

Management of Multiple-Use Commons

Focusing on Land Use for Forestry and Reindeer
Husbandry in Northern Sweden

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Abstract

This thesis addresses an example of multiple-use commons problems: the case of land use for forestry and reindeer husbandry. Forestry use land for industrial purposes while reindeer husbandry (practiced by the indigenous people, the Sami) use the same land for reindeer grazing. The land use rights are shared between the two sectors: forestry owns the forest resource while reindeer husbandry has usufructuary rights. Among other things, the parallel land use and property rights situation are the reasons why land use is problematic. An institutional arrangement, consultations, was installed to ease the conflicts over land use. However, consultations have shortcomings since conflicts over land use still occur.

The institutional and development (IAD) framework is used to analyze consultations. To analyze the nature of the problem, the individuals and the institutions involved is studied by using the ladder of participation, design principles, social planner's model, and transaction cost theory. The intent is to, by using interdisciplinary theories and methods, discuss the economic aspects of natural resource management in general, and the forestry-reindeer husbandry land use problems in particular.

The results show that the current institutional arrangement does not lead to a stable outcome. One reason for this instability is the uneven power relation within consultations. Additionally, there is unevenness between the sectors in economic terms. To overcome the shortcomings of the institutional arrangement, the thesis identifies possible improvements to the consultation process, applicable within the present legal framework.

The thesis provides valuable contributions to the knowledge of the forestry-reindeer husbandry land use management, and to the theoretical understanding of multiple-use commons.

Keywords: co-management, conflict management, design principles, institutional analysis and development (IAD) framework, ladder of participation, *Rangifer t. tarandus*, Sami, social planner's model, transaction costs.

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Sammanfattning

Oenigheter och konflikter om användning och förvaltning av naturresurser, särskilt gemensamma resurser, är ett utbrett problem runt om i världen. Det finns flera orsaker till detta. Där ibland återfinns att resursanvändaren ofta har olika syften med sitt nyttjande, komplexa äganderätsstrukturer, samt skillnader i kulturella eller ekonomiska bakgrunder. En tänkbar lösning på oenigheter och konflikter kan vara att skapa ett institutionellt ramverk för att reglera användandet av resursen.

Skogsresursen i norra Sverige används parallellt mellan rennäring och skogsbruk. Rennäring bedrivs av renskötande samer, ursprungsbefolkning i Skandinavien, medan skogsbruk bedrivs av storskaliga skogsföretag¹. Konflikterna kring hur marken ska nyttjas blev mer allvarig sedan skogsbruket industrialiserades. För att lösa konflikterna mellan de båda näringarna instiftades samråd 1979, vilket skapade ett tillfälle för näringarna att mötas och diskutera hur marken ska nyttjas. Det uppstår emellertid fortfarande konflikter över hur marken ska användas.

Syftet i avhandlingen är att analysera effektiviteten och stabiliteten av samråd. De bakomliggande frågeställningarna är:

- Hur har relationen mellan rennäring och skogsbruk utvecklats?
 - Hur ser användarna på samrådsituationen?
 - Vilka är anledningarna till varför inte samråden fungerar?
- Vilka möjligheter finns det att förändra nuvarande samrådsprocess?
 - Vilka begränsningar finns inom nuvarande samråd?
- Hur påverkar förändringar av samrådsprocessen policy för samråden?
 - Vilka förändringar behövs för fortsatt framtida samexistens?

Resultaten visar att samråden inte kan karaktäriseras som ett hållbart, stabilt, samförvaltningsystem, eftersom konflikter över markanvändning fortsätter att ske, samråden till trots. Anledningen till att samråden inte fungerar tillfredsställande beror främst på tre variabler: (1) Lavresursen är knapp vilket gör att konflikterna inom samråden blir mer komplexa. För att tillgodose betesbehovet är rennäringen allt oftare tvingade att neka föreslagna avverkningar och även om skogsbruket kan acceptera ett moratorium för en kortare period, måste området avverkas förr eller senare. (2) Den historiska utvecklingen av markanvändning i norra Sverige och dess skiftet mellan jordbruk, skogsbruk, gruvnäring och rennäring har lett till förvirring. (3) Detta har förstärkts av att det juridiska ramverket också varierat beroende på vad skogsnäringen bör fokusera på, från att främja återväxt av skogen, till att maximera produktionen, till att kombinera produktion med miljömål.

Resultat visar också att makten är ojämnt fördelad inom samråden mellan de båda näringarna. Detta baseras främst på hur äganderätten är fördelad mellan näringarna. Skogsbolagen, med sin äganderätt, är den starkare parten inom samråden jämfört med rennäringens nyttjanderätt. Rennäringen anser sig också ha ett svagt inflytande

¹ Skogsbruk bedrivs också av enskilda privata skogsägare, men dessa utelämnas eftersom dessa inte omfattas av samrådsplikten.

i samråden. Ytterligare en orsak till att skogsbolagen är starkare i samråden baseras på dess ekonomiska ställning i samhället. Skogsbolagens resultat påverkar såväl bolaget och dess ägare som regionen som helhet.

Vidare, visar resultat att det är mer ekonomiskt fördelaktigt för skogsbruket att kompensera rennärningen för förluster av betesmark, jämfört med att anpassa skogsbolagets planer till rennärningens betesbehov. Här har dock ingen hänsyn tagits till det kulturella värdet av rennärningen för den samiska kulturen. Dessutom anses rennärningen vara av nationellt intresse. Därför lyfts frågan vad som krävs för att skapa ett hållbart och stabilt samförvaltningssystem av skogsresursen för att försäkra att båda näringarna kan fortsätta samexistera.

Föreliggande avhandling fokuserar främst på att, inom nuvarande lagstiftning, hitta hållbara samförvaltningslösningar. Förbättringar kan ske både via den officiella vägen (Riksdagen) och via den frivilliga vägen (certifieringen FSC, Forest Stewardship Council²). Resultaten visar att effekten av transaktionskostnader av samråd är ojämnt fördelade mellan näringarna. För att kunna skapa en jämnare fördelning av transaktionskostnader och därmed förbättra samrådsprocessen krävs förbättringar inom följande områden:

- klargörande av syfte och innehåll i samråden,
- jämkna planeringsperspektiv (tids- och områdesperspektiv),
- kunskap om resursen och varandras näringar, och
- skapa konfliktlösande mekanismer.

Genom att skapa en tydlig definition av samråden och vad som ska ingå, vet parterna vad som kan förväntas. Genom att även justera planeringshorisonten (både i tid och område) kan parterna diskutera markanvändning på samma villkor. I nuvarande samrådsprocess sker samråden sent i skogsbolagets planeringsprocess. Om samråd med rennärningen skulle ske tidigare i skogsbolagets planeringsprocess kan också rennärningens intressen bättre införlivas i skogsbolagets planering, dvs. större hänsyn tas till rennärningen i samråden. Ytterligare vinning kan erhållas om rennärningen på ett tidigt skede känner till avverkningsplaner och därmed kan beta ett område mer intensivt inför en avverkning och spara andra områden.

Kunskapen om resursen och om varandras näringar nämndes också som en viktig parameter att förbättra i samråden. Här kan forskning fylla en viktig funktion. Ytterligare en viktig aspekt att förbättra är att skapa mekanismer (till låg kostnad) för att lösa de konflikter som inte kan lösas via samråden.

Om de föreslagna förändringarna implementeras inom samråden skulle effekten av transaktionskostnader på vardera näring bli mer jämnt fördelade, i varje fall på lång sikt. Problemet är dock att incitamenten att införa förändringar är olika. Rennärningen har starka incitament att införa de föreslagna förändringarna eftersom de behöver säkerställa framtida betesbehov. Skogsbrukets incitament är betydligt svagare, baserat på de juridiska kraven och marknadens krav via FSC. Även om rennärningen har mest att vinna på en förändring är deras äganderätt så svag att de inte har någon möjlighet att själva initiera förändringar.

² Alla skogsbolag som äger mark i renbetesområdet är certifierade via FSC.

Slutligen, resultaten av dessa studier visar att det finns en vilja hos både ren- och skogsnäringen att göra förändringar för att stärka samrådsprocessen. Starka externa krafter som kan tänkas påverka skogsbolagen (och/eller staten) att förändra samrådsprocessen är certifieringssystemen (FSC eller PEFC). Ytterligare påverkan kan ILO 169 (International Labor Organization) ha om Sverige skulle ratificera konventionen. Under 2002 beslöt FSC internationellt också att ILO-konventionens paragrafer om ursprungsbefolkningars markanvändning skall inkluderas i FSC, oavsett om landet ratificerat fördraget eller inte. Detta borde få stor effekt på samrådsprocessen i Sverige tillsammans med förtydligande av ägande- och nyttjanderätten av skogsmark i norra Sverige.

Dedication

To my mother for always believing in me. I wish you were here now to share this moment with me.

To my father for always helping me see the positive side of things.

To my husband for love and support.

To my children for unconditional love.

The significant problems we face cannot be solved at the same level of thinking we were at when we created them.

Albert Einstein

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List of Appended Papers

This thesis is based on the work described in the following papers, which are referred to by the corresponding Roman numerals in the text:

- I Widmark, C. (2006). Forestry and Reindeer Husbandry in Sweden – the Development of a Land Use Conflict. *Rangifer* 26 (2), 43-54.
- II Sandström, C. Widmark, C. (2007). Stakeholders' Perceptions of Consultations as Tools for Co-management – A Case Study of the Forestry and Reindeer Herding Sectors in Northern Sweden. *Forest Policy and Economics* 10, 25-35.
- III Widmark, C. Gong, P. Bostedt, G. (2009) Optimal Level of Influence in Forest Management – The Case of Consultations between Forestry and Reindeer Husbandry Sectors (manuscript).
- IV Widmark, C. Sandström, C. (2009). Incentives and Transaction Costs of Institutional Change in Multiple Use Commons – The Case of Forestry and Reindeer Husbandry in Northern Sweden (manuscript).

