at the local level, since information on the issue-at-hand is among the necessary factors for self-organisation (Ostrom, 2009).

In contrast to individual forest owners, some actors participating in forest water management at the river basin level acknowledged the potentially negative effects of forestry operations on water but also confirmed that many important stakeholders lack information on the issue (Article III). This fact, coupled with anglers' capacity to steer the focus of management on angling-related issues, such as physical hinders and fish migration, leaves diffuse pollution largely unaddressed at the local and regional institutional levels. The management process at the river basin level tackles issues and builds on knowledge that neither seems to feed into the national process nor seems to be affected by it. Rather, the management at the regional river basin does not include a forest-water interface and thus stands independent from forest policy and forest sector. Since the national level is suitable for reaching consensus over broader aims and policy (Margerum, 2008), establishing a cross-sectoral process at local and regional level for reaching consensus on context-specific outputs could lead to the implementation of more effective outputs.

This can be characterised as a Catch-22 situation. The Dialogue Process is organised at the national level because it is a dialogue between the centralised SFA and commercial forestry. To effectively change on-ground practice, the process must include context-specific local knowledge. However, deciding policy at the national level excludes context-specific local knowledge per se, as decisions cannot be too detailed and complex to be of national relevance. At the same time, if decisions are too vague to be transferable to most local contexts, they run the risk of being watered down and ineffective (Ostrom, 2009; 2010). The results of the studies do indicate however, that the outputs from the established forest governance process at the national level are extensively implemented at the regional and local institutional levels, albeit mainly within the forest sector.

Although Article IV shows that aspects regarding multi-level coordination of knowledge might *not* be important for the *effective implementation* of the outputs from the process, they do limit the *multi-level characteristics* and the *scope* of the cross-sectoral governance and the outputs it has produced. Despite evidence of the implementation of the Strategic Objectives at all institutional levels, questions remain regarding the inclusiveness and effectiveness of a governance process established and functioning at the national level, but aiming to change on-ground management practices. To be implemented and lead to the desired outcomes, the outputs must be relevant to the specific environmental conditions where they are to be applied. This requires *two-way* coordination between levels: coordination of context-specific knowledge up to the governance process at national level; and coordination of the implementation of the outputs from the national, down to the regional and local levels. Previous research has shown that conflicting policy goals at different institutional levels impede the implementation of state policy goals (Greenwood, 2013). Moreover, given that the willingness of actors with decision-making power is crucial for the implementation of non-binding policy instruments (Sabatier, Leach, et al., 2005; Treib et al., 2007; Margerum, 2011; Koontz & Newig, 2014), not having Strategic Objectives that are relevant and "speak" to the many individual forest owners in Sweden might impede their use.

The results of Article II do not indicate that the Strategic Objectives as a policy instrument had by that point in time reached to individual forest owners, despite the first ones having been published two years before the study was carried out. However, their broad implementation probably affects individual forest owners and their management practices even if they lack information about them. Given that all Forest Owner Associations and most commercial forestry organisations have implemented the outputs in their planning and management materials, by being members of a Forest Owner Association, or resorting to the services of commercial forestry actors for management, individual forest owners are likely to be affected by the implementation.

Challenges in collaborative governance

While Article IV shows that there may have been difficulties to achieving *cross-sectoral* governance and that the scope of the aims and representation of interests in existing processes might be limited, it also proves that the process was *collaborative* in nature. The Dialogue Process had a high level of process, source-based and substantive legitimacy (as defined by Karlsson-Vinkhuyzen & Vihma, 2009). Deliberations were perceived as open and fair, many sources of knowledge were used and balanced, and although forestry interests were perceived as overrepresented, all actors' viewpoints were taken into consideration in consensus-building and reflected in the outputs. The deliberative process organised by the SFA at national level can therefore be classified as collaborative in the sense that it included two-way information and knowledge exchange, as well as inclusiveness and broad stakeholder representation in consensus-building, including cross-sectoral (Margerum, 2008; Newig et al., 2018). However, it is worth underlining that the sources of knowledge used had questionable neutrality (Mansbridge, 2014). In addition, environmental protection actors chose to leave the process as it aimed at reaching consensus *within the boundaries of current forest environmental political goals*. A collaboration that is cross-sectoral should be prepared to re-think and re-evaluate the boundaries of each of the sectors' policy arenas, as their goals should have equal importance (Lubell et al., 2010). The Dialogue Process falls short of such ambitions. Since the knowledge-input from other institutional levels was limited, the Dialogue Process could be described as cross-sectoral collaboration with limited multi-level input but broad multi-level implementation of outputs.

