Co-management of the agricultural landscape in the UNESCO Biosphere Reserve "East Vättern Scarp Landscape" - A social network approach to analyzing the role of a bridging organization

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ABSTRACT

Securing the production of ecosystem services, essential for human well-being, is a challenging task that has both social and ecological dimension. Calls for more adaptive institutional management arrangements that not only account for the complex and cross-scale nature of ecosystems, but also the corresponding social dynamics of actors and institutions that manage those ecosystems have emerged. Social network analysis is a tool increasingly used to empirically map and analyze such social/institutional dynamics. In this study, social network analysis is used to investigate the social network of actors engaged in nature conservation in the UNESCO Biosphere Reserve "East Vättern Scarp Landscape", Sweden. The results reveal a large network of 117 individuals representing 21 organizations. The representatives in a collaborative project group perform both structural and functional bridging, why the group can be classified as a bridging organization. Members of the bridging organization are well-anchored among the people they represent. Hence, the objectives of peripheral members are represented in the core, even though the network is highly centralized. The institutional arrangements made visible in this study show many traits of adaptive co-management. Qualitative data on what type of information that flows through the network, and what effect that the network structure has on the production if ecosystem services is however lacking. This calls for further studies in the area.

INTRODUCTION

Background

Securing the production of ecosystem services, essential for human well-being (Millennium Ecosystem Assessment, 2005), is a challenging task that has both social and ecological dimensions (e.g. Folke et al. 2005). Some ecosystem services are common-pool resources that many people compete to use, risking a "tragedy of the commons"- scenario (Hardin 1968). In other cases, the production of some ecosystem services leads to the loss of others (Millennium Ecosystem Assessment, 2005). An example is agriculture where the production of food has lead to the deterioration of services such as pollination and water regulation (Ibid.). Furthermore, ecosystems do not abide by human-made borders. Rather, they are interlinked and dependent on landscape configurations (e.g. Daily 1997).

Considering this "social-ecological" interdependence (Berkes and Folke 1998), not only need the complex and cross-scale nature of ecosystems be understood and accounted for in management, but also the corresponding social dynamics of actors and institutions that manage those ecosystems (Folke et al. 2003, Berkes 2009).

Single agency, top-down management has shown to be poorly suited for this challenge (Ostrom 1990, Gunderson et al. 1995, Wilshusen et al. 2002). Instead, co-management of natural resources has become an increasingly common practice globally (Pretty 2003) and calls for more adaptive governance frameworks have emerged (e.g. Folke et al. 2005). Two of the twelve Malawi Principles in the Ecosystem Approach, adopted by the UN Convention on Biodiversity (CBD) as "the primary framework for action", point at the involvement of actors from all relevant sectors of society and the use of a diverse set of knowledge in management, such as scientific knowledge and traditional knowledge (UN Convention on Biological Diversity 1995). Moreover, ideas of developing multi-actor management arrangements where power and decision-making is shared between the state and local communities or user groups in a flexible, learning-by-doing process are increasingly being put forward in the ecosystem management literature, often gathered in the concepts of adaptive co-management, adaptive governance and co-management (Holling 2001, Carlsson and Berkes 2005, Folke et al. 2005, Folke 2006). Adaptive co-management is a fusion of the learning-by-doing-approach in adaptive management (Holling 1978) and the collaborative aspects of co-management (e.g. Berkes 2009), and is viewed here as the site-specific operationalization of adaptive governance

(Hahn et al. 2006). Adaptive co-management is pointed out as an instrumental tool when building resilience -the capacity to absorb or buffer disturbance without losing functionality – in social-ecological systems (Folke 2006). In adaptive co-management, as opposed to centralized, top-down management, the state is considered one possible actor, but not necessarily the most important one (Carlsson & Sandström 2008).

Managing complex social-ecological systems is an information intensive endeavor (Folke et al. 2002, Berkes 2009). One of the ideas with adaptive co-management is that no agency alone has enough understanding of how to deal with problems arising from social-ecological systems. By involving a diversity of actors at different administrative and geographical scales, with different types of knowledge, management problems can be more adequately addressed at appropriate scales (e.g. Folke et al. 2005, Berkes 2009, Cumming et al. 2012).

Not only knowledge of different kinds, acquired at different scales can be brought up to the discussion table, but also conflicting objectives about a certain area or resource (Berkes 2009). In an agricultural context, for example, in which this thesis is set, farmers might be concerned about the production of food, nature conservationists about the protection of a certain species or habitat, the local heritage society about conserving the cultural landscape, and the sports club about the recreational values of the agricultural landscape. If the different actors are brought together in co-management, there is a potential to mediate between conflicting views, which could enable a management that takes several ecosystem values or services into account (Berkes 2009).

A key aspect of adaptive co-management is the role of bridging organizations. They are platforms where actors can come together and serve as arenas for "trust-building, vertical and horizontal collaboration, learning, sense-making, identification of common interests, and conflict resolution" (Hahn et al. 2006 p. 586). And importantly, they facilitate networking among actors (Berkes 2009). Carlsson and Berkes (2005:1) describe co-management as a "...continuous problem-solving *process* rather than a fixed state, involving extensive deliberation, negotiation and joint learning within problem-solving networks". Tuvendal (2012) proposes that two aspects of bridging organizations must be evaluated; its structural position in the network and the function it fulfills in the network. Structural bridging implies that the organization's network position increases the connection between relevant subgroups. Functional bridging means that the organization uses its position for action that is purposeful for the network, such as building trust and resolving conflict (ibid).

The potential of using social networks to evaluate and improve natural resource management has gained increased attention in the literature (e.g. Crona and Bodin 2006, Bodin and Crona 2009, Ernstson et al. 2008, Newig et al. 2010, Sandström and Rova 2010, Bodin and Prell 2011, Stein et al. 2011) . It is argued that social networks form the core of co-management (Schneider et al. 2003) and that the structure of social networks can significantly determine the outcome of natural resource management (Bodin and Crona 2009). Studying social networks is thus a way to "uncover the social fabric" of adaptive co-management (Bodin and Prell 2011, quote inspired by book title).

A well-developed method for studying social networks is social network analysis (SNA), emerging from the social sciences (Wasserman and Faust 1994, Freeman 2004). In SNA, a social network is viewed as a set of nodes/actors that are connected/linked through different kinds of relations (Marin and Wellman 2010). The benefits of using SNA to study adaptive co-management are many. With SNA software tools such as UCINet (Borgatti et al. 2002) and NetDraw (Borgatti 2002), co-management can be visualized and powerful actors, missing links, strong relations, groups or individuals with a bridging role, etc., be identified (Bodin and Prell 2011). Hence, the structural characteristics of the co-management network can be empirically analyzed.

Aim

The aim of this thesis is to use a social network approach to visualize and analyze the social network of nature conservationists ("Naturvårdare"/"Nature care-takers") in a small-scale cultural landscape in the south of Sweden, and to particularly investigate whether or not a collaborative project group functions as a bridging organization. Earlier studies suggest that Biosphere Reserves have the potential to "illuminate the practical dimensions" of adaptive co-management and resilience theory (Schultz and Lundholm 2010 p. 660, Schultz et al.2011). During the process of writing this thesis, the area "East Vättern Scarp Landscape" moved from being a UNESCO Biosphere Reserve-candidate to be accepted as a formal reserve, making it a particularly interesting area to study co-management in (See Box 1).

A methodological approach is developed so as to enable similar comparative studies nationally and globally, both in Biosphere Reserves and elsewhere.

Research questions

1. Is there a co-management network in place?
   a. What actors are involved in nature conservation in the agricultural landscape in the area?
   b. How are they connected in terms of the importance they put on different contacts?
   c. Studying the network structure, what can be said about the network in terms of function?
2. Is the collaborative project group a bridging organization?
   a. Do project group representatives have structurally bridging positions?
   b. Do project group members perform bridging functions, i.e. improving collaboration climate and trust and conflict resolution among actors?
3. Is the network resilient to the removal of key-actors?

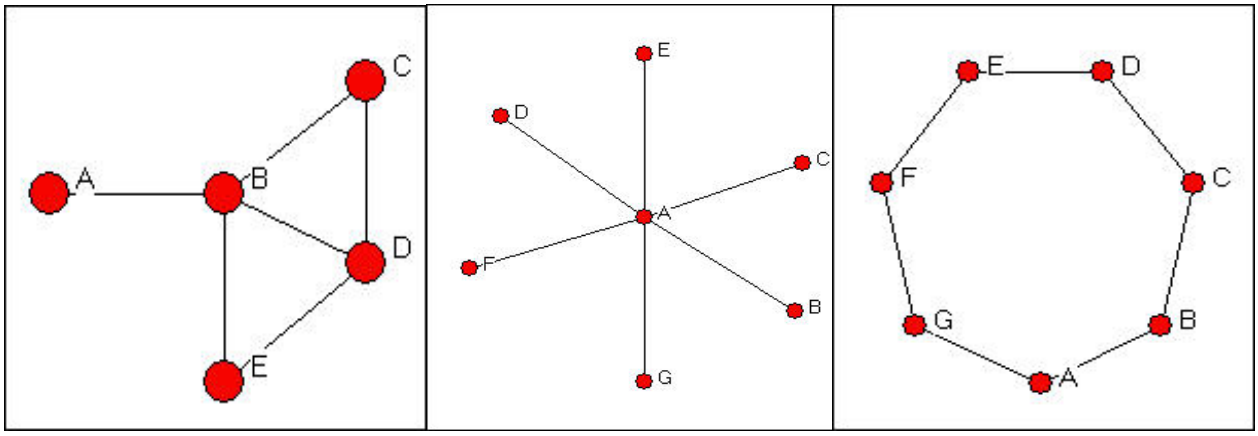
SOCIAL NETWORK CONCEPTS AND THEORY

In this thesis the theoretical framework used is social network theory. I view it as a prolongation of the adaptive co-management theories presented in the introduction and as a base to the SNA that I carry out in the methods section. Here, I start off by defining the social network concepts that I use in the thesis followed by a discussion on different network structures and their relation to network function.

Network concepts

Density and network centralization are two useful measurements when approaching the data on a whole network level.