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Abbreviations

IAD	Institutional Analysis and Development
CPR	Common Pool Resource
FSC	Forest Stewardship Council
ILO	International Labour Organisation
LUP	Land Use Plan for Reindeer Husbandry ('Renbruksplan')
NIE	New Institutional Economics
PEFC	The Programme for the Endorsement of Forest Certification
RHC	Reindeer Herding Community ('Sameby')

1 Introduction

1.1 Background

Disagreements and conflicts¹ related to the use and management of natural resources are common problems in most countries around the world. Key issues to address in such cases are those associated with ‘collective action’, e.g. the need to establish effective rules to control the use of the natural resources in order to avoid the ‘tragedy of the commons’² and to mitigate externalities³ (Hardin, 1968; Bromley, 1992; Ostrom et al., 1997; Ostrom, 2003; 2005; Kyllönen et al., 2006). A possible solution to such problems in some cases is to establish institutional arrangements for regulating use of the land (Berkes, 1989; Pinkerton, 1989; Ostrom, 1990; Baland & Platteau 1996; Ostrom et al., 1997; Ostrom, 2005; Bromley, 2006). The ways in which certain institutional arrangements work and, more importantly, how they may facilitate sustainable management, depend on a complex web of factors, e.g. the physical needs of the stakeholders, societal and judicial factors and the interactions between the actors involved (Dietz et al., 2002; Ostrom, 2005).

¹ Management of a conflict or a dispute refers to “*desirable and feasible changes [that] can be made in a problematic situation in order to improve the situation*” (Walker & Daniels, 1997, p.2). The term ‘conflict management’ is thus used to characterize situations where conflicts may not be fully resolved, but the situation is at least improved (Walker & Daniels, 1997). In a democratic society, conflicts *per se* are not necessarily problematic. Rather, the opposite, since a lack of conflict may indicate an undemocratic society in which conflicts are not allowed to surface (Lukes 1974; Raitio, 2008). However, intense conflicts that remain unmanaged and unresolved may lead to insecurity and frustration (Hellström, 2001).

² Over-use and degradation of a resource.

³ Adverse effects of stakeholders on other sets of stakeholders when using a resource.

In analyses of natural resource management, common pool resources (CPR) are of particular interest. In this context a CPR is “a natural or manmade resource that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use” (Ostrom, 1990, p.30). In some cases the use of commons may be relatively straightforward, for instance in cases where all stakeholders have identical rights to use the resources and have the same objective: to acquire benefits from the resource (Oakerson, 1992). However, many CPR situations are more complex, for instance multiple kinds of stakeholders may use the resource for widely differing objectives, the property rights may be complex and the stakeholder groups may be culturally, economically or otherwise heterogenic (Edwards & Stein, 1998). In such cases there is an extensive need for negotiations and trade-offs among users to maximize welfare.

The forest resource, including both timber and ground vegetation, in Northern Sweden and its multiple uses provide an interesting case in point. Several sets of stakeholders with unevenly distributed power and differing rights use the land in parallel to each other, with different objectives. These objectives include protection of biodiversity, recreational use of forestland, and use of forestland for industrial purposes, e.g. forestry, mining and reindeer (*Rangifer t. tarandus*) husbandry. Of particular interest here are the foci of the interdisciplinary *Mountain Mistra Research Program*⁴ (which financed the studies this thesis is based upon): the large-scale forestry industry and the small-scale reindeer husbandry practiced by the indigenous people, the Sami⁵. Forestry and reindeer husbandry are parallel land uses for which institutional arrangements in the form of consultations between the practitioners were introduced by the Swedish Forestry Act in 1979 (SwFA, 1979:429) and extended geographically by the Forest Stewardship Council (FSC) in 2000 (FSC, 2000). These consultations were intended to provide an arena for the stakeholders to meet and discuss land use issues, in order to reduce land use conflicts and externalities. However, conflicts over land use management are still occurring despite the consultations.

Two main contributors to the conflicts over land use between forestry and reindeer husbandry have been identified. First, property rights over the forestland are divided between the two groups of stakeholders: forestry

⁴ The Mountain Mistra Research Program was an interdisciplinary research program focusing on 15 municipalities in the northern mountain area in Sweden. The main objective of the program was to find strategies for management of the mountain region's resource, based on scientific results (Fjällfokus, 2003).

⁵ The government recognized the Sami as the indigenous people of Sweden in 1977 (Johansson, 2008).

interests (mainly forestry companies, non-industrial private owners and the State) own the resource while reindeer herders⁶ have usufructuary rights, originating from time immemorial⁷. This imbalance in property rights provides insufficient protection of the reindeer herders' grazing rights (Hahn, 2000). The property rights imbalance has also led to an uneven power distribution between the stakeholders in the institutional arrangement (Paper II). Second, forestry imposes externalities on reindeer husbandry since the timber harvests reduce the value of the land for grazing, which is a key parameter for the viability of reindeer husbandry. A further complication is that natural grazing has not been valued economically (Hahn, 2000; Paper II; Paper IV).

1.2 Previous Research

There has been extensive research on the use of natural resources and proposed solutions to associated social dilemmas. In relation to land used for both forestry and reindeer husbandry, a number of studies warrant special mention. Mattson (1981) provided a thorough outline of the development of the relationship between forestry and reindeer husbandry, concluding that conflicts over land use have escalated, due partly to the mechanization of forestry, partly to fluctuations in reindeer stock and partly to the technical development of reindeer husbandry (Mattsson, 1981). About 20 years later, in 2000, Hahn discussed management of conflicts between small game hunting, forestry and reindeer husbandry. Hahn focused on the property rights involved, and the findings indicate that the property rights provide insufficient protection for grazing rights, resulting in imbalance of power between the stakeholders (Hahn, 2000).

There have also been several studies on economic aspects of forestry and reindeer husbandry. Notably, Parks et al. (2002) developed an analytical framework to study management and policy-driven environmental changes in the Swedish mountainous area, based on simulated timber and reindeer

⁶ The term reindeer herder is used for Sami who conduct reindeer husbandry. Reindeer herding is legally protected as an exclusive Sami livelihood, such that only persons of Sami descent can own, and hence make a living, from reindeer herding. However, not all Sami own reindeers or are reindeer herders (about 20 000 Sami live in Sweden (Sametinget 2008), and of them about 4 700 herd reindeer (Statistics Sweden, 1999)).

⁷ The Swedish Government acknowledged that the Sami had exclusive right to use land before modern property rights emerged. However, the exact contents of these rights are unclear and the geographical boundaries are also questionable. The recent Boundary Delimitation Commission of 2006 formally clarified boundaries of grazing areas in northern Sweden (Hahn, 2000; SOU 2006:14).

stock harvest decisions. Using this framework, Bostedt et al. (2003) analyzed the effects of timber harvest decisions, and their results imply that reindeer husbandry's profits would be increased by a reduction in timber harvests, with relatively low opportunity costs for timber. Zhou (2006) further considered the effects of land use choices on reindeer herding profits by optimizing timber and reindeer harvest decisions under various management scenarios. Bostedt (2005) studied the pastoralist behavior of reindeer herders, and found that the utility of being a reindeer herder plays an important role in the production of reindeer meat. Further, the study highlighted the need for more research on the economic circumstances of reindeer herders because the economic returns are marginal so even minor externalities caused by other land users can profoundly affect them (Bostedt, 2005). This result is also supported by Riseth (2006).

More general studies on land use issues include the thesis presented by Allard (2006) and Beland Lindahl (2008). Allard compares the interface between environmental law and Sami law, with analogous situations in New Zealand and Canada. Although the institutional arrangement is not directly considered in the cited thesis, it states that as the competition for use of the natural resource is increasing. Reindeer herding would gain from integration of reindeer husbandry policy with natural conservation policy since land use planning for forestry would become more integrated with measures to limit exclusion (Allard, 2006). Beland Lindahl (2008) discusses the politics of natural resource management, focusing on the forest resource. Although she does not deal only with reindeer husbandry and forestry, she recognizes the problems for reindeer herders caused by the management of forests, and the conflicts between reindeer husbandry, nature conservation and forestry. She concludes that integration of these issues with forest management would probably be helpful for reindeer husbandry (Beland Lindahl, 2008).

Few studies have specifically addressed the institutional arrangement of consultations. However, Sandström et al. (2006) discuss the possibilities for the future co-existence of forestry and reindeer husbandry by altering the institutional arrangement to avoid the problems associated with collective action. Further, Keskitalo (2008) states that the conflict over land use is manifested at the state level, through the creation of legal frameworks, and the international level, through actions by actors such as the FSC. It is therefore important to see the land use conflict through the eyes of both local actors and national/international actors (Keskitalo, 2008). Sehlin MacNeil (2006) assesses the specific possibility of managing conflict through the use of a mediator. The cited study shows that dialogue between the

stakeholders promotes conflict management and increases understanding of each other's sector. The use of a mediator is also preferred to solving conflicts legally, although mediation has been rarely used in practice (Sehlin MacNeil, 2006). In addition, Persson (2000) provided a reindeer care-adapted forestry plan, intended to be a tool in consultations to understand reindeer husbandry land use needs. The adapted forestry plan consists of practical techniques to include information on reindeer husbandry in forestry plans and can be used digitally by stakeholders, including forest companies, non-industrial private forest owners and reindeer herders (Persson, 2000).

However, research on multiple-use commons and conflict management within an institutional arrangement are few, especially with focus on the economic implication of a CPR. This thesis intend to attempt to fill this gap.

1.3 Purpose and Intended Contribution

The research questions of the studies this thesis is based upon (Papers I-IV), were three-folded.

- First, how has consultations evolved and how is the situation understood by the two stakeholders? Further, what are the reasons to why the institutional arrangement does not work satisfactory?
- Second, what are the possible alternatives to the present consultation process? What are the limits of present consultations and what possible changes can be made to the consultation process?
- Finally, what are the policy implications of possible changes? What changes are required to ensure continued co-existence?

The objective of the thesis is thus to analyze the robustness, thus stability and viability, and efficiency of the institutional arrangement established to ease the relationship between forestry and reindeer husbandry in a two-step manner. First the exogenous variables affecting the consultations (Paper I) were explored, and then the outcome of the consultations was analyzed both empirically (Paper II) and theoretically (Papers III & IV). In the section on research design (4), the framework and methods are discussed.

