Master Thesis

Governance for Sustainable Regional Development: Network Development in a Swiss Regional Nature Park

Supervisor:
Prof. Dr. Paul Burger
University of Basel
Sustainability Research

Author:

Mario Angst

mario.angst@gmail.com
Student ID: 08-202-293

Co-Supervisor:
Dr. Christian Hirschi
Federal Institute of Technology Zurich
Environmental Politics and Natural
Resource Governance

A thesis submitted in fulfilment of the requirements
for the degree of Master of Science in Sustainable Development at the Faculty of
*Humanities, University of Basel*

June 30th, 2014

Declaration of Authorship

I, Mario ANGST, declare that this thesis titled, *Governance for Sustainable Regional Development: Network Development in a Swiss Regional Nature Park* and the work presented in it are my own. I confirm that

- I am familiar with the „Regeln zur Sicherung wissenschaftlicher Redlichkeit" published by the faculty of humanities of Basel and that I have followed them thoroughly.

- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.

- I have acknowledged all main sources of help.

- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signed:

_____

Date:

_____
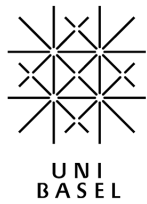
UNIVERSITY OF BASEL

Abstract

Master of Science in Sustainable Development

Governance for Sustainable Regional Development: Network Development in a Swiss Regional Nature Park

by Mario ANGST

Governance for sustainable regional development faces dynamic challenges of addressing uncertainty, solving cross-scale problems and managing natural resources. Regional governance networks can answer these challenges by performing the functions of enabling collective action as well as ensuring adaptive capacity and robustness. This thesis argues that two main dynamics in the development of governance networks can be expected during the implementation of a project aimed at sustainable regional development. First, the high importance of collective action results in a continuous emphasis on local closure. Second, an increasing importance of adaptive capacity and robustness leads to increased bridging of global structural holes. Social network analysis tools are used to explore the empirical development of a governance network in the Swiss regional nature park of Thal. An initial exploratory analysis makes use of various measures for closure and structural holes, including a blockmodeling approach. It is further substantiated by a statistical analysis using exponential random graph modeling. The analysis finds an interesting trend towards increasing transitive closure but decreasing centralization. This is combined with an increase in the bridging of global structural holes in the network. The results show that a dynamic network perspective contributes essential insights to the study of governance for sustainable regional development. Further research in this vein could include linking governance network structure to sustainability assessments, quality of participation or ecological networks.

Acknowledgements

Contents

List of Figures

List of Tables

Part I

Introduction

S USTAINABLE DEVELOPMENT needs regions. They connect the inherently global questions of sustainable development with its implementation on the local level. The global, interdependent and cross-scale perspective of sustainable development is one of its crucial paradigmatic achievements as a political program. But this global view will not find its way into the process of sub-national policy-making and local implementation without a regional complement.

At the same time, regions need sustainable development. Across the world, regions will tackle the sustainable development challenge for different reasons. Some regions might face economic deterioration and depopulation. Others will have to find ways to rein in rampant growth. While still others might be forced to innovate in the face of changing environmental conditions, which render age-old practices of resource management obsolete. Some might face demands by their respective constituencies for more participation in matters of development. But some might struggle to find ways to precisely gather enough local knowledge to make sufficiently informed decision. Thus, it seems clear that sustainable regional development is a widespread necessity. But when it is attempted, it happens under a widely varying set of pretexts.

Sustainable development entails changing existing forms of governance to enable development that is both more environmentally sustainable and equitable (Meadowcroft 2009, p. 323). The challenge lies in finding a governance system which is fit for this task. At first, specifying features of such a governance system seems to present an incredibly difficult if not insurmountable task. However, a number of attempts have already been made in this direction.

Network governance as a way of societal steering which is focused on non-hierarchical and horizontal coordination between different societal, economic and state actors has been a promising concept put forward in the context of sustainable development (Dedeurwaerdere 2005). However, network governance is often understood as a specific empirical phenomenon representing an ideal-typical mode of governance. This thesis sees a more promising approach in using network governance as an analytical tool. A perspective, which incorporates political networks into a wider model of policy-making contributes towards understanding the importance of the network level in governance for sustainable development.