Density is a measure of network cohesiveness and is calculated by dividing the number of realized ties with the number of possible ties in the network (Scott 2000). A density score of 1 means that 100% of the possible links are present, a score of 0,5 that half of the possible links are realized, etc. The larger the network, the less likely to get high density scores due to the rapid increase of possible ties (Ibid). Density does however not say anything about how the links in the network are distributed among the actors. Two networks can have the same density but different levels of interconnectedness (Prell 2011). As a complement to the density score, degree centralization can be used to investigate to what extent one actor holds all the links in the network (Wasserman and Faust 1994). Centralization is measured like a proportion where a centralization score of 1 indicates that one individual holds all of the network ties (Prell 2011). Figure 1 b and c illustrate a network with a centralization score of 1 and 0, respectively.



a b c

Fig. 1. Illustration of a, bridging function b, centralized "star" network c, decentralized "circle" network. In network a, node B has the highest betweenness centrality value since it lies on the shortest path between node A and nodes C, D and E. Network b illustrates a network with a centralization value of 1. Node A has 6 links while the others only have 1 connection each. The "circle" network c has a centralization value of 0. All nodes have the same number of ties and the network is completely decentralized. Images derived from Hanneman and Riddle (2005).

Degree centrality and betweenness centrality can be used to identify potentially powerful and influential key-actors in the network. While degree centrality measures the number of direct links an actor has to others (Scott 2000), betweenness centrality calculates the number of times an actor lies on the shortest path between any two other actors (Ibid). Actors that connect otherwise unconnected stakeholder groups function as bridges and the ties that link those otherwise unconnected sets of actors are referred to as bridging ties (Fig 1 a) (Pretty 2003).

Having many contacts and sitting in-between many actors implies having a favorable structural position in the network. An actor with a high betweenness centrality score can control the flow of resources (such as information and money) by either blocking or enabling the connection of others (Bodin and Prell 2011). Actors with high centrality scores also access more resources by being in contact with many people. These resources are likely to be diverse if the actor has bridging ties to different types of subsets of actors (Granovetter 1973).

Network structure and function

In co-management with many stakeholders involved, difficulties with coordination and accountability may arise (Hahn 2011, Cumming et al. 2012). Moreover, if existing power imbalances among the stakeholders are not recognized, social structural inequalities can be reflected and reinforced in the co-management system (Adger et al. 2006, Nelson et al. 2007). Authorities might give away some of their power as a way of legitimizing their domination or to "offload a regulatory function that is proven too expensive to manage" (Carlsson and Berkes 2005 p. 71). Consequently, while a diversity of actors are important, it is very much the structure of this diversity that determines influence in, and the outcome of, the management process (Ernstson et al., 2008) Different network structures can vary in efficiency depending on the purpose of the network.

While dense networks are said to be better at coordinating and organizing action and to enable communication and cooperation (Granovetter 1973, Carlsson and Sandström 2008), too dense networks lack inflow of and variation in knowledge (Bodin and Norberg 2005). This lack of "new thought" makes the network less capable of coping with external stress, i.e, less resilient, and less innovative (ibid). Innovation is crucial for networks dealing complex social-ecological systems (ibid). On the other hand, if a network is too fragmented, information cannot "diffuse fully", which results in a less effective, less coordinated network (Marin and Wellman 2010 p.11).

The same reasoning goes for heterogeneity and homogeneity in networks. Carlsson and Sandström (2008) argue that a heterogeneous network with a diverse set of actors with different attributes, such as organizational affiliation or geographical localization is more likely to possess the proper resources, such as ecological knowledge, at appropriate scales. If the network is too heterogeneous, however, it can be more difficult to make joint decisions, agree on a common agenda for the ecosystem being managed and to make priorities (Carlsson and Sandström 2008). And like too dense networks, homogeneous structures might be less prepared for adaptation in times of change, surprises and disturbances (ibid).

Centralized networks can be beneficial during the initial stages of ecosystem management (Crona and Bodin 2006, Hahn et al. 2006), since the core can mobilize and coordinate resources and spread news about innovation throughout the network (Prell 2011). By being dense and influential, the core has the power to frame the objectives of the network and to take early and effective action (Ernstson et al. 2008). For long-term management of ecosystems, less centralized networks may be desired as

such networks are better at solving complex tasks (Leavitt 1951 and Shaw 1981 through Crona and Bodin 2006). Managing complex, social-ecological systems can be definitely be viewed as a complex task.

In a centralized, core-periphery network, positional advantages are distributed unequally (Hanneman and Riddle 2005, Ernstson et al. 2008). This raises the issue of variation in individual influence in the network. In their study of the Ecopark Movement, protecting the Stockholm National Urban Park from exploitation, Ernstson et al. (2008) showed that peripheral organizations had a hard time getting their concerns and interests lifted by the core and semi-core. This could be traced back to the early process of framing the identity of the movement and the park, an identity mostly associated with conservation biology and cultural heritage. Due to their structural advantage, core and semi-core actors dominated this process, while peripheral user groups, such as a boating club and allotment gardens had less influence. Consequently, their user-intensive activities did not resonate well with the identity of the park. On the other hand, a core-periphery structure described in Hahn et al. (2006) managed to achieve a joint decision-making process of wetland-management between different user groups, much thanks to the central bridging organization and a broad vision.

This thesis builds on previous work done about social networks and natural resource management, further highlighting the benefits of joining those field. I specifically focus on investigating if a collaborative project group shows characteristics of a bridging organization. This is the first study made that uses Tuvendal's (2012) two-folded definition of bridging organizations (structural bridging and functional bridging) to assess a collaborative initiative.

Moreover, the study adds to the literature on co-management and stakeholder participation in UNESCO Biosphere Reserves (see for example Schultz and Lundholm 2010 and Schultz et al 2011).

Box 1. UNESCO Biosphere Reserves

Biosphere Reserves are areas selected by UNESCO's Man and Biosphere program with the purpose of "maintaining and developing ecological and cultural diversity and securing ecosystem services for human well-being" (UNESCO 2008 p. 8). As for November 2012, 610 reserves had been established in 117 countries (UNESCO Web page 2012). During the 30 years of the program, Biosphere Reserve- objectives have moved from having a focus on biodiversity conservation to aiming at becoming sites for sustainable social-ecological development.

All Biosphere Reserves are supposed to foster local social and economic development as well as supporting research, monitoring and education (UNESCO 2008). Another criterion is the involvement of a diverse set of actors from all sectors of society (e.g., NGO's, land-owners, local communities, researchers) in the local Biosphere Reserve organization who cooperate in the designation of the site and the performance of its functions (UNESCO 2008).

Biosphere Reserves are dived into three zones, each with a different function (See Fig. 2). The core zone consists of areas formally protected for biodiversity conservation. Surrounding the core is a buffer zone where activities and resource use in line with the protection of the core are encouraged, such as eco-tourism and organic farming (UNESCO 1996). The transition zone is the outer area of the reserve where locally anchored, sustainable development is prioritized. Cities and human dominated land-use, such as large scale agriculture, can be included in this zone (UNESCO 1996).

Considering the design, functions and criteria of Biosphere Reserves, covering both strict conservation and social-ecological development, these areas could serve as potentially interesting model- or learning-sites for social-ecological sustainability (UNESCO 2008, Schultz and Lundholm 2010). The processes encouraged in Biosphere Reserves also show similarities to features of adaptive co-management, such as monitoring, adaptive management and stakeholder participation. Therefore, they are also sites in which effectiveness of adaptive co-management can be tested and evaluated (Schultz et al. 2011).

STUDY SITE

The East Vättern Scarp Landscape (Östra Vätterbranterna) is an area of 46 000 ha land that stretches along the eastern coast of lake Vättern in southern Sweden. Most of the land is privately owned with more than 670 farming units and some 1000 farm-owners (Jonsson 2004). Many farmers manage both agricultural land and forests and are thus both farmers and foresters. The area has a high documented biodiversity, mostly related to broad-leaved deciduous trees, and a mosaic cultural landscape (Jonegård et al. 2010).

After years of conflict between a local biodiversity conservation group Gränna Forest Group (Gränna Skogsgrupp), working for the protection of certain biologically valuable species and habitats, and landowners' organizations, fearing that the identification of valuable areas on the members' land would increase the "risk" of nature reserves and land-use restrictions, the small, collaborative project group "Project East Vättern Scarp Landscape" (Projekt Östra Vätterbranterna) was initiated in 1998 by the County Administrative Board. It brought together representatives from different actor groups such as farmers, forest owners, Gränna Forest Group and the municipality in an attempt to promote collaborative management of the area. Moreover, coordination efforts between authorities needed improvement. After a slow start with many disputes, the project group became an arena for knowledge exchange and conflict resolution, where different actors now collaborate in the management of ecosystems in ÖVB (Jonsson 2004, Jonegård et al. 2010). The main objective of the project was "to work from the perspective of incorporating environmental protection as well as production in a holistic approach" (Jonegård et al. 2010 p. 9).

The project group handed in a Biosphere Reserve-application to the UNESCO Man and Biosphere committee in 2010 and in July 2012, UNESCO formally pronounced the East Vättern Scarp Landscape a Biosphere Reserve.

The organizations that are represented in the project group are Jönköping Municpality, Gränna Forest Group, The Federation of Swedish Farmers (LRF), The Association of Forest Owners Southern Sweden (Södra), The Swedish Forest Agency, The County Administrative Board and WWF. In total, 18 people are involved. The organization of the project group is being restructured due to its transformation into a Biosphere Reserve office. At the time for data collection (mainly fall 2011) it was organized in three sections: A steering group, a working group and an executive committee.