The work provides both theoretical and empirical contributions. The theoretical contribution consists of further development of CPR-models for analyzing multiple-use CPR resources in terms of economic concepts: social planning and transaction costs. The empirical contribution consists of the evaluation of the management of land used for both forestry and reindeer husbandry in Northern Sweden to identify possible tools to improve

consultations and avoid the ‘tragedy of the commons’ and/or other problems commonly associated with the use of such resources.

Some limitations should also be mentioned. The forest resource has multiple users, including other users apart from the forestry sector and reindeer herders, who use the resource in parallel. Each stakeholder group using the resource affects the others to varying degrees, thus causing externalities. The scope of the studies is restricted to the parallel land use by the forestry and reindeer herding sectors, leaving conflicting land uses by other stakeholders’ for future research.

1.4 Analytic Approach

It was assumed at the start of the *Mountain Mistra Research Program* that the common use of land for forestry and reindeer husbandry, in conjunction with the shortcomings of the institutional arrangement, poses a potential threat to their continued co-existence. If so, it is important to understand the underlying aspects of this relationship. To avoid a tragedy of the commons and the stakeholder’s entrapment in a ‘prisoner’s dilemma’ situation⁸, as further discussed in section 3, the natural resource needs to be regulated. Either representatives of the stakeholders themselves, or the government (central or local) could control access to and regulate the resource, i.e. manage it (Carlsson & Berkes, 2005). The term management can be defined in various ways, depending on the situation, but here it is understood as “*the right to regulate internal use patterns and transform the resource by making improvements*” (Ostrom & Schalger, 1996, p. 131). Management of CPR consists of setting degrees of access to and regulating the resource, in a manner that is beneficial to all parties, as far as possible, ideally with at least some degree of co-management (Ostrom, 1990; Carlsson, 1999; Hanna, 1994; 2003; Rova 2004).

The forestry-reindeer husbandry land use is a multiple-use situation with two groups of stakeholders using the resource for different purposes, complicating land use management. In addition, lichens are negatively affected by timber harvests, thus the management method may have profound effects on both forestry and reindeer husbandry. Further, every management situation is associated with some transaction costs, i.e. the cost to maintain property rights, which will increase with increases in the regulation of the management situation⁹ (Ostrom, 1990; Carlsson, 1999; Rova, 2004). However, the current institutional arrangement seems to have

⁸ Meaning that stakeholders act in a self-interest way that may be detrimental to all.

⁹ See further discussion in Paper II.

serious shortcomings, insufficiently regulating land use to avoid conflicts. Hence, the institutional and development (IAD) framework is used to evaluate its robustness and efficiency (Ostrom 1990; Ostrom et al., 1997; Imperial 1999; Ostrom, 2005). This framework was specifically developed to analyze complex community systems and the framework does not restrict the researcher to the use of any particular theory or model (Ostrom et al., 1997; Ostrom, 2005). Among the strengths of the framework is that it recognizes the contextual, independent conditions of the management situation, i.e. physical, biological, social, economic and cultural conditions that may affect the institutional design (Imperial, 1999).

Institutional analysis addresses both the characteristics of the problems individuals in the management situation face, and the rules used to manage the resource. Thus, it requires an understanding of the nature of the problem, the individuals and the institution¹⁰ involved (Ostrom, 1990; Ostrom et al., 1997; Imperial, 1999; Ostrom, 2005). Hardin's (1968) 'tragedy of the commons' and the resolution of other problems associated with collective action and common pool resources can be mitigated by using appropriate institutions and institutional arrangements (Ostrom, 1990; Ostrom et al., 1997; Imperial 1999; Ostrom, 2005).

When analyzing an institutional arrangement in terms of the IAD framework, a key aspect to consider is the 'action arena', in this case the consultations, in which stakeholders participate in the decision-making regarding the resource and share the costs and benefits associated with the decision-making arrangements (Ostrom et al., 1997; Imperial 1999; Ostrom, 2005). The action arena is affected by the independent variables (physical and societal attributes, and rules in use) analyzed. The nature of the problem affects the actors and the action arena. Further, the action arena is affected by the patterns of interactions, which in turn affect the outcome of interactions in the action arena (Imperial, 1999; Ostrom, 2005). An action arena can also be analyzed in terms of the levels of rules that affect the stakeholders' actions. Three levels of rules can be distinguished. First, operational level rules affect day-to-day decisions. Second, collective-choice rules affect the operational activities and determine the stakeholders that are to be included in the arena. Finally, constitutional-choice rules also affect the operational activities and include a set of rules needed to craft the collective-choice rules, further affecting the operational rules. The effort and cost of changing the rules increase as the level of rules rises (Ostrom et al., 1997). This thesis focuses on the collective-choice level of rules.

¹⁰ The term institution is understood as the "*rules of the game in a society [...] that shape human interaction*" (North, 1990, p.3) with the aim to resolve social dilemmas (Imperial, 1999).

The complexity of the contextual factors, focusing primarily on the resource, the community and its impact on the common resource, and the rules used to regulate its use, has to be addressed. In addition, the size and heterogeneity of stakeholders involved in the management situation may further complicate the situation. The size of a group is relevant in solving collective action problems, since the transaction costs seem to increase with the size of the stakeholder group. In addition, the communication between stakeholders becomes increasingly complex as the number of stakeholders rises (Ostrom, 2005). Heterogeneity between stakeholders may also cause problems in an institutional arrangement. Typical heterogeneities are in cultural background, interests and endowments. Creating an effective institutional arrangement with heterogeneous stakeholders is challenging, and there is a risk that the more powerful group of actors (politically or economically) may dominate the weaker group (Baland & Platteau, 1996; Ostrom, 2005).

1.5 Outline

The remainder of this thesis is organized as follows. In section two the study area and its actors are described. In section three the theoretical framework of this thesis are presented and section four discuss the research design. Further, section five briefly summarizes the appended papers. In section six the main findings and their implications are discussed and the four papers from which the results are drawn are presented in the appendix.

2 The Study Area and Actors

The region this thesis and the underlying studies concerns is the northern part of Sweden; more specifically the northern parts of Dalarna, Jämtland, Västerbotten and Norrbotten (see the grey-shaded area in fig. 1). This region, which covers about 204 000 km² (ca. 45% of the total land area of Sweden) is sparsely populated, especially inland, although there are urban centers close to the coast, with an average density of ca. 3.2¹¹ inhabitant/km². Farming, forestry and reindeer husbandry are the main traditional private land uses, while the main industrial uses are mining and forestry. The industrial use of land developed following the colonization process, beginning in the 16th century. The colonizers, who used land for both agricultural and forestry purposes, and reindeer herders have been living side by side for centuries, but conflicts over land use have escalated in the last 50–60 years since the industrialization began¹².

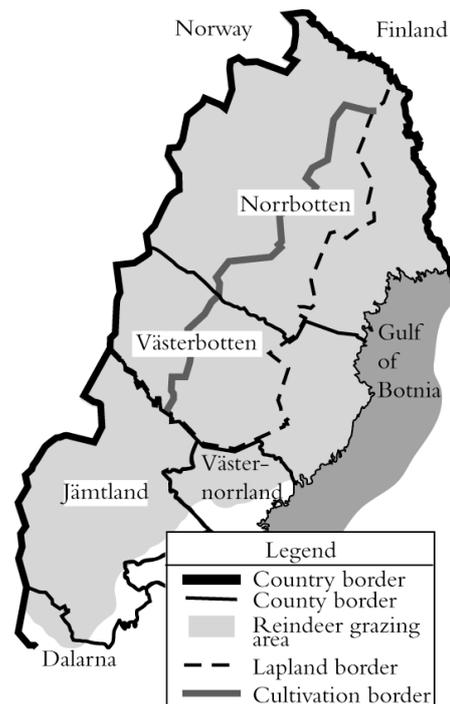


Figure 1. Northern Sweden, reindeer herding area and Reindeer Herding Communities (RHC).

¹¹ Compared to the average density of people of Sweden 20/km².

¹² See Paper I for a historical overview of land use in northern Sweden.

2.1 The Forest Resource, Forestry and Reindeer Husbandry

In Northern Sweden¹³, forests cover approximately 9.4 million hectares, constituting about 48 % of the total land area (Statistical Yearbook of Forestry, 2008). Thus, forestry is an important component of the regional economy, producing timber and pulpwood. Ownership of the forestland is divided between large corporations (49.8%), non-industrial private forest owners (37.9%) and the State (5.9 %) (Paper I).

However, much of the same land, shaded gray in fig. 1, is also used for grazing about 230 000 reindeer, managed by about 4 700 reindeer herders. Reindeer herding is an exclusive right of the Sami people. The reindeer owners are organized in 51 Reindeer Herding Communities (RHC), which serve both as geographical entities delimiting grazing areas and economic organizations representing their member's interests (Statistics Sweden, 1999). Reindeer husbandry is also an important part of the Sami culture, playing a key role in the cultural identity of the Sami (Bostedt, et al., 2003; Danell, 2004; Riseth, 2006).

The reindeer herds follow a migration cycle, mainly grazing in pastures close to, or in the mountains during the summer, and moving to forests closer to the coast during the winter¹⁴, where they mainly graze lichens (*Cladina*, *Alectoria* and *Bruoria* spp.) and are highly dependent on free-grazing areas in mature forests. Supplementary fodder is used only when essential, because of its high cost. The climate conditions are also an important factor in the provision of fodder. Since the reindeer dig for forage during the winter months, the snow conditions are vital (Statistics Sweden, 1999; Moen, 2008). An additional factor affecting grazing conditions is forestry, since the growth of lichens requires appropriate light and moisture conditions, thus forest management decisions also affect grazing possibilities (Gaio-Olivera et al., 2006; Moen, 2008).

2.2 Property Rights

Property rights can be characterized as a “*social relation that defines the property holder with respect to something of value against all others*” (Bromley, 1992, p.4), and can be divided into full ownership, (by the state or private owners), common property and usufructuary rights (Bromley, 2006). A usufructuary right is a nontransferable right to use a resource and exclude others from the

¹³ See Paper 1 for details on land use, resource users and identification of key issues of the conflict

¹⁴ Grazing land is divided into two areas, year-round (allowed all year) and winter grazing areas (allowed from 30 October till 30 April) (Statistics Sweden, 1999).

similar use of the resource. In addition, for completeness, no one has exclusive rights over some things (often wild animals or open-access areas of land) regarded as *res nullius* (literally nobody's thing); a status that should not be confused with the common property regime (Bromley & Cernea, 1989; Ostrom, 2003; Bromley, 2006).