In line with previous theoretical and empirical findings (Emerson et al., 2012; Koontz & Newig, 2014; Eckerberg et al., 2015; Zachrisson et al., 2018), the availability of financial resources that promote cross-sectoral and multi-level collaboration proved to be among the key challenges for initiating that sort of interplay. Collaboration in general demands resources and significant commitment (Till & Meyer, 2001; Thomas & Koontz, 2011; Thomas, 2013), especially for actors in rural, sparsely populated areas (Bjärstig & Sandström, 2017) and *cross-sectoral* collaboration even more so if there is to be interplay between two governance systems (Lubell et al., 2010; Feiock, 2013). Both local and regional actors interviewed in Articles II and III underlined the lack of resources as a reason behind the lack of cross-sectoral interplay in forest water management.

At the national level, state resources were designated for establishing cross-sectoral deliberation and the attainment of consensus on nature consideration in forestry between commercial forestry on the one hand, and on the other both forest and non-forest public and private actors. The subsequent decision made by

the SFA to allocate additional resources for compensating actors who wish to participate in the process but lack resources to do so, indicates the state's determination to broaden participation and switch to what according to Arnouts et al. (2012) defines as an "open" co-governance mode. This change can level out resource and thus power asymmetries between participants (Brisbois & de Loe, 2016; Bjärstig & Sandström, 2017) and potentially deepen its cross-sectoral and multi-level characteristics. Furthermore, the state has allocated significant resources for the implementation of the "soft" Strategic Objectives (Article IV). Bearing in mind the results from Article I pointing to the state's unsuccessfulness in attaining policy goals by using soft policy instruments for several decades, adding binding policy instruments to the mixture might have proven more effective.

The state-initiated Water Council at the regional river basin level initially aimed to have a broad problem focus and include all stakeholders and practices that have an impact on water quality in the river basin. However, its top-down provided budget was meagre and had little room for any concrete on-ground action. When available, additional water management resources at the regional level usually come in the form of funding for projects and require mobilisation on behalf of regional actors. They are thus either earmarked for specific on-ground actions, such as physical restoration of streams, or bound by requirements that do not necessarily stimulate the inclusion of all sectors relevant for river basin management and promote cross-sectoral collaboration. The results suggest that those stakeholders who are most active in seeking funds, are the ones who decide what issues the funds will be used to address. At the river basin level, the anglers became the most active in seeking project funding for action-oriented collaboration, resulting in collaboration focusing mainly on improving fish stocks. These results confirm concerns raised by Borgström et al. (2016) about the strong reliance of regional and local institutions on EU and/or state funding and "project proliferation" when resolving environmental issues. Since securing funds is dependent on regional administrative capacity, there is a risk of geographic disparity in the distribution of these funds.

Most importantly, certain environmental issues, especially those that affect economic interests, are generally found to be prioritised over others. As Article II indicates, this can be especially problematic if stakeholders are not aware of the problem at hand and have little incentive for organising collectively to address the issue. In that manner, diffuse pollution issues can remain marginalised in project financing, because knowledgeable actors with other interests both tend to be more active in securing project financing, as well as in steering attention towards "their issues". Specific environmental problems of high ecological significance to society at large can consequently, either not initiate collaboration at all or can be ignored by existing collaborative efforts. If cross-sectoral

governance of forest water is to be stimulated at the river basin level specifically, then the state should allocate resources that are unambiguously meant for promoting such interplay, as was the case at national level (Article IV).