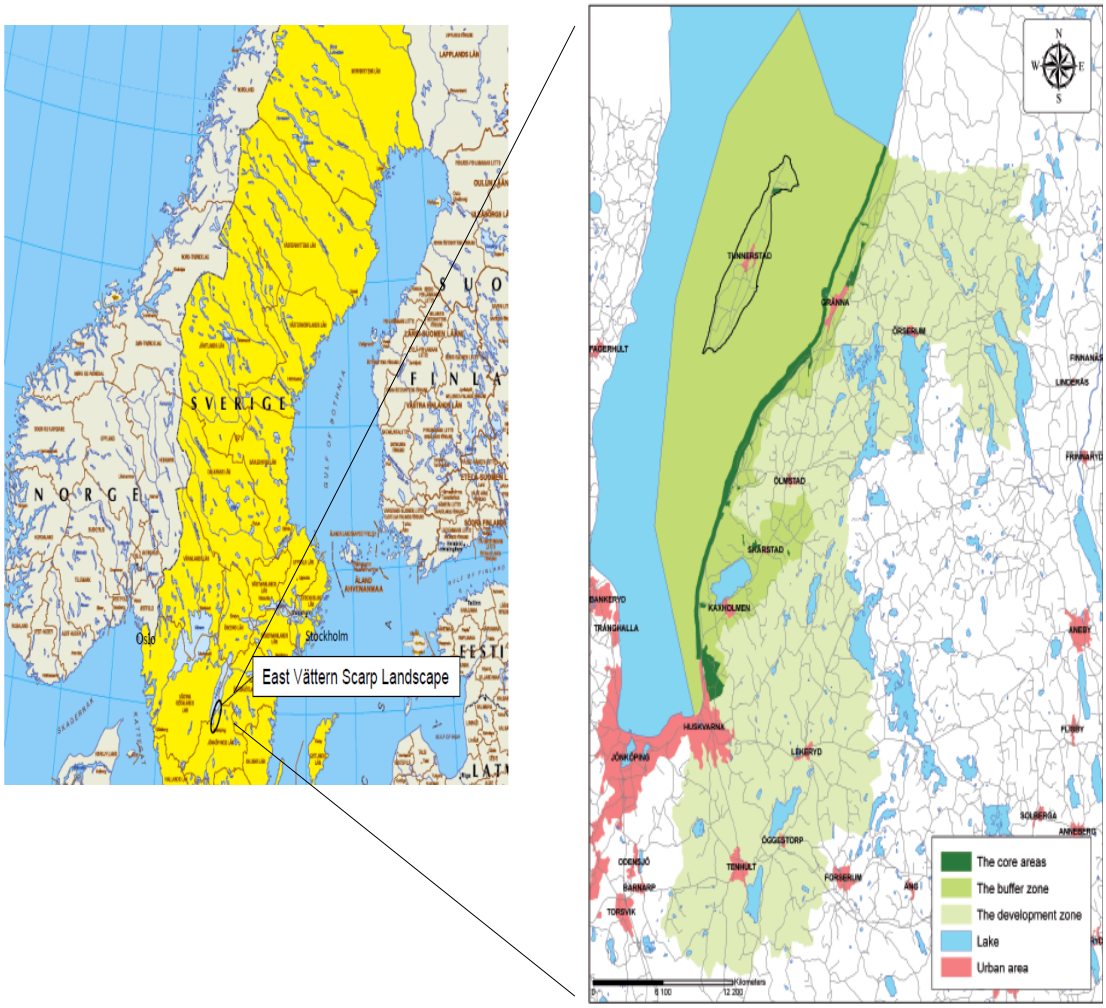


Figure 2. Zonation map of the East Vättern Scarp Landscape Biosphere Reserve in the South of Sweden. Each Biosphere Reserve consists of a core zone with many areas formally protected for biodiversity conservation (dark green);a buffer zone where activities and resource use in line with the protection of the core are encouraged (medium green), and a transition zone where locally anchored, sustainable development is prioritized (light green). For more information, see Box 1. Maps derived från URL:http://www.ostravatterbranterna.se/wpcontent/uploads/2011/12/Unesco-application-for-East-Vättern-Scarp-Landscape.pdf

METHODS

In the first paragraph, a summary of the methods used are presented. Then follows a detailed description of each methodological step taken.

To answer research question 1 a, names of nature conservationists were gathered via short telephone interviews, using a snowball sampling/chain referral approach (see below) that generated a recall list. A recall list is a collection of relations/names generated by the respondents (Webb and Bodin 2008). To gather relational data for research question 1 b, i.e. to find out who is in contact with whom, the people identified during the sampling received an online survey containing the list of names where they could mark their connection to others based on the importance of the relation.

The survey also contained a few closed questions on collaboration, targeting research question 2 b (Appendix A). The relational data was then imported to a SNA software program where the network could be visualized and where various network measurements were carried out. This way, the structure of the network could be analyzed, providing input to research questions 1 c and 2 a. The resilience test for question 3 could also be made.

Literature search

Literature to the study was mainly identified in a snowball-manner by reading well-cited articles and looking up references in them. Some articles were found through web search on Google Scholar and Web of Science using key-words such as “Social Network Analysis + Natural Resource Management”, “Social Network Analysis + Bridging organizations”, “Adaptive co-management + Biosphere Reserves”. In addition to scientific articles, I consulted books on social network analysis and interview techniques (Scott 2000, Kvale and Brinkmann 2009, Prell 2011, Bodin and Prell 2011)

Data collection

Criteria for nodes and links/actors and relations

An actor/node was defined to be a person, living or working within the borders of the East Vättern Scarp Landscape (Fig 2.), who is actively engaged in direct or indirect nature conservation

(Naturvård) in the agricultural landscape in the defined area. Direct nature conservation means actors that modify the landscape directly, i.e., a farmer using practices that enhance biodiversity or ecosystem services such as pollination, biological control and cultural values. Indirect influence in nature conservation is carried out by actors who do not actively modify the landscape but who influence those who do, for example an environmentalist lobbying for habitat protection or a civil servant advising farmers on nature conservation. Engagement in other green areas such as city parks, villa and allotment gardens and in the lake Vättern was excluded.

This broad definition of who is a nature conservationist recognizes that actors being engaged in nature conservation can stretch outside of formal administrative structures (e.g. Berkes 2002, Barthel et al. 2005, Sandström and Rova 2010) and that real-life co-management networks might not correspond to formal co-management structures.

A link in the network was defined as exchange in knowledge/information and/or collaboration between two actors in issues regarding nature conservation connected to the agricultural landscape in the given area.

Snowball-sampling

Names for the network of nature conservationists were gathered through short semi-structured telephone-interviews (Kvale and Brinkmann 2009) carried out in fall 2011. In total, some 150 interviewees were asked to spontaneously name people they considered to have an engagement in nature conservation (Naturvård) in the agricultural landscape within Jönköping municipality, east of lake Vättern. It could be a person they knew or knew of. Note that I did not ask for people engaged in nature conservation (Naturvård) in the *East Vättern Scarp Landscape*. That name is closely connected to the work of the project group and could bias the answers towards its members.

The criteria for relevant actors (see above) were explained to the interviewee. Other than that, the definition of who is a nature conservationist was left to the interviewees themselves, recognizing that I, as a biologist, might have a different perception of what nature and nature conservation is, compared to a farmer, for instance (Ahnström 2009 and references therein). I did however tell them that a nature conservationist could be a farmer, a state official, members of clubs and associations, engaged individuals etc, just to get their mind set on thinking broadly. Using academic terms and asking for ecosystem- or ecosystem services managers might have left me with a network consisting

solely of ecologists at the County Administrative Board.

The names were gathered using the “snowball”- or “chain-referral technique”. It is a method to identify important stakeholders, working through “referrals made among people who share or know of others who possess some characteristics that are of research interest” ((Biernacki and Waldorf 1981 p. 141). Using this technique, a number of selected respondents are asked to name people they know of who are of interest for the study; in this case nature conservationists. The named people are also contacted and asked for new names. This procedure is then repeated until few or no new names come up or until the desired population is targeted (Erickson and Nosanschuck 1983). The method allows for the network-members themselves to help setting the network-boundaries. Considering the bottom-up approach of this study and the desire to capture both formal and informal network-members, the snowball-sampling technique is a very suitable method. (Sandström (2011) argue in the same way in her study on fisheries networks. Identifying knowledgeable actors and asking them to list the other relevant actors was thus not appropriate for this study. Moreover, research has shown that snowball-sampling reflects the actual population better than using informed experts, for example (Doreian and Woodard 1992 in Webb and Bodin 2008). Further, it would have been far too time consuming to generate relational data through observation, especially since I did not know what network size to expect.

A challenge when using the snowball-technique is to decide where to start "rolling the snowball", i.e. who to contact first. There is a risk of missing out on sub-sets of actors who are connected to each other, but not to the starting point. As one of my research questions investigates if the collaborative project group functions as a bridging organization, initiating the sampling within that group could lead to biased results. Also, this would have made comparative studies difficult since the project group is unique for the area.

So, to avoid this kind of bias, the snowball-sampling was initiated at nine different starting-points, within eight different organizations (Table 1). Three main criteria were used when selecting the organizations. First, they had to be found in any Swedish municipality or county to facilitate national and international comparative studies. Second, they ought to have a stake in nature conservation-related issues in the agricultural landscape, and third, they were chosen to capture a diversity of opinions regarding nature conservation and to span over a large part of society; from state authorities to civil society, from “formal” to “informal” nature conservationists.

When comparing the snowball sampling with organizations represented in the project group, we find that six out of the eight organizations initially contacted are also represented in the project group but that there is no overlap at the individual level. The Swedish Rural and Agricultural Societies (Hushållningssällskapet) and the Local Heritage Movement (Hembygdsförbundet) are not represented in the project group. In the project group SSNC is represented by Gränna Forest Group, an independent part of the Jönköping-branch. This kind of independent group within a local SSNC-branch is relatively rare nationally. Therefore a local SSNC-branch in the area was chosen as starting-point instead of Gränna Forest Group, again to facilitate comparative studies and to avoid bias towards project group actors.

Table 1. List of initial contacts during the snowball-sampling. The organizations were selected to represent different parts of society. Organizations marked with an asterix (* are represented in the project group.

Organization	Contact person
The County Administrative Board* *Länsstyrelsen*	The head of the Nature department The head of the Department for rural development
Swedish Forest Agency* *Skogsstyrelsen*	The head of Jönköping District
Södra* Association of Forest Owners Southern Sweden	Forest conservation leader
LRF* Federation of Swedish Farmers	The chair of Jönköping municipality group
Jönköping Municipality*	The chair of the Environmental office
The Swedish Rural and Agricultural Societies *Hushållningssällskapet*	Employee at the Jönköping-branch
The Swedish Local Heritage Movement *Hembygdsförbundet*	Local heritage curator/consultant in Jönköping County
The Swedish Society for Nature Conservation (SSNC)* *Naturskyddsföreningen*	The chair of the Huskvarna-Gränna-branch

In total, 147 people were contacted via telephone, generating a “most-cited-list” of names of nature conservationists.

A wave-system was created to keep track of the names gathered during the telephone-interviews (Table 2). The initial nine contacts made up the first wave. The people they recommended made up the second wave, and so on. Of the 59 people in the second wave, 6 were not available.

According to Biernacki and Waldorf (1981), the researcher must actively and deliberately develop and control the snowball sampling’s initiation, progress and termination. Apart from aiming for representativeness, the researcher should seek to avoid data repetition. This was achieved by limiting the number of phone-calls within groups that many people belonged to, for example the County Administrative Board, as they tended to recommend each other. Instead, in the third and fourth wave I targeted “isolated” individuals, such as farmers and members of newly mentioned organizations. Out of the 12 people that I contacted in wave 4, 4 worked at the CAB (two of which worked at departments not mentioned earlier), one was a farmer, one was a land owner, 2 were forest managers, one worked at the Swedish Board of Agriculture, one was a member of a local heritage society, one worked at LRF and one was a forest consultant at the Swedish Forestry Board.