The forest resource in Northern Sweden is subject to parallel property rights, since the forestry sector owns the timber resource while reindeer herders have usufructuary rights to graze reindeer on land owned by the state, forest companies and non-industrial private forest owners (SwRHA, 1971:437; Statistics Sweden, 1999; Hahn, 2000). The usufructuary rights are protected by law in the same manner as private property rights, so both of the two groups of stakeholders have legally-enshrined rights to use forestland (Hahn, 2000). However, the reindeer husbandry land use rights have always been contentious since the time when farmers and foresters colonized the northern parts of Sweden and Swedish land use policy began to be formulated and enforced (Allard, 2006). While grazing rights are strong in year-around areas, reindeer grazing rights are disputed in some winter grazing areas, particularly in the southern parts (SOU 2006:14).

It should be noted here that International Labor Organization Convention (ILO) 169¹⁵ could strengthen the reindeer herders' rights to use land and water, but Sweden has not yet ratified it (Hahn, 2000; Paper IV)¹⁶.

2.3 The Institutional Arrangement - Consultations on Forest Land

The two sectors use land in parallel for different purposes, and adversely affect each other causing externalities: forestry by harvesting timber in grazing areas, and reindeer husbandry through the reindeer trampling seedlings, rubbing their antlers on branches and breaking shoots or branches when digging in the snow to find lichens (Roturier & Bergsten, 2006). The

¹⁵ ILO (International Labor Organization) aims at guarding the worker's conditions and discrimination. By installing the ILO 169 convention, the rights of indigenous peoples and their integrity is protected. Among other things, the convention aims at special protection of the indigenous peoples' institutions, property, land use, culture and environment. The convention also state that consultations between government and indigenous peoples on matters that concern the group should be held and that the group should be given the possibility to decide over their own future and development. The convention was installed 1991 and countries are able to ratify the convention to protect indigenous peoples rights and integrity. Sweden has not to date ratified the ILO 169 (SOU 1999:25).

¹⁶ For further developed discussion on conventions and indigenous peoples, see Johansson, 2008.

externalities are substantial; modern forestry is considered one of the major threats to the reindeer herding sector, while foresters argue that conforming to the needs of reindeer husbandry is not economically defensible (Björklund, 2000; Persson, 2000; Danell, 2004). Bostedt et al. (2003) also show that the opportunity costs are too high to be defensible. However, the effect of externalities on the reindeer husbandry sector is more severe than their effect on forestry (Mattsson, 1981; Hahn, 2000; Paper II). For these reasons, together with the uneven property rights situation (Hahn, 2000), the State recognized the growing conflicts over land use between forestry and reindeer husbandry early in the 1970s and introduced consultations to foster bilateral agreements regarding land use. The intended function of the consultations was to strengthen the position of reindeer husbandry in relation to the forest sector (Prop 1990/91:3).

Each forest company (see Box 1) is obliged to hold consultations with RHCs before applying for felling permits in management units larger than 500 hectares for clearings larger than 20 hectares (10 hectares in mountainous forests) within each area and for fellings conducted in preparation to construct forest roads. In addition, consultations are mandatory for fellings in important, tree-lichen rich areas, areas used for moving the reindeer, areas on the border of clearings and in young stands covering more than 20 hectares (10 hectares in mountainous forests) (SKSFS 1993:2). During consultations forest companies¹⁷ outline the areas that will be affected by their actions, e.g. final fellings, soil scarification, fertilization and forest road construction. Minutes should be taken, and included in applications for fellings together with a duly completed standard form detailing considerations regarding reindeer husbandry (SKSFS 1993:2; Hamilton, 2003). Applications for felling permits may be rejected if consultations have not been properly conducted (Prop 1990/91:3).

This legal consultation framework applies to year-round grazing areas, leaving the important winter grazing areas outside consultations, partly because the reindeer herders' land rights on winter grazing land are not as strong as on the year-round land (Prop. 1990/91:3; SOU 2006:14).

It is possible that voluntary solutions could effectively bolster the reindeer herders' rights to use winter grazing areas. Indeed, when forest companies started to join certification programs, which include clauses regarding concern for indigenous peoples, consultations were voluntarily extended to

¹⁷ Non-industrial private forest owners are not obliged to engage in the consultations process, although a government investigation has proposed that they should be obliged to do so in the future (SOU 2001:101).

include winter grazing areas (Prop. 1990/91:3). The FSC introduced consultations on winter grazing areas with the same rules as those applied to the year-round areas (FSC, 2000). In addition, the PEFC (Programme for the Endorsement of Forest Certification) promotes collaboration between forestry and reindeer husbandry. It instructs certified companies to consider the needs of reindeer husbandry when applying treatments such as soil scarification and road construction (PEFC, 2006). However, PEFC certification is a weaker certification framework than FSC when it comes to the indigenous land use rights (Keskitalo et al., forthcoming)

Box 1. Forestry Act, sections concerning consultations

Section 20

Before felling takes place in an area where reindeer husbandry is permitted throughout the entire year (year-round grazing areas) in accordance with the Reindeer Husbandry Act, the Sami village concerned shall be given the opportunity to participate in joint consultations, as stipulated in regulations issued by the Government, or public authority designated by the Government.

Section 21

When applying for felling permission pursuant to section 16 above, the forest owner shall describe planned measures to satisfy reindeer husbandry interests.

In year-round grazing areas, felling is not permitted, if it:

- (i) causes such a significant loss of reindeer grazing land that the possibility to maintain the permitted number of reindeer is limited; or
- (ii) precludes the customary grouping and migration of reindeer herds.

When felling permission is granted, the Regional Forestry Board shall decide what consideration shall be taken to reindeer husbandry interests as regards, inter alia, the size and location of the felling site, and permissible felling method.

These conditions may only apply to what is clearly required with regard to the rights applicable to reindeer husbandry.

Section 31

Forest management measures, which concern the form and size of felling areas, the establishment of new stands, the retention of tree groups, and the routing of forest roads, are to take account of essential reindeer husbandry requirements. When planning and implementing forest management measures, it is desirable that the Sami village concerned be given annual access to both a sufficiently large and cohesive grazing area, and an ample amount of vegetation in those areas used for reindeer corralling, migration and resting.

(SwFA, 1979:429. Translation on <http://www.svo.se>)

3 Theoretical Framework

A core problem of collective actions consists of eliminating externality problems when large groups are involved (Olson, 1965). Further problems in many CPR situations are ‘free-riding’ and the likelihood that stakeholders may act solely in their own interests rather than for the benefit of the whole stakeholder group (Olson, 1965; Marshall, 2005). These issues, and the need to establish incentives to deter such behavior, complicate the management and creation of institutional arrangements. Furthermore, in a CPR it is difficult to limit resource users or to prevent other users from drawing benefits from it, i.e. excludability. In addition, another user cannot use the resource when the resource is consumed, i.e. it is “subtractable” (Ostrom et al., 1997; Ostrom, 2003). As the CPR-framework was developed, theories concerning individual behavior, social choice and strategic interaction evolved (e.g., Olsson 1965; Dawes, 1973; 1975).

In this section, theoretical concepts needed to analyze the robustness of the institutional arrangement between forestry and reindeer husbandry are discussed.

3.1 The Commons, Collective Actions and Market Failures

The ‘tragedy of the commons’ concept, first formulated by Hardin in 1968, introduced the idea of over-use and degradation of a resource due to a lack of institutional arrangements to regulate its use (Hardin, 1968). Following Hardin’s model, Dawes (1973; 1975) formalized the tragedy as a prisoner’s dilemma, which is conceptualized as a non-cooperative game. An interesting aspect of the prisoner’s dilemma is the paradox that rational individual choices can lead to irrational collective choices (Ostrom, 1990; Baland & Platteau, 1996; Ostrom et al., 1997). This led to the logic of collective action, developed by Olson (1965), which discusses the interesting

behavior of individuals when interacting in groups having common interests. Olson summarizes the logic of collective action as follows:

“...if the members of some group have a common interest or object, and if they would all be better off if that objective were achieved [...], the individuals in that group would, if they were rational and self-interested, act to achieve that objective” (Olson, 1965, p.1).

Olson stresses that there are few incentives for single actors to contribute voluntarily to the provision of a collective good, especially in cases of large stakeholder groups (Olson, 1965; Marshall, 2005). Olson’s argument can also be modeled as a prisoner’s dilemma and the logic of prisoner’s dilemma games can be used to illustrate social dilemmas in cases where the outcome is non-Pareto optimal (Baland & Platteau, 1996; Marshall, 2005; Ostrom, 2005). CPR-analysis evolved to evaluate institutional solutions to the collective action problem (Marshall, 2005).

Game theory frameworks can be used to explore how and why social dilemmas evolve and why they may readily lead to policy disputes or open conflicts (Kyllönen et al., 2006). In addition to using game theory to address social dilemmas, the market-failure concept can also be used to explain the need for institutions and to assess their performance. Market failures occur when the market forces do not lead to optimal allocation, i.e. does not fulfill the goals of Pareto efficiency and optimal social welfare. Externalities comprise one type of market failure, which can be addressed by various policy instruments, e.g. direct regulation through taxes, subsidies, tradable permits and/or property rights creations (Sterner, 2003).

In an externality situation “*unwanted costs are visited on others*” (Bromley, 1991, p.60), and there are no contractual terms or other mechanisms for internalizing the externality. In other words, there are costs, besides market costs, which have not been internalized by the market forces and thus the market cannot induce Pareto optimal behavior (Dahlman, 1979; Bromley, 1991). Transaction costs are indicators of externalities, because without such costs, the externalities would be internalized by ‘costless’ bargaining (Coase, 1960; Dahlman, 1979). Following Coase’s arguments, the New Institutional Economics (NIE) approach evolved, in which institutions are analyzed from an economic perspective (including transaction costs). NIE considers institutional environments and governance, the ‘rules’ of the game and the way the game is played (Williamson, 1998; 2000). Further, Challen (2000) concluded that transaction costs may be useful for explaining the character of institutions in institutional analyses.’