Challenges in implementation

It is probably safe to say that the results from the governance approach to forest water are just as limited as its cross-sectoral and multi-level characteristics. The only cross-sectoral collaborative process where the forest and water sector were both represented and that produced tangible results, was the Dialogue Process at national level. Thus, the only outputs produced through cross-sectoral collaboration are the Strategic Objectives. They are informative non-binding instruments that rely on voluntarism. They can be seen as limited in both their cross-sectoral, as well as multi-level characteristics, due to the way the process was set up, but they nevertheless reflect an attempt to integrate water protection goals into forest management practices. Moreover, all institutional levels might have not been represented in the process, but the *implementation* of the outputs is broad and across all institutional levels. The exploration of forest water policy development in Sweden shows that, although since the 1990s environmental protection goals are put on par with production goals, the soft policy instruments (Treib et al., 2007; Howlett, 2018) used for reaching environmental goals and attributed to the forest sector governance system where implementation is traditionally voluntary and dependent on forest sector actors (Sundström, 2009), have only led to partial improvements in the application of water protection measures in forestry practices (Article I). Whether this will change in the future due to further implementation of the Strategic Objectives and the educational measures that accompany it, is still too early to predict. However, changes in practice are likely to mimic the previous slow development after the enactment of a long series of relevant policies (Article I).

The Dialogue Process can be seen as part of the general trend from the last two decades, where the state focuses significant resources towards the implementation of non-binding soft steering instruments (information and education campaigns, etc.). Interviewees from several of the studies (Articles II and IV) claimed that this trend has led to an obvious shift in attitudes. Environmental issues, and specifically issues in relation to forestry's impact on forest water, have moved higher up the agenda and ecologists see themselves as perceived more seriously than two decades ago.

The role of the state

The state plays a crucial role not only in providing resources for prioritising and implementing political goals but also in applying suitable policy instruments for

establishing a governance mode (Kooiman, 2003; Pierre & Peters, 2005; Sundström, 2005; Treib et al., 2007; Arnouts et al., 2012; Baker & Eckerberg, 2014) that promotes cross-sectoral collaboration. The results of all four articles confirm previous findings about the state's crucial role in facilitating cross-sectoral and multi-level collaboration. Article IV shows that state authorities provide the elements needed for the initiation and maintenance of collaborative approaches (Zachrisson et al., 2018), not least by designing and facilitating collaborative processes so that they are fair and inclusive (Purdy, 2012; Brisbois & de Loe, 2016). Thus the state plays an instrumental role in designing the collaborative process so that it fosters legitimacy. Process legitimacy is important as it leads to effective implementation of the produced outputs (Reed, 2008; Pahl-Wostl et al., 2013; Raitio & Harkki, 2014; Johansson, 2016; Newig et al., 2018) and the results of Article IV confirm that.

Economic instruments play a crucial role for the implementation of state-prioritised policy goals at the regional and local institutional levels (Baker & Eckerberg, 2008b) and for the initiation and maintenance of collaborative processes (Leach & Sabatier, 2005; Sabatier, Focht, et al., 2005; Koontz & Newig, 2014; Emerson & Nabatchi, 2015; Eckerberg et al., 2015). Since the WFD sees the river basin as the crucial level for addressing water issues, collaboration at this institutional level to minimise the impact forestry has on water could have been made a state priority. Articles II, III and IV explore the bottom-up vs. top-down aspects of collaborative processes and show that top-down financing and coordination can be decisive in determining both their duration and their capacity to foster cross-sectoral interplay. The state could have established cross-sectoral collaboration at any governance level, depending on the aim and problem focus (Margerum, 2008). However, the results suggest that having available resources for cross-sectoral collaboration only at the national level, means that cross-sectoral interplay for the management of diffuse pollution is present only at that institutional level. The lack of top-down provided coordination and resources earmarked for financing cross-sectoral interplay, has been recognised as significantly hampering WFD implementation and the establishment of effective water management institutions in Sweden (CRSWA, 2019). Moreover, even the Water Council, where the very limited resources are channelled to foster cross-sectoral collaboration and work for attaining water policy goals, is not focusing on those forest water issues. One reason is that those stakeholders who come across as most knowledgeable easily usurp the collaborative focus and direct the process and decisions according to their interests. In the studied Water Council, it was the anglers who were perceived by other actors as more knowledgeable on issues regarding water management. Thereby they steered the focus of the collaborative arrangement towards issues related to angling. Organising deliberative processes in thematic groups nurtures mutual understanding between stakeholders, as well as the establishment of a common

goal (Zachrisson, 2009b). Since goal-specificity has shown to positively affect the attainment of goals (Biddle & Koontz, 2014), if collaboration in the Water Council was organised in thematic working groups as in the Dialogue Process at national level, forestry might not have only taken more space on the regional agenda but also have been more effective in attaining the desired environmental outcomes.