The "networks" in network governance often stay mere general ideas about a form of cooperation between the actors involved. But it is clear that governance networks may differ greatly . Some may be more or less dense, contain more or less social capital or prove to spread information slower or faster, to name just a few of a myriad of possible differences. Thus, there is a need to take a closer look at the properties of network form when attempting to assess the contribution of governance networks to sustainable development. Otherwise, one risks failing to substantially understand the contribution of networks. This thesis aims to address this by providing answers to the following central research question:

> *What structural form of a governance network enables sustainable develop-*
> *ment?*

A good number of suggestions have been made about the form of governance networks for sustainable development and natural resource management, discussing different structural characteristics (eg. Bodin and Crona 2009; Carlsson and Sandström 2008; Robins et al. 2011; Janssen et al. 2006; Newig and Pahl-wostl 2010). Most of these suggestions stop short of operationalizing their hypotheses. By reviewing the existing literature, a tentative framework of structural characteristics of governance networks for sustainable development can be constructed.

There is, however, a lack of empirical examination of these general characteristics in specific governance networks, which aim to promote sustainable development. Crucially, the *dynamic* character of governance networks has not been treated sufficiently.

In studies that focus on the structural characteristics of social-ecological systems, a static view of networks is predominantly taken (Janssen et al. 2006). This fails to grasp an important component of natural resource governance and sustainable development. Sustainable development is always set in time, dealing as much with the present as with preparing for the future. Systems which address these cross-temporal scale problems are more likely to achieve sustainable outcomes (Cash et al. 2006).

Thus, a *dynamic view* is of utmost importance when considering governance for sustainable regional development. During the implementation of sustainable regional development, the functions a governance network has to fulfill are bound to change and evolve. Little has been written about the properties of this functional change and its consequences for the form of a governance network. To address this research gap, the main research question is thus further specified by the following question:

> *What dynamics in the structural form of a governance network enable sustainable re-*
> *gional development during an implementation period?*

Summing up, this thesis is therefore innovative in two main aspects. Adopting a dynamic perspective, it identifies dynamic components of governance networks, which enable sustainable regional development over time. It then explores these changes in a specific empirical example.

The empirical test case

The Swiss regional nature park (RNP) of Thal offers a well suited empirical test case for the considerations outlined above. Regional nature parks are a relatively new and essential element of the Swiss strategy for regional development. As a policy instrument they have been enshrined in a revision of

the federal act on the protection of nature and cultural heritage, which was enacted in 2007. Contrary to national parks, which focus exclusively on nature protection, regional nature parks are supposed to strike a balance between advancing sustainable business activities as well as maintaining and enhancing a rich natural and cultural landscape (Art. 23g, Federal Law on the Protection of Nature and Landscape, Federal Authorities of the Swiss Confederation 2014). Referring to socioeconomic development as well as physical sustainability, RNPs integrate the concept of sustainable development into Swiss regional development (Hirschi 2010) or landscape policy (Gerber and Knoepfel 2008). This makes RNPs a good test case to study sustainable regional development.

The involvement and participation of all actors in a region is an important part of the regional nature park policy and prescribed for the establishment as well as the management of an RNP (BAFU 2008). The establishment of a park thus combines top-down guidance by higher administrative levels with required top-down local initiative (Hirschi 2010). The establishment of a governance network surrounding an RNP consisting of a wide variety of actors is thus not only a goal but also a distinctive characteristic of RNPs. RNPs are thus a prime example of regional network governance.

The RNP of Thal was the first park to complete the process of applying for the federal RNP label, which it received in 2009. At the time of writing, it has therefore officially been in existence for more than five years and is at a very different place from where it started. A phase of initiation has been succeeded by what will be called consolidation in this thesis. This makes it possible to look at the development of the park governance network over time and in different states of development.

In sum, due to its explicit focus on sustainable development on a regional level, the establishment of a related, multi-faceted governance network and its existence over several years, the RNP of Thal makes an excellent test case for the research questions of this thesis.

Thesis structure

To provide answers to the research questions above, theoretical considerations must be addressed on three levels, before analyzing the case study.