Connected to the Pareto optimality concept, there are effective models to identify and analyze externalities, but it is equally important to understand

the structure of the institutions that are subject to the externalities, since the institutions define the property rights situation (Bromley, 1991).

Important aspects to consider when studying an institutional arrangement regulating a CPR include: (1) the nature of the resource; (2) the supply and demand of the resource; (3) characteristics of the users; and (4) legal and political features of the environment that affect its use, and thus are important determinants of the outcome (Bromley & Cernea, 1989; Ostrom, 1990; 2005). For such studies the IAD-framework is useful since it provides a means to understand the institutional arrangement, in terms of these four aspects, thus connecting problems related to collective action with problems associated with internalizing externalities. The rest of this section discusses the connecting theories used to analyze the institutional arrangement in the IAD framework.

3.2 Theories for Analyzing the Action Arena

3.2.1 Power Relations within the Management Regime

A co-management regime is often helpful for solving resource management situations, resolving conflicts and promoting co-existence (Berkes, 1989; Pinkerton, 1989; Campbell, 1996; Jentoft, 1998; Kooiman, 2003; Carlsson & Berkes, 2005). However, the term co-management has a wide variety of definitions and it is used rather loosely to include many types of user groups and management situations. Despite the diversity of the definitions, they seem to share three features: (1) the term is connected to natural resource management, (2) some sort of partnership between private and public actors is involved, and (3) co-management is an ongoing process (Carlsson & Berkes, 2005). Since co-management in the studied context involves two groups of stakeholders managing the forest resource, the term co-management is understood as “*a situation in which some or all of the relevant stakeholders [...] are involved in a substantial way in management activities*” (Borrini-Feyerabend, 1996, p.12). The stakeholders then negotiate, define and guarantee sharing of the resource within a given territory¹⁸ (Borrini-Feyerabend, 1996). Co-management usually implies integrated management between the State and local actors (Berkes, 1994). However, in the forestry-reindeer husbandry situation the State has delegated the responsibilities of management to the local stakeholders. Under the legal framework, which

¹⁸ Furthermore, in a co-management regime decentralized governance is promoted, and thus has strong resemblance to self-governance, i.e. autonomous, interdependent regulation of the interactions between the stakeholders (Kooiman, 2003), see Paper II for further discussion.

provides large degrees of freedom, the foresters have control over the institutional arrangement, through their role as initiators of the consultations (Paper II).

In a co-management situation the stakeholders, encouraging interaction and communication between them, take decisions cooperatively and several studies have shown that co-management fosters greater legitimacy than centralized management. Further, stakeholders seem to become more sensitive to each other's needs and more perceptive of the other stakeholders in co-management situations (Osherenko, 1988; Berkes, 1989; Jentoft & Kristoffersen, 1989; Pinkerton, 1989; Ostrom, 1990; Berkes & Preston, 1991; Pomeroy & Berkes, 1997).

Clearly, no institutional arrangement, including co-management, can provide an absolute solution to all problems or an ideal framework for all management situations in isolation. The co-management arrangement has to be based on solid foundations of property rights, which can be effectively monitored and enforced (Phillipson, 2002). Thus, it is also essential to ensure that power is appropriately distributed between the stakeholders.

One way to measure the power distribution in a management regime is to study the influence of the stakeholders over the resource, for instance using the well-established ladder of participation, introduced by Sherry Arnstein (1969) and adapted by Berkes (1994), which builds on the classical Dahlian notion¹⁹ of power (see also Pinkerton, 1989; Campbell, 1996; DePaoli, 1999; Paper II).

The ladder of participation has two dimensions (levels of influence over resource management and levels of participation) and each of the 'rungs' equates to an important element of a co-management regime (Paper II). The level of co-management in a given situation can be identified by analyzing the management regime in terms of the influence of the stakeholders in management of the resource. In practice, the balance of power may change over time, in such cases the ladder of participation can also be used to evaluate the effects of changes in management and/or the stakeholders' influence. Each of the rungs of the ladder also corresponds to a certain level of influence in management, and hence level of co-management. The first three rungs – information (1), dialogue (2), and communication (3) – cannot be characterized as co-management situations,

¹⁹ The classical Dahlian notion of power implies that "*A has power over B to the extent that he can get B to do something that B would not otherwise do*" (Dahl, 1957, p.202-3). Other definitions of power are more complex. However, Dahl's minimal power definition is applicable in empirical evaluations, although important aspects of power may be neglected. See further discussion in Paper II.

since stakeholders are given few opportunities to actually participate in management. In situations corresponding to the next three rungs – advisory system (4), co-operation (5) and management board (6) – there are increasing degrees of influence, and hence of co-management. The stakeholders' different resource objectives are increasingly incorporated in management of the resource. In arrangements corresponding to the last rung, partnership (7), the stakeholders participate equally, sharing power and making decisions collectively (Arnstein, 1969; Berkes & Preston, 1991; Berkes, 1994).

The forestry-reindeer husbandry management regime can be evaluated using the ladder of participation. Since foresters own the resource, and thus are the stronger party, the power of the reindeer herders in relation to forestry is subject to analysis. A change in power relations has direct economic implications for each of the stakeholders. However, each step up to another rung implies that the reindeer herders have greater influence in consultations. In addition, changes that have a minor impact on forestry may have substantial effects on reindeer husbandry, although there have been few empirical studies to substantiate this hypothesis (e.g., Mattsson, 1981; Bostedt et al., 2003).

3.2.2 Analyzing the Robustness of the Management Regime

To evaluate if a co-management situation is stable or viable i.e., robust, the power relations between the stakeholders are not the only important aspects to consider. The design principles, developed by Ostrom (1990; 2005) are used to assess the robustness of the forestry-reindeer husbandry management regime. The eight design principles (further developed in paper II) are; clear boundaries (1), correspondence between benefits and costs (2), collective choice (3), monitoring (4), graduated sanctions (5), conflict resolution mechanisms (6), rights to organize (7), and multi-level governance (8). The design principles can be used to identify robust regimes, and underlying weaknesses that are likely to lead to failures to establish effective regimes. However, there may be a danger in using the design principles if managers only strive to fulfill them, neglecting the intended aims of the institutional design, and thus failing to establish effective management (Ostrom, 2005). Hence, the use of the design principles has to be seen in the context of the complex management regime, using the principles to identify underlying factors that lead to inefficiency.

3.2.3 Analyzing the Optimal Influence in the Management Regime

A model to determine the reindeer herders' optimal influence was developed by considering the social planner's perspective, i.e. the societal optimal level for all stakeholders. The model was built on optimization assumptions, including assumptions regarding the management activities of all stakeholders involved in the institutional arrangement, which reflect their influence in forest management and the power distribution. Further, since each stakeholder's management activities affect the profits of all stakeholders, to varying degrees, the model can also be used to elucidate the economic effect of changes in the reindeer herders' influence in forest management, and thus determine their socially economically optimal level of influence.

3.2.4 Transaction cost analysis of the action arena

Transaction cost theory was originally developed to analyze costs arising when externalities are present in interactions between economic organizations in the industrial sector (Coase, 1937; 1960; Williamson, 1998; 2000; Dahlman, 1979; North, 1990). However, transaction costs are being increasingly used in the study of institutions, especially in analyses of natural resource management (Hanna, 1994; 2003; Abdullah, et al., 1998; Challen, 2000; McCann et al., 2005). In some cases, at least, externalities can be internalized in attempts to improve overall welfare, through negotiations (Coase, 1960; Dahlman, 1979). Hence, the effectiveness of arrangements in practice often depends on the possibilities to reduce transaction costs (Libecap, 1991; Hanna, 2003; Mburu et al., 2003). Consequently, individuals often prefer institutional arrangements that minimize transaction costs, and thus optimally internalize externalities and maximize welfare²⁰ (Abdullah et al., 1998; Challen, 2000).

However, transaction costs are seldom taken explicitly into account in analyses of natural resource management, even though including transaction costs improves analyses of institutions, possible alternatives, policy choices and policy design (Hanna, 1994; Abdullah et al., 1998; McCann et al., 2005). In addition, the analysis of transaction costs also demands deeper understanding of the political and natural resource systems and the ways in

²⁰ However, welfare, i.e. Pareto, improvements are difficult to achieve since it is difficult to find arrangements that can make one person better off without making some other person worse off. It is thus more appropriate to use the Kaldor-Hicks framework in which one actor, at least in theory, compensates others suffering from an externality. This can then be used to search for Pareto improvements, rather than true Pareto efficiency (Kaldor, 1939; Hicks, 1940).

which policy is made and implemented (McCann et al., 2005). Analyses of transactions costs also provide a means to capture effects of institutional changes over time, or of single events, since they are functions of the institution (North, 1990).

The definitions of transaction costs vary depending on the context. For instance, Coase (1960) defines them as the costs of participating in a market or implementing governmental policy, while others (e.g. Demsetz, 1968; Allen, 1991) focus on the costs of establishing and maintaining property rights. However, despite the differences in definitions, the fundamental concept of a transaction cost is that it includes both the *ex ante* and *ex post* costs of a situation (Matthews, 1986; Ostrom, et al., 1993; Abdullah et al., 1998; Williamson, 2000). In the forestry-reindeer husbandry relationship the *ex ante* costs correspond to the costs arising from the relationship before and during consultation, while the *ex post* costs correspond to costs arising from the consultations, e.g. costs of monitoring and evaluating land use. The *ex ante* and *ex post* costs can, in turn, be divided into three sub-sets: information costs, collective decision-making costs, and collective operational costs (Abdullah et al., 1998). The information (*ex ante*) costs include costs such as those of acquiring knowledge of the resource and its users, and organizing the information for decision-making purposes (Abdullah et al., 1998). The quality (i.e. the amount, type and accuracy) of the information is important for creation of successful institutional arrangements. A lack, or poor quality, of information may lead to information asymmetry, which in turn may increase transaction costs. Typical examples of information asymmetries include traditional knowledge versus knowledge obtained from research, and poor knowledge exchange (Sternier, 2003; McCann et al., 2005). Next, the collective decision-making (also *ex ante*) costs are those associated with strategic planning and the co-ordination of resource use within the institutional arrangement. The institutional design and its effectiveness are important aspects to consider in attempts to create arrangements to regulate natural resource use that suit all stakeholders, while keeping transaction costs within acceptable limits (Hanna, 1994; Abdullah et al., 1998). The last sub-set, collective operational (*ex post*) costs accrue as decisions within the institutional arrangement are enforced, and may include conflict resolution, evaluation and/or monitoring costs (Hanna, 1994; Abdullah et al., 1998).