Varying knowledge and political capacities among different stakeholders can affect their power to influence the collaborative process and decisions (Galaz, 2006; Özerol & Newig, 2008; Sandström, 2009; Purdy, 2012; Brisbois & de Loe, 2016; Bressers et al., 2016) and the Swedish state played an important coordinating role in balancing different types of knowledge, as well as coordinating its use between levels. Both these functions are key to establishing and coordinating polycentric governance such as cross-sector collaboration (Feiock, 2013; Porter & Birdi, 2018; Morrison et al., 2019).

The results of applying a collaborative approach to the governance of water depend not only on context (Moss, 2004; Pahl-Wostl, 2009) but also on adaptiveness that is only possible in flexible governance systems (Boer & Bressers, 2011). In polycentric governance, knowledge dissemination and coordination between levels and entities is crucial for achieving adaptiveness (Ostrom, 2010; Koontz et al., 2015), not least for the implementation of outputs that are produced at a different level than the one they are implemented at. Also, coordination in polycentric governance systems is important since its absence leads to increased costs without making use of the benefits of institutional overlap, such as institutional learning and adaptiveness (Koontz et al., 2015). In the governance of resources that require collaboration across policy arenas, the costs for sharing knowledge and negotiating priorities (amongst others) are much higher and can represent a hindrance to decision-making (Feiock, 2013). The case of Swedish forest water governance shows that there is a striking difference in the degree of state coordination at the national and at the regional level. At the national level, the forest sector in the face of the SFA is active in coordinating the efforts of different working groups, as well as coordinating with outside actors at different institutional levels. In contrast, at the regional river basin and district level, where the water sector should coordinate, there is hardly any state-led horizontal or vertical coordination.

The state (and the EU) can provide financing in various forms, with just one of them being through project financing. Top-down provided resources could also have compensated for the absence of essential contextual factors and drivers of collaboration at the local level (Article II). Investing resources in more than just educating the many forest owners and managers on the issue-at-hand (as results indicate) and maybe thereby changing their problem perception (Sabatier, Leach, et al., 2005; Ostrom, 2009) could have spurred collaboration over forest waters

at the local level with a potentially more tangible effect on how forest water is managed. Given that the availability of resources is underscored by collaborative governance literature as crucial for all stages of collaboration (Ansell & Gash, 2008; Emerson et al., 2012; Koontz & Newig, 2014; Eckerberg et al., 2015), and specifically for levelling out the playing field between unequal participants in the collaborative process (Özerol & Newig, 2008), if establishing interplay across two governance systems is a state priority, then it requires financial commitment on behalf of the state.

Summing up

Exploring the governance of forest water and the challenges associated with the establishment of cross-sectoral governance proved to be a venture that has led to plentiful empirical and theoretical findings. To start with, it confirmed existing knowledge that merely introducing framework legislation, as in the case of the WFD, does not automatically lead to a change of governance mode and to cross-sectoral interplay between two separate governance systems. Although binding, framework regulation implementation does not materialise unless significant effort and resources are channelled into strengthening institutions and coordinating between them (Moss, 2004; Albrecht, 2013). Attaining cross-sectoral interplay in particular remains among the foremost challenges in water governance (Moss, 2004; Hagberg, 2010; Keskitalo & Pettersson, 2012; CRSWA, 2019). In forest water governance it proves to be further complicated by the need to find points of overlap between two distinct governance systems, as the studied sectors have competing policy goals, as well as different (albeit subtly) governance modes, institutions and mixes of policy instruments (see Figure 5).

The combined results of the four articles suggest that state involvement in all stages of collaboration is not straightforward and requires reflectiveness and careful overweighing of decisions. This holds true for both direct state involvement as organiser and coordinator of cross-sectoral collaboration, as well as indirect involvement, namely through setting the governance frame, funding collaborative initiatives and implementation, as well as controlling for implementation and compliance. The role of the state in these cases, as coordinator between multiple nested institutions and across levels, is crucial (Ostrom, 2010; Koontz et al., 2015), especially if the governance of a resource from two policy arenas is concerned.