Table 2. The snowball sampling procedure revealing the number of *new* names generated in each wave. Out of the 9 people in the first wave, all were telephoned generating a second wave of 59 new names. Out of these, 53 were contacted, resulting in a third wave of 128 new names, and so on. Remember that many more referrals not demonstrated here were made in each wave, but that these referred to actors already mentioned in an earlier wave.

Wave:	1	2	3	4	5	
Number of new names/wave:	9* →	59 →	128 →	112 →	17 →	STOP
Telephoned:	9*	53	73	12	-	

* Starting points for snowball sampling, see Table 1.

Out of the 320 names that were collected, half were mentioned twice or more (In Table 2 it may seem like a total of 325 names were gathered. Five of the nine starting points did not receive any

recommendations and were thus not counted.) The top-name had 98 hits, being recommended by remarkable two thirds of the interviewees.

To end the sampling, the level of saturation of names was calculated. The percentage of actors repeatedly mentioned served as an indicator for saturation and was calculated for each of the 93 last respondents. The saturation rate averaged 81% , with about half of the respondents delivering no new names. More than four out of five names had thus already been mentioned by somebody else within the same or an earlier wave. The 12 persons that I interviewed in the fourth wave suggested 104 names of which only 17 were new names. Since they referred back to earlier waves rather than revealing a new hub, I concluded that the desired population had been targeted.

The survey

An online survey created in http://surveymonkey.com including the recall-list of 157 of the 159 people mentioned twice or more during the snowball-sampling was sent to the 157 people on the list. In other words, if you were on the list, you received the list. Two people were excluded due to illness and an expressed will over the phone not to be on the list. 19 people received a paper-version of the survey since they were unfamiliar to using computers and the internet or due to the fact that I had not been in contact with them and did not know their e-mail address.

The list was limited to people recommended twice or more partly to avoid tiredness from respondents when filling out the survey (Erickson and Nosanschuck, 1983, Marin and Wellman, 2010). Further, by including people with two recommendations or more, I added robustness to the network and sifted out individuals who were incorrectly mentioned during the snowball-sampling phase. People with only one recommendation were considered to be very peripheral to the network and would likely have a very low impact on the overall network structure.

On the recall-list, the stakeholders assigned their connection to the other 156 named stakeholders based on the question “Estimate the importance of the collaboration and/or information exchange you have with the following people regarding nature conservation in agriculture and forestry”, on a scale from 1 to 5 where 1 equaled “Little importance” and 5 “Great importance”. “No collaboration/information exchange” was also an option. For a more thorough description of the recall-list, see Appendix B.

Only reciprocal links were included to add robustness to the data and because an exchange or collaboration implies mutual recognition, not one-directional. Moreover, reciprocated ties reported by the targeted individuals themselves better reflect observed interaction than non-reciprocal ties (Hammer 1985 in Marsden 1990).

In addition to the recall-list, the survey included six closed questions regarding collaboration, such as changes in the collaboration-climate between 1998 and 2011, trust, conflict resolution, and knowledge about and opinions on the then ongoing biosphere reserve-process (Appendix A). Survey questions1 and 2 aimed at investigating perceived changes in the collaboration climate among the organizations represented in the collaborative project group. WWF was excluded as they represent national/international interests and connect the Project East Vättern Scarp Landscape to higher levels of governance rather than networking locally.

Handling and analyzing the data

The response rate for the survey was 74 % (117 people). No specific group of people was more reluctant to answer. Among the people I had telephoned before sending the survey, the rate of response was 82%. For non-interviewed people it was 51%. This indicates that the willingness to respond was higher among people who had been in personal contact with me and who had received a more thorough explanation about the study.

The data generated from the recall-list was coded in an adjacency matrix with 117 rows and 117 columns. Each respondent filled up a row in the matrix, where perceived collaboration/information exchange was numbered 1-5, depending on the importance of the relation, and no collaboration/information exchange was coded 0. Attribute data was added to another matrix with 117 rows and one column per attribute. Organizational affiliation is an example of one of the attributes used.

This way the data could be imported to the network software tools UCINet and Netdraw (Borgatti et al, 2002, Borgatti 2002) where the network could be visualized and structural network properties measured. A number of measurements such as density, degree and betweenness centrality were carried out to test network cohesion and heterogeneity, identify powerful actors etc. For a detailed description of the steps taken in UCINet, see Appendix C.

RESULTS

In this section, I start off by presenting the data for research question 1 a. This is followed by a demonstration of the network properties (research question 1 b and c) and the results regarding the structural role of the project group (question 2 a). Finally, the network resilience test (question 3) and the survey-results are presented (2 b).

Network members

The respondents represent no less that 21 organizations covering different parts of society, such as state agencies, environmental NGO's, landowner associations, museums and local heritage societies. An exhaustive list of all organizations and the distribution of people between these are presented in Table 3.

The results show that the two biggest groups networking (collaborating/exchanging information) on nature conservation are farmers and employees at the County Administrative Board (CAB). The farmers active in this network are mainly concentrated to localities around Gränna (N=13) and Huskvarna (N=11). One farmer lives on Visingsö and one in Lekeryd. Hence, most farmers live in the core-area or in the buffer zone (See Figure 2) of the now Biosphere Reserve. At the CAB, three departments are represented: the nature department (N=19), the department for rural development (N=5) and the department of environmental and spatial planning (N=2).

The Swedish Rural and Agricultural Society is missing even though it was one of the eight organizations where the snowball-sampling was initiated. One of the farmers in the network works at the Swedish Rural and Agricultural Society but was described as a farmer by the people who recommended him/her. The farmer also wished to be part of the network as a farmer and not as an employee at the Swedish Rural and Agricultural Society. The absence of this organization is quite surprising as it plays an important part in the agricultural sector in Sweden. One possible explanation could be that they might be more important in areas with large-scale agricultural production, while East Vättern Scarp Landscape is characterized by a small-scale mosaic agricultural landscape.

Gränna Forest Group and Jönköping Bird Club have 8 and 5 members respectively in the network, even though not being snowballing starting points. The network has a clear focus on nature

conservation, and GSG 1 is one of the driving forces behind this. It is thus not surprising that organizations with a nature conservation agenda have high levels of representativeness in the network.

The County Administrative Board has as many as 26 representatives in the network (Table 3). During the snowball-sampling I could have further limited my phone calls within that public authority as they recommended each other back and forth. Hence it was much easier for CAB-employees to be included on the recall-list and, consequently, to end up in the network, compared to farmers, for example.

Table 3. A list of the 21 organizations represented in the network and the number of people within each organization. Farmers are categorized as an organization although not being an organization per se. Among the people in the "others"-group are for example forest managers, nature conservation consultants, entrepreneurs, a photographer and a painter. The organizations marked with an asterix (*) are represented in the project group.

Color	Organization	Abbreviation	Number of people
	County Administrative Board*	CAB	26
	Farmer	FAR	26
	Jönköping Municipality*	MUN	10
	Gränna Forest Group*	GSG	8
	Södra*	SOD	6
	Jönköping Bird Club		5
	Swedish Forest Agency*	SFA	4
	LRF*	LRF	3
	The Swedish Outdoor Association		1
	Botanical Society		1
	Swedish Board of Agriculture		1
	SSNC – Local branches	SSNC	
	Friends of Ingaryd		1
	Huskvarna - Gränna		1
	Jönköping		1
	Local Heritage Societies		
	Skärstad		1
	Ölmstad		1
	Visingsö		1
	Museums		
	Grenna Museum		1
	Jönköping County Museum		2
	UNESCO		1
	WWF*		1
White nodes	Others		15
	Total		117

Network cohesion

The complete network with all nodes (N=117) and reciprocal links of all strengths (1-5) is illustrated in Figure 3. The network is held together as one unit with no isolates.

One way to test to what extent the network is cohesive is to calculate its density value. This network has a density of 0,227, meaning that 22,7% of all possible links are present. This is a high number considering that this is a relatively large network and that the density value is dependent on network size. Larger networks tend to have a lower density score due to the increasing number of possible relations.

The average geodesic distance between two nodes in the network is only 1,8 (std 0,5). This means that, on average, a person in the network is only 1,8 link away from any other member of the network. Being a large network of 117 nodes, this is a very low number. The maximum distance is three, indicating a very cohesive network.

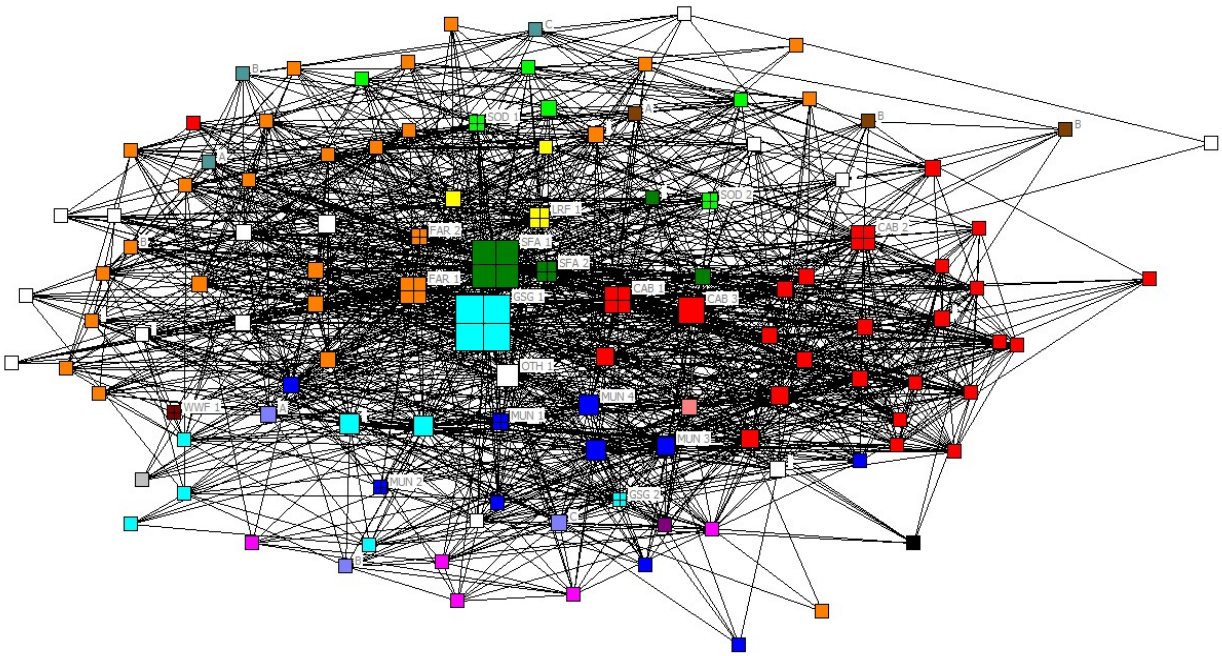


Figure 3. Illustration of the network containing all nodes (N=117) and reciprocal links of all strengths (2-10). Color indicates organizational affiliation (see Table 3.). Node size is based on betweenness centrality. Nodes with a cross belong to the project group.