Bromley (1991) observed that, since property rights structures influence transaction costs, the weaker stakeholder in the institutional arrangement has to initiate actions to deal with the other stakeholder.

4 Research Design

As discussed in the introduction, the research underlying this thesis was based on the IAD-framework, focusing on the robustness and efficiency of the action arena. To analyze consultations a first important step was to understand the exogenous variables that affect the action arena, aspects addressed in Paper I. Next, the management regime was analyzed using the variables labeled in the top box of figure 2. The potential outcome of the management regime depends on the participants, information, control and net costs and benefits. The participants and the positions they adopt, together with the actions and the control are linked to the potential outcome of actions taken in the arena (Ostrom, 2005); aspects addressed in Papers II and III. The theoretical bases of the analyses in Paper II are the ladder of participation and the design principles, while the ladder of participation and social planner's model were utilized in Paper III. Further, the net costs and benefits associated with the action arena affect the potential outcome (Ostrom, 2005), which was evaluated, by analyzing transaction costs, in Paper IV.

In addition to the theoretical approaches to analyzing the action arena, an empirical model (ladder of participation) was used to *observe* the interactions and outcomes of the action arena, as described in Paper II, while a theoretical framework (social planner's model and transaction costs) was used to *predict* interactions and outcomes of the arena in Papers III and IV.

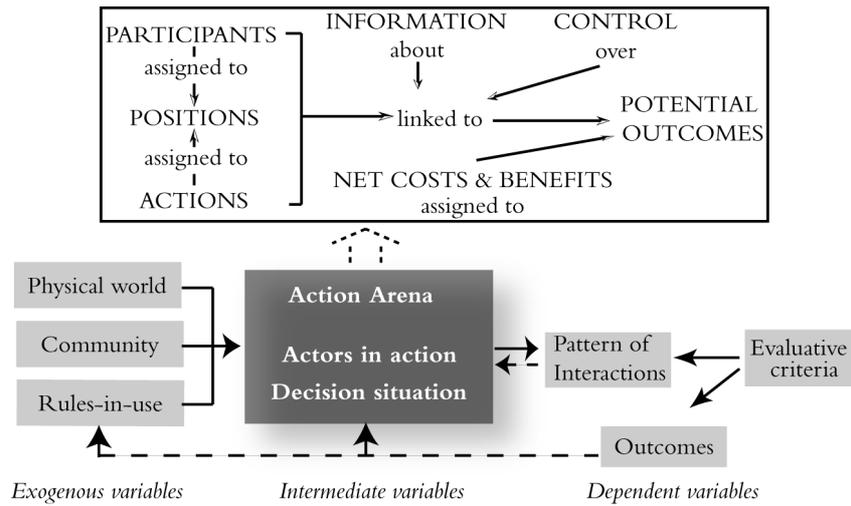


Figure 2. The IAD-framework and analysis of the action arena (adapted from Ostrom, et. al., 1997; Imperial, 1999; Ostrom, 2005)

This thesis is based on both qualitative and quantitative methods. In addition to literature studies, individual interviews, focal group interviews, collaborative learning and scenario techniques are used. Further, data was gathered to facilitate the numerical solution of an optimization model as well as simulation analysis. For details of each of the methodological consideration, turn to the papers in the appendix.

5 Overview of Appended Papers

In this section each of the appended papers is briefly summarized, and the methods used and main results are presented. For details, turn to the specific papers.

5.1 Forestry and Reindeer Husbandry in Sweden – the Development of a Land Use Conflict (Paper I)

In this first paper, the aim was to identify and elucidate the contextual variables (exogenous variables in the IAD-framework) that affect the stakeholders in consultations, based on literature studies.

The state of the lichen resource is difficult to investigate. Foresters have good knowledge of the timber resource since they keep detailed plans of their forest areas, but they have no incentive to keep records of the lichen resource. Reindeer herders' records of the lichen resource are limited, usually consisting of traditional knowledge that is not written down. Attempts have been made to document the grazing resource through the Land Use Plan for reindeer husbandry (LUP), but it is a time-consuming and costly measure implemented by only 14 of the 51 RHCs²¹. However, data, collected in 1955 and 1995, indicate that the proportion of lichen-rich forestland is decreasing, due to changes in the age distribution of trees that have occurred within forests in Northern Sweden over the last 80 years. The proportion of young forests has almost doubled in this time, and the conditions have become less suitable for the growth of lichens since the young forests are dense. Furthermore, the National Board of Forestry²² is concerned that forests, particularly in Northern Sweden, are being overused

²¹ Six RHCs are currently using the LUP, a further eight are making efforts to implement it, and 19 more RHCs are waiting to start the implementation (Sandström, 2008).

²² Skogsstyrelsen in Swedish.

and that harvest rates are not sustainable, especially since storms in southern parts of Sweden have increased the pressure on forests in the north.

Next, in terms of societal attributes, the historical development of land use together with the development of the society's attitudes toward the two sectors was analyzed. The attitudes toward land use have historically shifted several times from the 16th century to our time. In the 16th century, farmers colonized forestland in order to increase agricultural activities. At the same time, reindeer husbandry was recognized as an important land use. However, as mining and subsequently forestry began to develop, the state started to recognize the value of the forest and forestland, pushing reindeer herding from previously used land. As the forest sector became industrialized during the 1950s and 1960s, conflicts over land use between forestry and reindeer husbandry became deeper. However, the Swedish state made attempts to protect the reindeer herding sector, by setting a 'cultivation border', above which colonization was prohibited. The economic value of timber, the growing forest sector and the need for unbroken land for colonization purposes were, however, regarded as more important, and given priority over reindeer husbandry. These shifts have led to confusion over land use rights and the attitude towards each of the sectors.

The last contextual factor affecting the action arena is the rules-in-use. Although reindeer husbandry has co-existed with colonizers/forestry since, at least, the 17th century, law and regulations regarding their relationship were vague or non-existent until the end of the 19th century. Then the first Swedish Reindeer Husbandry Act was introduced, originally to regulate the Sami right to herd reindeer and the movement of reindeer between Sweden and Norway. Forestry was regulated through the Swedish Forestry Act in 1903, initially to ensure forest regeneration, and later extended to consider economic dimensions of forestry and natural conservation issues.

As conflicts over land use increased, due to societal developments, the need for conflict-resolving mechanisms became acute. Consequently, the State initiated consultations. However, the State chose to endow the consultations with a large degree of freedom, which led to vague perceptions of what consultations mean, what should be included and what consideration forestry had to give to reindeer husbandry.

The independent variables all in all indicate that the two stakeholders have different views of land use and land use management. As conflicts over land use still occur, the consultations are insufficient to provide an arena where the two land use views can be customized.

5.2 Stakeholders' Perceptions of Consultations as Tools for Co-management – A Case Study of the Forestry and Reindeer Herding Sectors in Northern Sweden (Paper II)

This paper explores the present institutional arrangement's ability to consider the interests of each of the stakeholders, by focusing on the power distribution between them, using the ladder of participation to evaluate the power relations and design principles to evaluate the management situation, based mainly on responses in interviews with stakeholders.

The results shows that about half of the reindeer herders think consultations have little or no significance. Few think that the consultations have considerable significance, indicating that most reindeer herders think consultations have no use for them. However, most of the reindeer herders think the importance consultations has increased over time. Forest companies have an opposite opinion regarding the significance of consultations, considering reindeer husbandry to have considerable or great impact on forest management.

The power distribution between the two groups of stakeholders was then assessed using the ladder of participation. Foresters and reindeer herders were asked to indicate the degree of influence they think reindeer husbandry has in consultations. The results show that both sectors have about the same understanding of reindeer husbandry's influence in consultations. The respondents were also asked if reindeer herders' influence could be changed in the future. Although reindeer herders had a rather pessimistic view of their current influence, there was a belief that their influence could be increased in the future. Foresters also thought that the influence of reindeer husbandry in forest management could be increased. However, almost 30 % of the foresters indicated that increases in the influence of reindeer husbandry in forest management would not be desirable or possible. Respondents also pointed out that the property rights situation is a fundamental determinant of the power distribution. The power analysis shows that foresters exercise their ownership right, having full power over the resource, while reindeer herders only have usufructuary rights. The forest companies who do not think that the reindeer herders' influence should be increased since they do not recognize the usufructuary rights.

In the next step of the analysis the arrangement was evaluated in terms of the design principles characteristic of a viable, stable co-management system. The results indicate that few of the design principles are fulfilled. Boundaries have been set for the resource, regulating who is allowed to use it, although there is some dispute over reindeer grazing lands, especially in the southern

part of the reindeer grazing area. However, several of the design principles are not met by the present institutional arrangement. There is no reliable assessment of the magnitudes of cost and benefits of consultations. This means that the correspondence between costs and benefits in the consultation process cannot be assessed. Consequently, the principle of low cost conflict resolution is not fulfilled. Further, the collective choice principle is not fulfilled since the stakeholders do not have opportunities to influence rules concerning consultations. The arrangement was also regarded as being deficient in terms of the monitoring and sanction principles by respondents in the case study (especially the reindeer herders), since there is little or no supervision of the forest sector's actions, and a lack of appropriate sanctions when agreements reached in consultations are not kept.

The respondents in the interviews were also asked to rank measures that could improve consultations. The most important measures cited were: knowledge of each other's activities, better understanding of the economic consequences of consultations, and personal relationships within consultations to build trust.

5.3 Optimal Level of Influence in Forest Management – The Case of Consultations between Forestry and Reindeer Husbandry Sectors (Paper III)

In the third paper the socio-economically optimal level of influence of reindeer husbandry in forest management (through consultations) is analyzed using an optimization model. The data for the optimization were compiled from four previous studies of activities and relevant parameters in a specific forest area that is especially important for reindeer husbandry, and maintaining the condition of the herds.