Cross-sectoral collaborative processes do not necessarily have to be established at every institutional level, just at the "right" one to stimulate multi-level implementation of the produced outputs. Even if collaboration is not ongoing at all levels (Article II) and is not cross-sectoral in all cases (Article III), the outputs produced by the cross-sectoral collaborative process at national level were

implemented at the regional and local level (Article IV). Thus the findings indicate that all institutional levels are affected by the cross-sectoral collaborative approach to forest water governance, but mainly through the implementation of the Strategic Objectives as outputs of the Dialogue Process. The coordination of knowledge and resources between institutional levels is lacking. This shortcoming can be mended through the use of state-provided economic instruments (Baker & Eckerberg, 2008b), and since in the studied cases most resources show to be top-down provided, the role of the state in initiating and maintaining this type of collaboration becomes crucial. The Dialogue Process demonstrates that the state has put effort in establishing cross-sectoral open collaboration (Arnouts et al., 2012) at the national institutional level.

The Swedish state has allocated significant resources towards the implementation of soft policy instruments, and these have so far failed to reach current environmental policy goals. They are also clearly insufficient for establishing and maintaining collaborative governance across two sectors with two separate governance systems. Applying an ecosystem approach for the governance of water may look good on paper, but multiple studies and reports have shown that it does not lead to more effective water governance if it is not coupled with ample additional resources and coordination (Moss, 2004; Huitema & Meijerink, 2014; Newig et al., 2016; CRSWA, 2019). The current water governance system resembles a highly decentralised polycentric governance system, and research has shown that this type of governance mode is ill-suited for addressing complex environmental issues (Morrison et al., 2019) and for facing the challenge of policy goal conflicts between sectors (Sandström et al., 2019). Diffuse water pollution from forestry is a case in point. The studies in this thesis confirm previous research conclusions that the multiple sectors and interests affected by and affecting water governance require a more holistic governance mode (Pahl-Wostl, 2019) that should be of a centralised polycentric type. Combining polycentric governance (including at the river basin scale) with centralised state-coordination could be a solution to governing issues requiring cross-sectoral interplay. Still however, when applying polycentric and network governance, it is important that the benefits outweigh the costs of coordination (Koontz et al., 2015). Similarly, the application of cross-sectoral governance approaches requires significant resources for coordination between governance systems.

With the current structure of Swedish water governance, forest water is governed collaboratively and across sectors only at the national level. Even though state authorities work with regional implementation of the outputs produced at national level, that implementation relies mainly on the forest sector and there is hardly any coordination with water sector institutions at the regional district or river basin levels. The potential of the cross-sectoral approach established at

national level to trickle down to all other administrative levels is therefore uncertain. Nevertheless, the implementation of the WFD raised the issue of the impacts of forestry on forest water on the political agenda in general, as well as on the agenda of the forest sector. This has spurred ample research and knowledge acquisition and has resulted in cross-sectoral collaborative efforts at the national level.

One way to compensate for the lack of multi-level interplay, is for the outputs produced at national level to be actively discussed within Water Councils at river basin level and customised to regional and local circumstances. This would require significant coordination between sectors, levels and institutions and the state is the only actor that has the capacity to carry out that coordinating task. At present, the water sector does not have the capacity for such coordinating efforts, while the forest sector does not have the incentive. Another way to overcome the isolation of the regional river basin level from cross-sectoral collaborative forest water governance, is to divide Water Councils into working groups, similar to the way the Dialogue Process was divided. This could give forestry actors the possibility of focusing on issues and setting goals that are relevant to them. The importance of setting up clear goals is also confirmed by the fact that the two collaborative processes that interviewees perceived as effective – one at river basin and one at national level – were both initiated as a reaction to an existing problem, rather than as an attempt to institutionalise cross-sectoral collaboration.

This study has revealed some interesting aspects in cross-sectoral governance and has raised many questions that future research should address. The results have hinted that power asymmetries between sectors can create or even worsen already existing misbalances in the collaborative process. However, they have only scratched the surface and leave many questions open regarding how shifts in governance modes caused by cross-sectoral collaboration affect those power asymmetries. Further inquiry in cross-sectoral interactions in natural resource governance could also bring understanding on how coordination in polycentric governance systems which are established according to ecological scales should be structured to mitigate policy goal conflicts across policy arenas and institutional levels and thus foster effective governance.

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