The network has a degree centralization value of 62,35%. This high centralization value indicates that the network has a core-periphery structure where some actors are very peripheral and some are very central (Prell 2011). A core-periphery test reveals that 35 people belong to the core where a diverse set of actors are represented, although 2/3 of the core actors are state officials or employed at the municipality (Fig. 4). Perhaps not surprising as civil servants working with nature conservation issues are expected to network with their colleagues and other stakeholders. For the same, but opposite, reason most farmers are located in the periphery. The core has a density value of 0,716, the periphery a value of 0,106 and the proportion of realized links between the core and the periphery is 0,264.

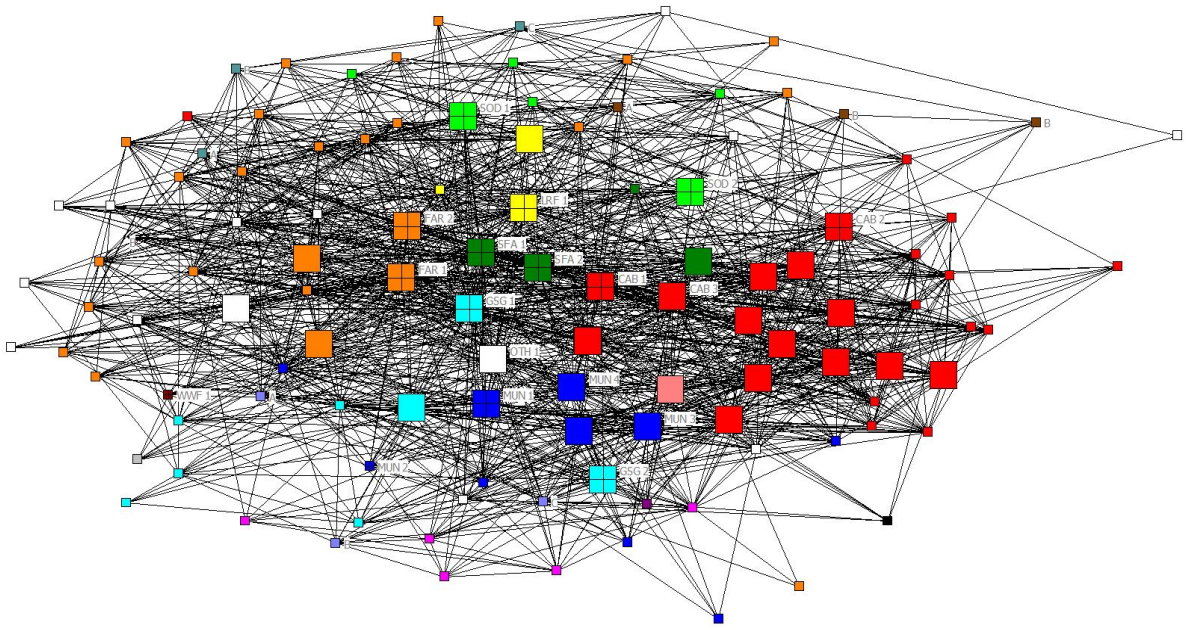


Figure 4. A core-periphery test reveals a core of 35 people (large nodes). Although 14 out of these work at the CAB, the core is diverse with several organizations represented.

The project group: A bridging organization?

Project group betweenness and degree values

Studying the network in figure 3, the largest and most central nodes are project group members. 12 out of the 14 project group members are central and belong to the core. The project group's mean betweenness value is more than four times as big as the whole network average, indicating a bigger role in tying the network together. Also, they have almost twice as many contacts on average (see Appendix D). The high standard deviation-value for betweenness centrality within the project group can be traced to the extraordinary high scores of the two “top-actors” GSG 1 and SFA 1.

The top-10 list of individual betweenness and degree values is demonstrated in Table 4. Not surprisingly, most of the top-10 people belong to the project group. CAB 3 is the head of the nature department, which has 19 members in the network, and OTH 1 has previously represented the municipality in the project group. This explains their high values.

Table 4. The list of top-10 individuals based on Freeman's betweennness and degree centrality values mostly includes project group representatives. Asterix *) indicates project group affiliation.

Freeman's Betweenness		Freeman's Centrality	
ID		ID	
GSG 1*	856,91	GSG 1*	98
SFA 1*	685,45	SFA 1*	91
FAR 1*	263,6	CAB 1*	71
CAB 3	261,67	FAR 1*	69
CAB 1*	260,09	CAB 3	63
CAB 2*	212,92	SFA 2*	56
OTH 1	183,91	OTH 1	56
MUN 4	135,68	LRF 1*	50
SFA 2*	134,5	MUN 4	49
LRF 1*	123,13	MUN 3	49

Worth noting is the Gränna Forest Group-representative who collaborates and/or exchanges information with 98 out of 117 people in the network. A real spider in the web!

Project group density

The project group has as expected a very high density of 0,813, and the proportion of realized ties between the project group and the rest of the network is 0,368. The latter density-value is higher than the network average (0,23) and the proportion of realized ties between the core and the periphery (0,264). These numbers confirm what is already visible in the network graph, that not only collaboration occurs within the project group, but there is also a substantial amount of collaboration and information exchange with the rest of the network.

To test the level of interaction between organizations, I calculated the proportion of realized ties between each of the organizations represented in the project group. The big differences in organization size made it problematic to compare the density values. I thus decided not to go into a deep analysis of those results. It can however be concluded that out of the 1974 links present when only including SOD/LRF/FAR (grouped as one organization), CAB, SFA, GSG and MUN, 996 (more than half) were bridging (links between groups) and 978 were boding (links within groups) For a table of the different density values, see Appendix E.

Project group representativeness

Now we know that project group members on average have more contacts and sit "in-between" more people than non-project members. The next question is how many contacts project members have among the people they are supposed to represent. For this test, degree centrality was calculated for organization by organization represented in the project group. Being a representative of farmers, the LRF project group member (LRF 1) was grouped with farmers. The two Södra BR-members (SOD 1 and SOD 2) were also grouped with farmers since they represent forest owners in the area. All organizations dealing with non-profit nature conservation were treated as one group: Gränna Forest Group, Jönköping Bird Club, the three local SSNC-branches, the Swedish Outdoor Association and the Botanical Society. They are represented by GSG 1 and GSG 2 in the network. No calculations were made for WWF as they represent national/international interests and connect the project group to higher levels of governance rather than networking locally.

Table 5. The BR-members have many contacts with the people they represent which refutes the hypothesis that the project group networks only internally

Project group representative	Number of contacts (Freeman's degree)	Max. possible no. of contacts	Average no. of contacts within group (std. dev.)	Percentage of peers covered together
CAB 1	23	25	18,538 (5,249)	96,00%
CAB 2	22			
GSG 1	16	17	7,667 (3,606)	94,10%
GSG 2	10			
LRF 1 (SOD)	19	26	-	73,00%
FAR 1 (LRF)	21	25	7,077 (4,296)	88,00%
FAR 2 (LRF)	11			
SOD 1	9	26	-	42,30%
SOD 2	4			
MUN 1	7	9	6,6 (1,8)	88,80%
MUN 2	7			
SFA 1	3	3	3 (0)	100,00%
SFA 2	3			

All representatives except two had more contacts than the average person within their group (Table 5). Södra (SOD 1 and SOD 2) network with 42,30% of their peers. The percentage for the other stakeholder groups were 73-100% which are very high values of representativeness. Hence the hypothesis that the project group networks only internally can be refuted.

LRF 1 represents LRF in the working group and Södra in the executive committee of the project group. FAR 1 and FAR 2 are elected representatives of LRF. The degree of representativeness is thus even bigger for Södra and LRF than what is demonstrated in table 5. Moreover, 4 of the 18 project group representatives did not part-take in this study (did not fill in recall-list and survey). They represent 1, The Swedish Society for Nature Conservation (nationally), 2, the Municipality, 3,

Södra and 4, LRF. The impact of those project group members on the level of representation remains unknown in this study.

Network resilience

Network resilience can be assessed in various ways that focus in different scenarios. Newman (2003) reviewed a number of metric-based approaches to the assessment of resilience in different networks. One can target links and assess tie vulnerability or focus on nodes and make tests based on degree centrality or betweenness centrality (ibid). In this case I chose to investigate a worst-case scenario where key individuals were to disappear from the network, in order to test the theory that highly centralized networks are sensitive to the removal of key-nodes (e.g. Newig et al. 2010).

Nodes were removed one-by-one according to their degree centrality value. Actors with the highest values were removed first. Network cohesion based on changes in maximum and average geodesic distances was used as an indicator of resilience (adopted from Albert et al. 2000, through Newman 2003).

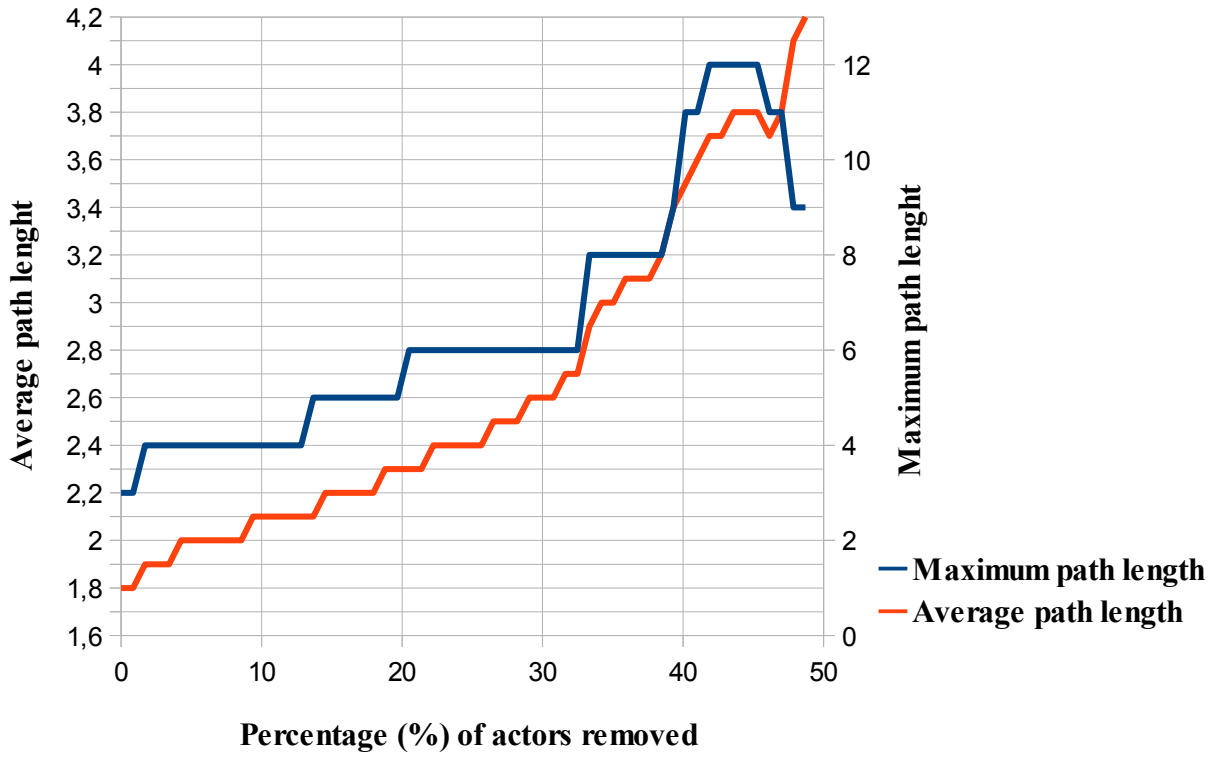


Fig 5. The network shows a remarkable resilience to the removal of key-actors. Only small changes in average and maximum geodesic distances occur. A doubling of maximum and average path length occurs as late as at 21% and 41% node removal respectively. The first isolate does not appear