The results presented in Paper II showed that reindeer husbandry's influence in consultations is weak, implying that power is unevenly distributed between the reindeer herders and the foresters, prompting the question what is the socio-economically optimal level of reindeer husbandry influence in forest management? To address this question, an optimization model of forest management was created, which optimizes the combined discounted profits of forestry and reindeer husbandry as a function of the level of influence of reindeer husbandry in forest management. The social gain (the increase of the sum of net present values of forest companies and reindeer husbandry) was assessed at various level of influence. Based on these assessments it is possible to estimate the economical optimal level of influence of reindeer husbandry in forest management. The results of the

optimization indicate that the socially optimal economic level of reindeer husbandry's influence in consultations is low, indicating that forestry should give little consideration to reindeer husbandry in forest management. A sensitivity analysis was also conducted, which showed that even when effects of timber harvest on larger areas than those actually harvested (due for instance to forest road construction or snow packing on areas close to clear-cut areas) were included the optimal level of influence is still low.

In addition, an analysis of changes in the breeding reindeer stock over the simulated time period, associated with the optimal economic parameters, provided interesting results. The optimal number of reindeer fluctuated greatly over time. If forestry do not adapt to the need of grazing areas for reindeer husbandry to a larger extent, then the optimal reindeer stock would be almost halved over the simulated 100 years, or could even diminish or disappear depending on the harvest effect multiplier. This implies that the effect of timber harvests is too great for reindeers to survive on natural grazing, and hence supplementary fodder would be required to maintain the reindeer herds.

5.4 Incentives and Transaction Costs of Institutional Change in Multiple Use Commons – The Case of Forestry and Reindeer Husbandry in Northern Sweden (Paper IV)

The last paper analyzes the institutional arrangement in both the current and a proposed altered consultation process, focusing on the effect of transaction costs on each of the sectors. Three workshops were held using a three-fold approach: focus group interviews, collaborative learning, and scenario techniques. To establish the effects of transaction costs on each of the sectors a scale ranging from negligible through low and high to very high, is used to measure each of the effects of transaction costs.

The results indicate that the effect of transaction costs is uneven between the sectors. The effect of transaction costs are assessed by studying the specific actions taken in land use management through consultations identifying explanations of the unevenness. The transaction costs with the most uneven effects are those related to collective decision-making, i.e. costs of land use planning, consultation meetings and the coordination of planning perspectives. The results show that forestry and reindeer husbandry have different temporal and spatial scales, i.e. the sectors' plans have different time perspectives and the areas included in the plans differ substantially in size. The temporal scales of each sector's plans conform to the characteristics of the resource: forestry conforms to the market demands for timber while

reindeer husbandry conforms to the slow-growing lichen²³. These differences in temporal scales complicate the relationship within consultations, and hence accrue transaction costs. The differences in spatial scale are due to differences in the planned areas to be used. Reindeer husbandry requires large natural grazing areas, allowing for variations in factors such as climate, to ensure there is sufficient grazing throughout the year. However, the ownership of the forest resource is fragmented and several different forest owners may own parts of a grazing area, and may have differing views on landscape planning and consultations. A further factor affecting the consultation situation is the lack of clear, consistent purposes and contents of consultations. Foresters have the initiative in consultations, and thus control the process, while reindeer husbandry has to conform to the given system.

Other aspects in which the effect of transaction costs are unevenly distributed, are related to information about the other stakeholders, the resource, and the costs of collecting information about the resource. Further, the lack of low-cost mechanisms for conflict resolution, monitoring and evaluating land use has created transaction costs for both stakeholders, although the effects of these deficits are uncertain. However, reindeer husbandry, as the subordinate actor in the consultations, is affected more by these transaction costs than forestry, mainly because forestry has the initiative in consultations.

The respondents in this study indicated five aspects in need of improvement: knowledge of the other stakeholders, knowledge of the resource, clarification of the intended function of consultations, planning perspectives, and conflict-resolution. In addition, the respondents cited a lack of awareness of the economic effects of consultations. The proposed changes to the consultations would affect these five key issues and, thus, the transaction costs, making them (at least in the long run) more evenly distributed. Since the stakeholders are free, within the current legal framework, to design consultations as desired, the proposed changes are within the present legal framework. Changes in planning perspectives, together with clear definitions of the institutional framework, could lead to substantial improvements. In current forest management, consultations are carried out late in the process, and simply by advancing consultations in time, the temporal planning scales could be more closely matched. The possibilities for negotiations, and the outcome of consultations, would also probably improve. The spatial scales would be more difficult to adjust, since consultations are held with each of the forest companies individually. In

²³ Lichens recover from severe depletion in about 20-30 years (Paper IV).

addition, the costs of acquiring and organizing information may be substantially reduced (and synchronization of the planning process could be enabled) by using digitalized LUP tools. Inclusion of lichen data in the forest management planning process would also increase the common level of understanding of the effects of forest harvests on the total resource, leading to a more balanced planning perspective. However, this measure would increase the effect of transaction costs on forestry, at least in the short run.

The analysis also considered possible changes to the incentive structure of conducting consultations. Results from this study show that there is no lack of ideas for improving consultations. However, no changes have been made to date to the process, partly due to the uneven incentive structure. The reindeer herders' incentive to participate in consultations is very strong, due to their economic need to secure grazing land, which is affected by forestry measures. In contrast, forest companies engage in consultations due to legal stipulations regarding year-around areas and the FSC-framework regarding winter grazing areas. However, since the legal framework is weak, each forest company is free to implement the legal framework as they see fit. On the other hand, a strong incentive for forestry to engage in consultations is to avoid further governmental intervention in forest management. None of the stakeholders are interested in driving consultations toward a more legally regulated system. A further incentive for forestry to engage in consultations is to improve their public image, especially since the FSC (and many potential customers) expect, or demand, indigenous people's land uses to be respected.

6 Concluding Discussion

A broad range of issues are considered in this thesis, and the underlying studies, to acquire a thorough understanding of the management of land used for both forestry and reindeer husbandry in Northern Sweden. The main objective was to analyze the robustness and efficiency of the institutional arrangement regulating the interactions between these sectors, and in this last section the most important results are discussed. The future prospects for managing conflict between forestry and reindeer husbandry (and for their continued co-existence) are also considered, together with policy implications and issues that should be addressed in future studies.

6.1 Innovation and Contribution

As illustrated in this thesis, the land use management between forestry and reindeer husbandry is affected by a complex web of factors, which leads to shortcomings in the institutional arrangement. It is important to understand both the institutional arrangement and the factors affecting stakeholders to explain externalities that occur and their effects on each stakeholder. The economic circumstances of reindeer husbandry lead to conflicts within consultations since reindeer herders often have to reject harvest proposals to guard their interests, and although forestry can accept a moratorium for a short time, timber has to be harvested sooner or later. Hence, not only the externalities caused by harvest measures, but also difficulties in reaching agreement in consultations are creating land use conflicts.

In this situation, the IAD-framework can facilitate attempts to understand the consultations, to identify ways to manage conflict and to evaluate the robustness of the institutional arrangement. The strength of the framework is the scope it provides to combine theoretical underpinnings, models and methods to capture the complexity of an institution. By utilizing the

theories concerning power and robustness of an institutional arrangement in combination with the economic theories of welfare theory (social planner's model) and new institutional economics (transaction cost theory), the institutional and economic aspects complement each other within the IAD-framework. The ambition is to obtain a deeper understanding of the institutions and its function in management. However, few studies have focused on the economic aspect of an institutional framework based on the IAD-framework, especially in cases of natural resource management where stakeholders with different objectives are involved. In addition, few studies have analyzed economic aspects of multiple-use commons, thus the studies presented here provide a potentially valuable contribution.

In these studies, CPR-theories have been combined with economic frameworks in attempts to elucidate complex aspects of land use management between forestry and reindeer husbandry. An analysis of the power relation within consultations, based on the stakeholders' perception has been conducted. Further, a social planner's model has been developed to include a power dimension through analyzing reindeer herders' influence in consultations. It provides a first step towards understanding of the economic effects of the consultations on each of the stakeholders.

The transaction cost framework has also been used to analyze the institutional arrangement regulating this common pool resource with conflicting land uses. Thus, the studies contribute both to the theoretical framework of transaction costs and to empirical research on forestry and reindeer husbandry. Representatives of both sectors state that economic understanding of the effect of consultations is lacking, and adjustments to the consultation process based on the transaction cost analyses, may provide such understanding.

Multiple methods were used in the studies, including individual interviews, focus group interviews, collaborative learning and scenario techniques. In the collaborative learning approach the researchers, together with the stakeholders, developed a joint understanding of the problems of land use management, while the scenario technique was used to nurture this learning process, allowing the stakeholders to freely discuss possible, desirable or undesirable, outcomes. Application of the collaborative learning approach and scenario technique in this multiple-use common resource context has been challenging, since the stakeholder groups are heterogeneous, with different land use objectives. However, the results of the process provided indications not only of possible desirable changes to the consultations process, but also extensive learning of the effects of consultations on each of the sectors for both stakeholders and researchers.

6.2 Characteristic Features and Persistent Problems of Land Use Management

As the results presented here show, the current institutional arrangement has shortcomings and it cannot be considered a co-management situation. Conflicts over land use occur, despite consultations, and conflicts that occur within consultations are not always resolved. The analysis of the arrangement also shows that the consultations do not have the characteristics ('design principles') of a viable, stable management regime. There is a lack of low-cost conflict-resolving mechanisms and there is no correspondence between costs and benefits. Further, in addition to the absence of conflict resolution mechanisms, there is no clear, consistent definition of consultations. The legal framework does not provide a definition, and leaves it to the stakeholders to establish the consultation framework, with reference to freedom-under-responsibility. The lack of a reliable assessment of the magnitude of costs and benefits within consultations are due essentially to the fact that stakeholders lack an understanding of the economic effects of consultations.