until 33% of top-node removal. At 48% removal, a cluster of 4 employees at the municipality becomes isolated. Decreases in average and maximum path length, like at ~ 45% node removal, happens when a node at the end of a chain of nodes is removed.

The results point towards a network that is very resilient to the removal of key actors in terms of network cohesiveness (Fig. 5 and 6). The removal of key actors has however a dramatic effect on network centralization. After removing the top-2 actors (GSG 1 and SFA 1), the centralization value immediately drop from 62,35% to 40,63%. Removing an additional 8 top-degree actors results in a network centralization of only 21,82%.

As many as 48,3% of the links in the network have a value of 7-10 (sum of link strengths between two nodes). Removal of weak ties (sum of link strengths between two nodes = 2-6) results in a network with only two isolates. Keeping only links of strengths 8-10 (sum of links strengths between two nodes) amounts in 6 isolates only. This means that a large part of the network is built on strong or very strong, reciprocal connections.

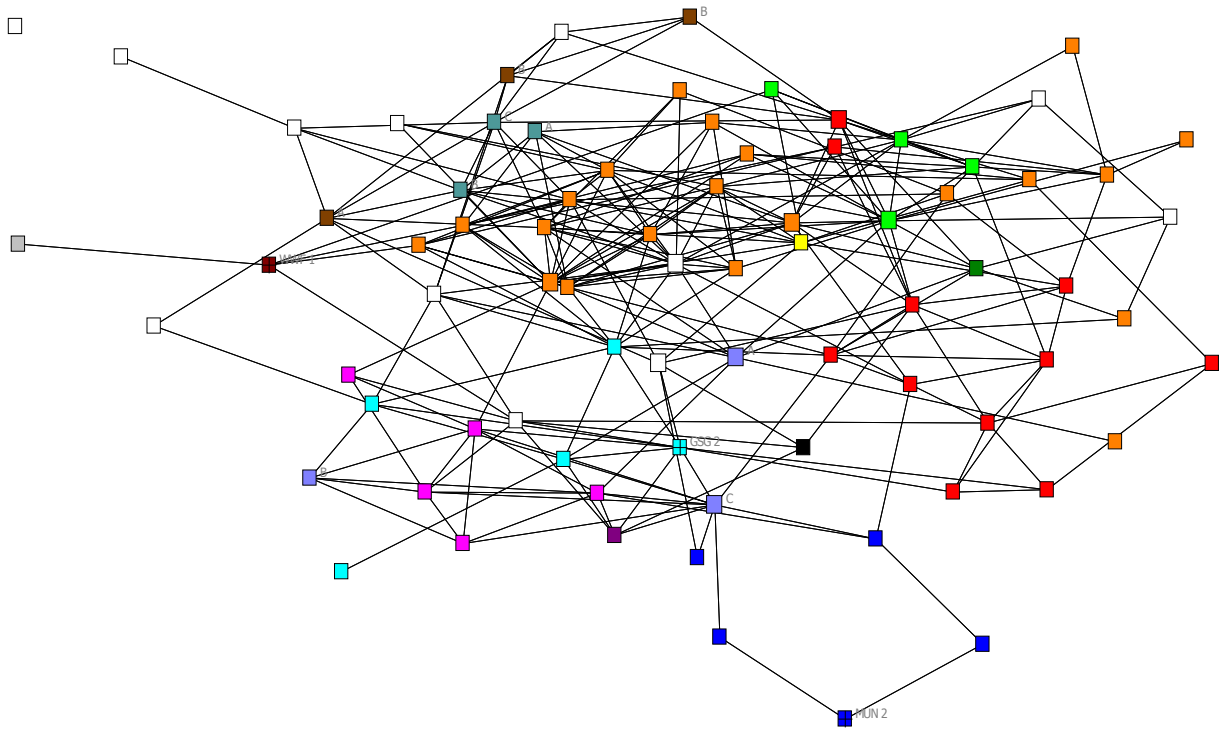


Fig. 6. Illustration of network after removal of 33% of the top-actors in terms of degree centrality. Only one isolate has appeared (white node, top left corner). One node equals one individual. Color indicates organizational affiliation. The cluster of four municipal employees at the bottom of the network is cut off after 48% top-node removal.

Survey results

Here, the survey responses to they questions of changes in the collaborative atmosphere are presented (Appendix A). The people in the network experience that Project East Vättern Scarp Landscape has improved both trust and conflict resolution. The response rate was 95,7%. No one answered that trust and conflict resolution had worsened or considerably worsened (Fig. 7). A remarkable 74,1% though that changes in the collaborative atmosphere in terms of trust had improved (37,5%) or improved considerably (36,6%). For conflict resolution the result was 68,75% (31,25%, 37,5%). Quite a few people had no opinion (19, 65% and 24,1% respectively). There can be many reasons to choose that answer: reluctance towards the project group, a neutral attitude, etc, but the data does not allow for further analysis of this.

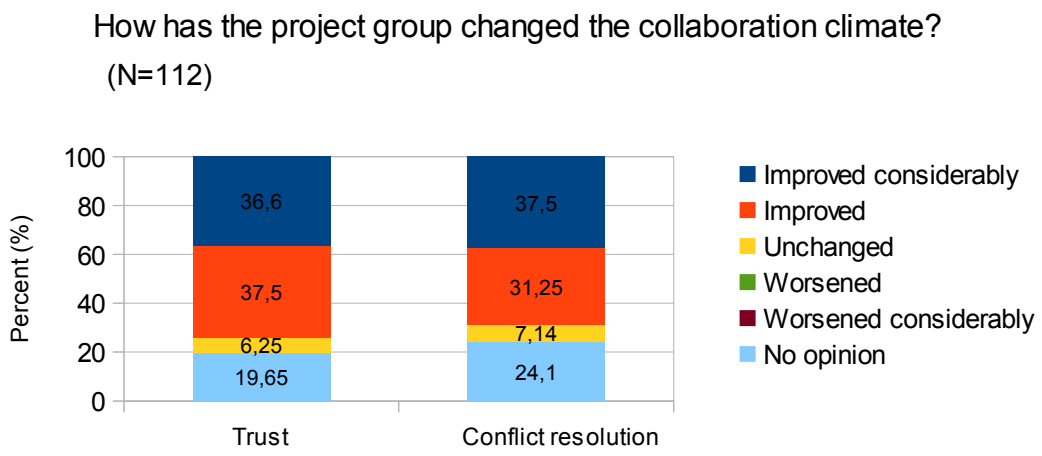


Figure 7. A great majority (68,75 – 74,1%) of the respondents answered that the collaboration climate has improved or improved considerably thanks to the Project East Vättern Scarp Landscape.

For the next question (Fig. 8), I was only interested in response from people who have had a personal experience of the collaboration climate, then and now. People relatively new to the area, etc, were excluded. We can see that the collaboration climate between the respondents and the 7 groups have improved between 1998 and 2011. Negative experiences before 1998 has decreased or disappeared in the 2011-diagram. Regarding the relatively high negative feedback for the municipality, I know from the comments given by the respondents that it is aimed at the Technical Services Department.

The data does not allow for an in-depth analysis of the “no collaboration”-choice. It is unlikely that

people collaborate with each of these groups, but choosing “No collaboration” could also be due to a previous bad experience with that group.

The percentage of people who experience a positive or very positive collaboration climate has increased for all organizations. For example, 39% experienced a positive or very positive collaboration climate between them and the CAB before 1998. In 2011, that number was 68%. For GSG the percentage almost doubled from 34% before 1998 to 62% in 2011.
100% of the respondents (N=112) knew about the tranformation into a Biosphere Reserve. 1,80 % did not have an opinon on this, 6,25% were neutral, 1,80% were negative, 15,15% were positive and 75% were very positive to the Biosphere Reserve appointment.

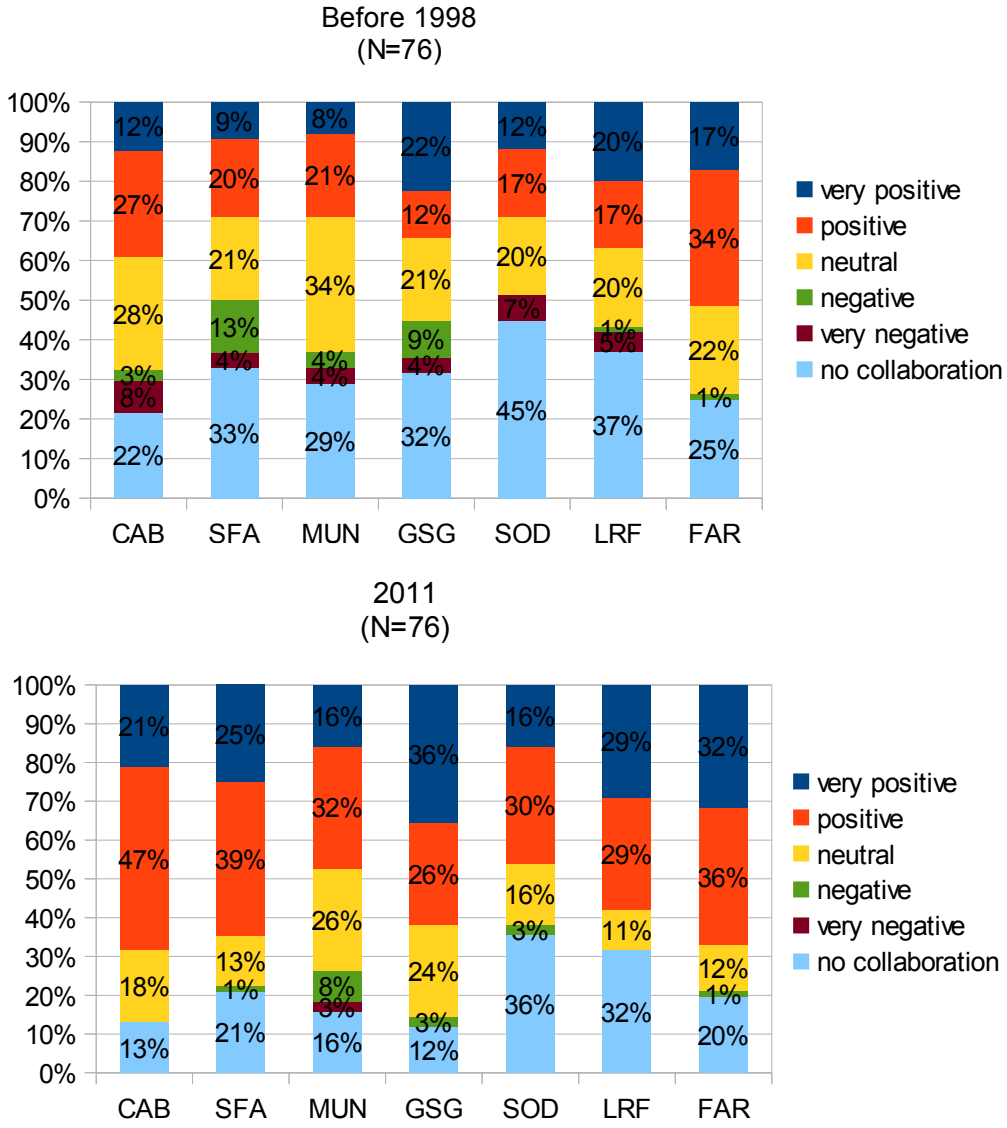


Figure 8. Changes in collaboration-climate from 1998 to 2011 between the respondents and the different organizations Farmers (FAR) are also group as an organization.

DISCUSSION

In this thesis, I set out to investigate if a co-management initiative initiated in 1998 in the East Vättern Scarp Landscape is reflected in the social network of nature conservationists in the area, be there any network at all. The role of the collaborative project group was given extra attention to see if it could be characterized as a bridging organization. Earlier quantitative reports written about the project group have described the process of moving from conflict to collaboration and bridging the gap between production and conservation (Jonsson 2004, Berglund 2010, Jonegård et al 2010, Olsson 2012). Those reports have however not demonstrated whether the collaborative success has spread outside of the project group that has a handful of members. This study revealed that a co-management network of nature conservationists is in place and that a large and diverse set of stakeholders from different sectors of society are represented in this network. Moreover, I argue that the collaborative project group is a bridging organization. With the aid of the social network analysis, not only the diversity of actors but also the *structure* of this diversity could be illustrated.

In this section I will start by discussing the implications of the network structure on network function and actor's influence in the management process. Then I analyze the role of the project group. This is followed by a discussion of the methods used. Finally, I discuss why my findings are relevant, both locally and in a larger context of sustainable management of ecosystem services.

Network structure and function

Centralization, power-distribution and resilience

The relatively high density (0,23) and the short average (1,6) and maximum (3) path lengths tell us that this is a cohesive network where substantial collaboration and information exchange is taking place. The large core of 35 individuals can be a sign of strength as the network is likely to be held together even if a few people leave(Hoppe and Reinelt 2010), something that is confirmed in the network resilience test (Fig. 5 and 6). T he periphery is also well populated and heterogeneous in terms of organizational affiliation. Having many peripheral members in a network could be a sign of adaptability as they allow for new ideas and resources to flow through the core and then out to other peripheral members (Hoppe and Reinelt 2010).

The high centralization of the network (62,35%) indicates that the core has the capacity to

coordinate action and to mobilize resources (Prell 2011) and that information can be transmitted efficiently (Newig et al. 2010). This ability would decrease should the network lose core-actors as the centralization value drops very fast. Removing the two actors with the highest degree values (GSG 1 and SFA 1), the centralization value immediately drops to 40,63%. Removing an additional eight top-degree actors leaves the network with a centralization of merely 21,82%.

Studies have found that highly centralized networks are less resilient to abrupt changes and losing central actors than less centralized networks (Frank et al. 2007 in Bodin and Crona 2009, Newig et al. 2010) because of their "strong reliance on a few heavily linked individuals" (Newig et al 2010 p 10). This network is not very effected by node-removal, at least not cohesiveness-wise, but in terms of coordination capacity, it is. It is a good sign that many links are kept intact even without central network actors. Collaboration and information exchange can still take place, although in a less organized, less coordinated manner.

Having now transformed into a UNESCO Biosphere Reserve, the collaborative initiative has become more "formalized", perhaps making it less dependent on the engagement of individual key-actors and less sensitive to opportunistic behavior or dysfunctional actors. The Biosphere Reserve framework might serve as a "protective hand" over coordination and collaboration-processes as co-management is one of the main criterion of Biosphere Reserves. These are however just speculations.

Actor's influence

The heterogeneity of the actors in the network indicates that this is a network with many different perspectives on management of the agricultural landscape. The variation in influence in the network does however vary substantially due to its core-periphery structure (Fig 4). Such asymmetric distributions of power need to be taken into consideration in the analysis of social networks (Bodin and Crona 2009, Ernstson et al. 2008). In a study about the network of actors protecting the National Urban Park in Stockholm from exploitation, Ernstson et al. (2008) show that user groups (allotment gardens, boating club) located in the periphery of the network had a hard time getting their voices heard. Their interests were getting downplayed by core and semi-core actors whose agendas were focused on conservation biology and cultural heritage. In this network, however, the diversity and the different perspectives of the many actors – even peripheral members - are to a large extent represented in the project group and in the core, whose members have the

most influential positions. This implies that resources, such as different types of knowledge, can be mobilized and trade-offs between different ecosystem services be made (Berkes 2009).

Network identity now and in the future

Although I asked for nature conservationists during the snowball sampling, and not for people engaged in Project East Vättern Scarp Landscape, I ended up with those people. Being a nature conservationist in this case implies being engaged in that project, or vice verse. This network, and the work of Project East Vättern Scarp Landscape started off with a focus on conservation biology. The top-node in the network is a biologist and has been involved since the early framing of the network identity. The question is if this conservation biology-identity will be negotiated now that the area has become a Biosphere Reserve with broader objectives. Can new interest groups break into this tight network of nature conservationists? Moreover, most of the farmers in the network live within or just outside of the core area (Fig. 2). What farmers in the buffer or transition zones think of the project, and whether there is still strong polarization between conservation and production outside of the network needs to be investigated.

The Project Group – A Bridging Organization

Studying the network, it stands clear that the project group members fulfill a structurally bridging role. They could have been a peripheral cluster of actors only networking internally, but this thesis proves the opposite; on average, they have more central positions, have more contacts and play a bigger role in tying the network together than do other network-members (Appendix D). They also show a very high level of representativeness among their peers (Table 5). I thus argue that the criteria for performing structural bridging, as suggested by Tuvendal (2012), is met.

According to Berkes (2009), a bridging organization should facilitate networking among actors. Since the centralization level, which has an effect on the coordination capacity, drops quickly after removing project group members such as GSG 1 and SFA 1, the project group's role in facilitating networking becomes evident.

Hahn et al. 2006 point out that bridging organizations serve as arenas for vertical and horizontal collaboration. They describe a successful case in the Kristianstads Vattenrike Biosphere Reserve in the south of Sweden, where a bridging organization has built a lose network of local stewards and

influential persons at the municipality and on higher societal levels to gain broad support and legitimacy for ecosystem management (ibid). This is also true in the East Vättern Scarp Landscape. The network members act on different administrative and geographical scales. There are representatives from county- (CAB, LRF, Södra), municipal- (Jönköping Municipality, the project group), and sub-municipal (SSNC-branches, Local Heritage Associations, Farmers, The Bird Club, etc.) levels. Links to higher levels of governance exist through WWF, UNESCO and the state agencies. According to Holling (1978) and Folke et al. (2005) this type of nested management across scale improves chances of a management that addresses challenges and issues on appropriate scales, allowing for faster adaptation to change and surprises.

Based on the survey results, it seems like the project group is also performing functional bridging (Tuvendal 2012). The results all point at increased levels of trust, improved conflict resolution and an improved collaboration climate (Fig. 7 and 8). This data could be further analyzed, for example by examining the more fine-grained information that is hidden in the graphs. The results could have been analyzed group-wise. How do Gränna Forest Group-members perceive the changes in collaboration climate? Farmers? State officials? Due to time-constraints, this analysis was not made. The stated improvements could perhaps be traced back to other drivers of change than the work of the project group, such as improved conditions for certain stakeholder groups. My quantitative data does however not allow for a further analysis of this.

Other reports that have been written about changes in the collaboration climate in the area have only focused on changes *within* the project group (i.e. Jonsson 2004, Berglund 2010, Olsson 2012). Although I lack qualitative data, my research was a first step in evaluating how these changes have spread outside of the group.

Reflections on methods used

The results in this thesis are based on quantitative data. Via the links in the network, collaboration and/or knowledge/information exchange related to nature conservation in the agricultural landscape takes place. A deeper insight into exactly what this exchange entails remains unexplored. For example, do certain parts or nodes of the network become active at different times/in response to different challenges, as in Hahn et al. (2006)? Further, I use the central positions and high betweenness and degree values as indicators of power and influence. A more qualitative approach is needed in order to analyze power and influence based on formal power. In this network, a formal

authority, such as a politician with a lot of influence on nature conservation, might be located in the periphery with very low centrality-values. It would also have been desirable to be able to investigate how the network structure has changed since the initiation of the collaborative project in 1998. This data is also lacking. Based on the thesis and the other studies made in the area, I would however have expected the network to have been much more fragmented and decentralized before 1998.

The choice of starting points in the snowball-sampling might have influenced my results. For example, it could have been beneficial to add an additional user-group, such as a hunter's club or, for a more theoretical perspective on nature conservation in the area: Jönköping University. Equivalent actor's groups can however not be found in any municipality or county in Sweden, which was a prerequisite in order to allow for repetition of the study. Considering the fact that more than two thirds of the people that I telephoned, disregarding of background, cited the top-node GSG 1, it seems unlikely that GSG 1 could have been anything other than very central in the network, for example. Thanks to the very thorough snowball procedure with ~150 phone calls, I reckon that it is unlikely that any important actors, or at least the organizations they represent, were missed.