There are several reasons why the present institutional arrangement is not a working co-management regime. The results of the studies show that contextual factors (exogenous variables in the IAD-framework), power- and economically-related issues affect the stakeholders, leading to shortcomings in the management regime. The contextual factors provide an understanding of how the relationships between stakeholders have evolved. Historical shifts in the prioritized land uses (farming, reindeer husbandry, mining, forestry *etc.*) have led to confusion regarding land uses. The focus of legal regulations covering forestry has also shifted, since at various times the main objectives of regulations regarding forestland has been to promote regeneration, maximize production and to foster a sustainable balance between conservation and production. Linking these changing priorities with consideration for the status of the lichen resource, which is essential for a successful institutional arrangement to regulate forestry and reindeer husbandry, is far from straightforward, as previously recognized by Mattsson (1981).

Another reason for the shortcomings is the uneven power distribution between the stakeholders. The results show that stakeholders have rather same views on reindeer husbandry's weak influence in consultations. The weak influence is further reflected in differences regarding the possibility and desirability of changes in their influence in future consultations. Reindeer herders think their influence could be substantially increased, while foresters think only modest changes could be made, and some even

state that increased reindeer husbandry influence would not be desirable. Thus, the consultations could be characterized as an arena in which the stronger party imposes their demands on the weaker party, i.e. as a means to implement power. One explanation for this is the uneven property rights situation (Hahn, 2000). Another explanation is economy. Forestry is one of the region's most important export industries. Thus, profits of the forestry sector affect not only the individual forest company (and its owners) but also the regional economy.

The results also show that, there is unevenness in economic terms with concern to the transaction costs. Further, as often seems to be the case, the weak stakeholders in the institutional arrangement appear to bear the most transaction costs, i.e. the analysis indicates that the transaction costs have high effects on reindeer husbandry and low effects on forestry.

6.3 Continued Co-existence?

By striving toward a co-management regime the integration and communication between the stakeholders could be strengthened, leading to better conflict management. In addition, the results show *indications* that if no changes are made the future existence of reindeer husbandry *may* be threatened, also found by previous researchers (e.g. Danell, 2004). However, reindeer husbandry is considered a national interest and has significant value for the Sami as a major part of their cultural heritage. Furthermore, if ILO Convention 169 is ratified in Sweden, the land use of the indigenous peoples has to be considered. This raises questions about the measures that would have to be taken to manage conflict between the two land use stakeholders with different objectives in order to create a viable, stable co-management regime.

There are, beside the adjustment of the institutional arrangement, two hypothetical paths to choose to move towards co-management: regulation or economic redistribution. Since this thesis concerns institutional arrangements, based on the present legal framework, the *focus of the analysis is on the last of these three approaches*, but the other two hypothetical solutions should be at least briefly mentioned.

Stronger regulation of land use within the legal framework is one hypothetical solution. This possibility was also discussed in the case study (Paper IV), but both stakeholder groups were reluctant to such a solution, the foresters more than the reindeer herders. The foresters' reluctance was mainly based on ideological reasons since such an institutional change would lead to a situation where they lose control over their property. Although the

reindeer herders desire greater regulation, in particular concerning their property rights, they perceived detailed regulation concerning operational rules as rather unrealistic. Both actors agreed that such detailed regulations would heavily reduce the flexible use of forested land and would probably lead to more intense conflicts over land use (Sandström et al., 2006, Paper IV). Both stakeholders thus seem to be satisfied with the *intention* of consultations, but not the *performance*.

The next hypothetical solution for continued co-existence is economic redistribution, which provides an obvious means to address market failures by obliging the stronger stakeholder to compensate the weaker for externalities caused by their land use. Results also show that, from an economic point of view, it is more profitable for forestry to compensate reindeer husbandry for lost grazing areas, instead of increasing consideration within consultations. Other economic tools are also available to internalize externalities, e.g. taxes or subsidies, or the legal regulation of land use, as discussed above. Findings based on the social planner's model show that redistribution through forestry compensating reindeer husbandry for lost grazing abilities, is most likely economically optimal for forestry. However, it would probably mean that reindeer husbandry, as practiced today, would diminish or even disappear in the future since natural grazing areas are decreasing. Thus, to ensure reindeer husbandry's continued existence, the compensation would have to correspond to the cost of feeding reindeer with supplementary fodder. However, this could seriously compromise the value of reindeer husbandry as a key component of Sami culture.

The third, and last, possible solution, is to strengthen the institutional arrangement within the present legal framework. Representatives of both sectors think it is possible to find solutions internally, to enable continued co-existence in this way. This could be done either formally via the parliament or voluntary via the FSC, which certifies all of the major forest companies who own forests in this region. The key issues to address are the uneven power relationship and effects of transaction costs. A number of possible key measures to achieve this were identified by the stakeholders, relating to improved knowledge of the resource and the stakeholders, including economic understanding, planning horizons and clarification of the definition of consultations.

The importance of clarifying the definition of consultations has already been discussed. In addition, the planning horizons also need to be adjusted. In current consultations, forest companies have planned forest management actions in detail before reindeer herders are given the opportunity to share their opinion. This is another reason why reindeer herders consider their

influence in forest management to be weak. By altering forest management procedures to include consultations with reindeer herders earlier, both sectors would have longer planning perspectives, allowing (for example) the herders to graze areas that are to be cleared in the near future more intensively than normal during the preceding period, thus using grazing areas more optimally. In addition, the stakeholders could gain a deeper understanding of land use objectives, especially regarding areas of particular importance for reindeer husbandry.

It is also important for the stakeholders to acquire increasing understanding of each other's sectors, the resource, and the economic effects of decisions taken in consultations. Several respondents mentioned such awareness as an important requirement during the case study. Here research can fill important gaps.

Yet another important aspect that could be improved is the conflict resolution mechanism. As previously mentioned, conflicts that are not solved within consultations are left unresolved. The stakeholders stated a desire for a conflict-resolving mechanism to solve this problem. This study does not provide a specific solution to this problem. However, some of the proposed changes, such as defining the concept of consultations and moving consultations to an earlier stage of forest planning, could potentially reduce conflicts over land use, and the results show that the stakeholders would prefer mediation rather than a legal resolution of conflicts of land use.

If these changes are implemented, the transaction costs would be decreased (at least in the long run), the effects of transaction costs on each of the sectors would be more evenly distributed, and may even enable Pareto improvements, according to Kaldor-Hicks criteria. This means that although foresters' transaction costs would slightly increase, the joint benefits of consultations would lead to Pareto improvements. A staunch believer in economic theory is probably asking why these improvements have not already been realized. The answer lies in the differences in the incentive structure of the stakeholders. Reindeer herders have strong incentives to participate in consultations, since they need to secure access to natural grazing and the sector is dependent on the measures taken by the forestry sector. The incentives are much weaker for forestry, being based on legal obligations, extended by the FSC, to conduct consultations. Another reason that no changes have been implemented is that reindeer husbandry would probably benefit most from the changes, but the reindeer herders have weaker property rights, and hence are in no position to force through the changes.

6.4 Policy Implications

Although this study has focused on the collective-choice rules, which can be affected by the stakeholders, the results of this study have several policy implications. The results of the studies show that both stakeholders are willing to make some changes in order to strengthen the institutional arrangement, but the question is what changes are required? Theoretical findings show that creating and sustaining institutional arrangements are likely to be problematic if the stakeholder groups are heterogeneous, as they are here, since the two sets of stakeholders have very different land use objectives and major cultural differences. There is also a risk in such cases, that the stronger will dominate the weaker stakeholders (as seems to have occurred here).

The incentive structure, as discussed above, differs strongly between the two sectors. There are few indications that forestry, without external forces, will have any incentive to change the present institutional arrangement. However, external forces may be applied through market-based demands for stronger engagement in consultations, via FSC or PEFC certification regimes and/or State regulation through ratification of ILO 169. The FSC policies was also changed in 2002 to include the ILO conventions of land use for indigenous peoples, regardless if the specific country has ratified the convention or not (FSC, 2002). This have strong implications for reindeer husbandry and forestry since Sweden have not ratified ILO 169.

However the problem of the incentive structure can be solved. Overall, the results provide indications of the reasons for the consultations' shortcomings and understanding of each stakeholder's situation. The results also suggest changes to the consultation process that could improve the process. Forestry could use the results to initiate changes to the consultation process, driven (in the absence of current incentives to do so) by the threat of stronger governmental regulations. Reindeer herders could use the results as foundations of arguments to pressure forestry to make changes. In addition, the State could use the results to put pressure on the forestry sector to make voluntary changes or, otherwise, to impose stronger governmental regulations concerning forestry's considerations of reindeer husbandry in land use management.

A measure that is probably needed to create a viable, stable co-management regime between forestry and reindeer husbandry is clarification of the property rights. This is manifested in the uncertainty regarding the consideration forestry has to give to reindeer husbandry's needs in consultations.

More generally, the results are applicable to other multiple-use commons where stakeholders are heterogeneous, with different objectives for uses of natural resources. The design principles are important to consider in attempts to create a stable, viable co-management regime. However, the history of the stakeholders should also be considered. Stakeholder groups are often heterogeneous in terms of both culture and historical background, which will influence both their positions in the institutional arrangement and their use of the resource. Further, it is also important to ensure that the property rights situation and both the intention and purpose of the institutional arrangement are clearly defined. These are lessons learned from the analysis of the consultation process between forestry and reindeer husbandry.

6.5 Future Studies

Since few studies have considered economic aspects of multiple-use commons, especially empirically, and thus no data regarding a number of pertinent variables are available, several relevant dimensions are not addressed by these studies. Notably, the social planner's model needs to be expanded to include the cultural values of reindeer husbandry for the Sami community. It would also be desirable to pinpoint the exact level of influence that is socially optimal, in order to address more fully the exact meaning of influence in forest management in economic terms.

Further, there is a need to increase the understanding of the effects of consultations on each of the sectors. It would be desirable to value each of the components of consultation in monetary terms, which was not possible in these studies. For instance, there is a lack of economic valuation of the lichen resource since there is no market for lichens, in contrast to timber. Similarly, there is no market value for the cultural value of reindeer husbandry to the Sami community.

There are also issues that are beyond the scope of this thesis, which would be interesting to address in relation to the institutional arrangement. Currently, the non-industrial private forest owners are not obliged to participate in consultations. However, a governmental investigation (SOU 2001:101) has recommended that these owners should also be included in the consultation process, but it is not clear how they would be included, nor what effects their inclusion would have on land use management.

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