Actors that only got one recommendation during the snowball-sampling were excluded from the analysis. Although they would not have had any large impact on the overall network structure, such peripheral, very weakly connected actors can be very important in terms of feeding in “new though” and innovation to the network (Granovetter 1973, Bodin and Norberg 2005). In that way, the effects of “social closure” and group thinking, which could hinder actors from reflecting on goals and norms, can be avoided (Newig et al. 2010, Sandström 2011). The possibility to negotiateknowledge, norms and values in a learning-by-doing manner and to promote innovation is essential in adaptive co-management systems (Folke et al. 2005).

Implications of findings...

... locally

Locally, network members will likely benefit from getting a “bird's-view” on how the network that they are a part of looks like. They will know whom to consult in certain matters, whom to talk to about ideas for a specific project. They will also be able to identify efficient ways to transfer information, or whom to consult to receive information. The project group can evaluate their efforts and form alliances with individuals or organizations they previously did not know had a nature

conservationist agenda, perhaps the museums or the local heritage societies?

A big issue here is the question of anonymity. Respondents have been guaranteed anonymity in the study. When I presented parts of my results during the opening ceremony week of the East Vättern Scarp Landscape Biosphere Reserve in September 2012, the project group and many other network members wished get to know the names of the people in the network. I will have to consult everyone in the network and get their approval before I reveal any personal information. It is however my utter wish that my results will be of practical use in this area.

... in a larger context

To sustain the production of ecosystem services, it is essential for managers and planners to take on a perspective that stretches beyond human administrative boarders (Goldman et al. 2007). This perspective is often lacking among local managers, but is sometimes held by planning authorities (Andersson et al. 2011)why it is necessary to bridge the divide between planners and practitioners. Taking on a larger perspective might imply involving more people. Therefore, several interests within a certain area need to combined (such as outdoor recreation, food production, biodiversity), and potential conflicts between these need to be dealt with (Lindborg et al. 2009).

The framework of the East Vättern Scarp Landscape project serves as a base for adaptive co-management as it allows for example individual farmers to see their practices in a larger context. Without this opportunity to see their farm as a part of a larger landscape, there is no co-management, only management of their own farm. Collaborating with other farmers to get information or help is no indication of co-management – it is simply collaboration. Co-management requires that individuals are a part of a decision-making process (Berkes 2009), which seems to be the case in my study.

Although data is lacking on how the co-management processes have effected the provision of different ecosystem services in the area, I argue that an appropriate institutional structure is in place for the ecosystem services to be managed in a sustainable manner. The network structure with the important project group serving as a bridging organization in the center, enables knowledge of different types, acquired at different administrative and geographical scales to be negotiated. There is a potential for trade-offs between different ecosystem services to be made, and for trust building and conflict resolution. Considering the multilevel characteristics of the network, there is also a

potential for problems and challenges to be dealt with on appropriate scales.

I argue that the Project East Vättern Scarp Landscaoe and the network of nature conservationists in the area have a lot to teach us on how to build social institutions that account for the complex and cross-scale nature of the ecosystems being managed – essential to sustain the production of ecosystem services.

CONCLUSION

Since qualitative data on what type of information that flows through the network, and what effect that the network structure has on the production of ecosystem services is lacking here, I recommend further studies in order to gain a deeper insight into the cross-scale social-ecological dynamics in the area.

The methodology applied in this thesis was developed in a way so as to enable comparative studies, both nationally and globally. The method can also be used as a first-hand approach to get an overview of a management system, leading on to more in-depth studies.

I would like to end this thesis with a quote

The Project East Vättern Scarp Landscape started off as a nature conservation project, today it implies much more than that. Now it's about conservation, development and research. The concept Biosphere Reserve shall now be filled with meaning. This is where it begins...

– *Network actor in Olsson (2012)*

(my translation)

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Zonation map of the East Vättern Scarp Landscape: http://www.ostravatterbranterna.se/wpcontent/uploads/2011/12/Unesco-application-for-East-Vättern-Scarp-Landscape.pdf

APPENDIX A.

Survey questions about changes in the collaboration climate between 1998 and 2011.

Samarbete.

I denna avslutande del av enkäten vill vi veta mer om samarbetsklimatet i området och hur det har förändrats över tid.

1.

Tänk dig tillbaka till tiden före 1998. Hur var samarbetsklimatet mellan dig och följande grupper då?

	Inget samarbete	Mycket negativt	Negativt	Neutralt	Positivt	Mycket positivt
Länsstyrelsen	○	○	○	○	○	○
Skogsstyrelsen	○	○	○	○	○	○
Jönköpings kommun	○	○	○	○	○	○
Gränna Skogsgrupp	○	○	○	○	○	○
Södra	○	○	○	○	○	○
LRF	○	○	○	○	○	○
Lantbrukare	○	○	○	○	○	○

Kommentar:

2.

Hur är samarbetsklimatet mellan dig och följande grupper idag?

	Inget samarbete	Mycket negativt	Negativt	Neutralt	Positivt	Mycket positivt
Länsstyrelsen	○	○	○	○	○	○
Skogsstyrelsen	○	○	○	○	○	○
Jönköpings kommun	○	○	○	○	○	○
Gränna Skogsgrupp	○	○	○	○	○	○
Södra	○	○	○	○	○	○
LRF	○	○	○	○	○	○
Lantbrukare	○	○	○	○	○	○

Kommentar:

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APPENDIX A. Continued.

3.

Projekt Östra Vätterbranterna initierades 1998 i ett försök att hantera den konflikt mellan produktion och bevarande som fanns i området. I arbetsgruppen finns representanter från Jönköpings kommun, Länsstyrelsen, Skogsstyrelsen, WWF, Gränna Skogsgrupp, Södra och LRF.

Hur tycker du att Projekt Östra Vätterbranterna förändrat samarbetsklimatet?

	Avsevärt försämrat	Försämrat	Oförändrat	Förbättrat	Avsevärt förbättrat	Ingen uppfattning/Vet ej
Tillit	○	○	○	○	○	○
Konfliktlösning	○	○	○	○	○	○

Kommentar:

4.

Känner du till att Projekt Östra Vätterbranterna har ansökt om att bli ett UNESCO Biosfärområde?

○ Ja
○ Nej

5.

Hur ställer du dig till att Östra Vätterbranterna eventuellt blir utsett till ett UNESCO Biosfärområde?

○ Mycket negativt ○ Negativt ○ Neutralt ○ Positivt ○ Mycket positivt ○ Ingen uppfattning/Vet ej

Kommentar:

APPENDIX B.

The recall-list

The list was divided into four sections of names; “Public authorities and the municipality”, “Farmers and people at LRF and Södra”, “People in associations, clubs and non-profit organizations” and “Others” (people with no organizational affiliation such as entrepreneurs, artists...) to facilitate for the respondents to get an overview of the survey. In addition to full name, the title or occupation of the stakeholders was written out. People were grouped according to how they themselves and others had defined them during the telephone interviews. For example a man in the network was a sociologist and a farmer. In the context of the network, he and others defined him as a farmer. He was thus placed in the “farmers”-category. Some people were both farmers/foresters and working at LRF/Södra or being elected local LRF/Södra - representatives. When being recommended by others, they were foremost defined as LRF/Södra-active, and were thus given that title.

Writing out names and titles raises the issue of anonymity. Of the 157 people who received the survey, I had been in contact with 115 during the snowball-sampling. They all agreed to be on the list with their full name and title. The remaining 42 persons that I had not been in contact with received an extra letter along with the survey where I explained the aim of the thesis more in-depth. I also gave them the opportunity to be removed from the list (surveymonkey allows for that) if they contacted me. No one contacted be in that matter. In the survey I guaranteed that no names would be written out in the “end-product”, i.e., the thesis but that it might be possible to figure out who is who by studying the network and the information on organizational affiliation. Since this is a “positive” network that respondents expressed a pride to be a part of, the question of anonymity was not as sensitive as it could have been had the thesis investigated another type of network.

The respondents had the opportunity to add names of people they thought were missing on the list and assign their contact to them. Is was thus up to the actors themselves to create the network boundaries (Hanneman and Riddle 2003). This possibility was mainly directed at the people who received the survey but whom I had not telephoned during the sampling of names. No person was added more than once and was thus not included in the network.

APPENDIX C.

Calculations made in UCINet:

To identify and subsequently remove non-reciprocal links:

1. Transform/Symmetrize/”Product”, resulting in that all non-reciprocal relations were given the value 0, and the others values from 1-25 (maximum 5*5)
2. Manually remove non-reciprocal relations from the original matrix (of values 0-5)

To make data binary (most UCINet-tests require binary data):

1. Transform/Recode.../Files
2. Input dataset with reciprocal links of values 0-5
3. Transform/Recode.../Recode/”Values from 1 to 5 are recoded as 1”

Core-periphery: Network/Core/Periphery/Categorical...

Density: Network/Cohesion/Density/Density/Density Overall

Geodesic distances: Network/Cohesion/Geodesic distances

Betweenness centrality: Network/Centrality and Power/Freeman Betweenness/Node Betweenness

Degree centrality and overall network centralization: Network/Centrality and Power/Degree...

To calculate density and degree centrality group-wise, each group was arranged in separate adjacency matrices. Tests were then run as described above

The resilience test was carried out by manually removing actor by actor according to degree-value from the matrix and running the Geodesic distances-test after every removal

APPENDIX D.

A comparison of mean degree and betweenness values between the whole network and the project group. The hight standard deviation values hint to a core-periphery structure. Degree and betweenness values vary considerably within the network.

	Freeman's degree	**Freeman's betweenness**
Complete network mean (std. dev.)	**26,29** (16,85)	**47,137** (109,74)
Maximum/Minimum	98/2	856,913 / 0
Project group mean (std dev.)	**48,5** (25,65)	**195,39** (262,12)
Maximum/Minimum	98/15	856,91/3,43

APPENDIX E.

Density (proportion of realized links) within and between groups

	CAB	FarmerSödraLRF	Municipality	Gränna Forest Group	Forestry Board
CAB (N=26)	**0,742**	0,127	0,269	0,207	0,567
FarmerSödraLRF (N=33)	0,127	**0,348**	0,121	0,205	0,477
Municipality (N=10)	0,269	0,12	**0,733**	0,363	0,525
Gränna Forest Group (N=8)	0,207	0,205	0,363	**0,893**	0,313
Forestry Board (4)	0,567	0,477	0,525	0,313	**1**