First, sustainable regional development as the central normative concept of this thesis has to be considered and identified as a governance problem. Four main challenges for sustainable regional development are identified in chapter 1.

Second, an analytical framework has to be chosen, which is suitable for the phenomenon studied. In chapter 2, it is argued that network governance as an analytical perspective situated in a wider model of policy networks can provide a suitable framework to study network governance for sustainable regional development.

Third, the analytical perspective is connected to the challenges previously identified . Four crucial functions of governance networks are identified, which enable sustainable regional development. Two main expected dynamics about changes in these functions during the implementation of a project aimed at sustainable regional development are identified.

The question now becomes in which way these changing functions are reflected in network form. To connect changes in function with changes in network form, a network theory of social capital is used as suggested by Carlsson and Sandström (2008). Different configurations of social capital are needed for a network to perform a certain function. This is reflected in different network form. Thus, a set of hypotheses about changes in form due to changes in functions can now be generated.

The hypotheses generated during the theoretical considerations are then explored in an empirical analysis of the chosen test case. This part consists of the research design and methods used (chapter 5), followed by the generated results (chapter 6) and their discussion (chapter 7).

In the empirical analysis a far-reaching set of methods is used. First, network and actor level measurement as well as blockmodeling techniques are used to conduct an exploratory analysis. The results of this first step are then reconsidered in a framework of more rigorous statistical inference. Here, cross-sectional exponential random graph (ERGM) modeling and a longitudinal extension of the former in a separate temporal exponential random graph model (STERGM) is applied.

A conclusions wraps up the thesis. It points towards theoretically interesting observed trends in the development of the network studied and provides a limited assessment of the park project from a network governance perspective. Directions for further promising research on network governance for sustainable development are then outlined.

Part II

Theory

Chapter 1

The Challenge: Sustainable Regional Development

Rural regions in Switzerland face a number of challenges. Among those is the diminishing importance of traditional economic sectors such as agriculture or forestry, which is accompanied by an increasing importance of the service sectors. As the services sector gravitates toward urban centers, this further marginalizes rural regions. Tourism often remains as the sole area of economic potential. However, intensified land use due to touristic development or other activities harbors the potential to environmentally degrade landscapes (Hirschi 2010, p. 16).

Sustainable regional development has been suggested as a way to address these issues. Sustainable development in this context strives to guide action and prescribe policy. Thus, it is a concept which contains an inherently normative component (Lange et al. 2013, p. 405). It offers (sometimes ambiguous) prescriptions and identifies challenges. These challenges will be outlined for the regional level in this chapter.

To arrive at this, the chapter is structured as follows. First, a definition of sustainable regional development involves choosing a suitable conceptualization of sustainable development. Second, sustainable regional development is identified as a governance problem. Third, four essential challenges to governance for sustainable regional development are listed. These are cross-scale and cross-level problems, uncertainty, participation and the management of natural resources.

1.1 Defining sustainable regional development

A first stumbling block in defining sustainable regional development is the unclear status of the 'region' itself. A region can be defined as "a spatially bounded area exhibiting a degree of internal coherence that distinguishes it from its surroundings" (Lyons and Deutz 2010, p. 183). Still, what

is empirically connected to this definition varies greatly in scale and how it relates to politically defined units. Thus, Lyons and Deutz (2010) highlight the importance of recognizing the region as a non-national space which is politically contingent and embedded in the global political economy.

A second stumbling block is the concept of sustainable development. Since the introduction of the term (although principles of sustainable use or harvest had been around for much longer) in *Our Common Future* (World Commission on Environment and Development 1987), it has grown to ubiquitous use. This paper will be based on the conceptual core of the concept established in Lafferty (2004), which is based on the Brundtland definition in the report by the World Commission on Environment and Development (1987). Lafferty (2004) identifies physical sustainability, generational equity and global equity as the three core semantic elements of the concept. Further, five distinctive characteristics of sustainable development characterize sustainable development as a political program.

This approach to a definition is well suited for the context of this paper. First, it contains the issues of environmental (physical) sustainability and equity, which have been introduced as core concepts in governance for sustainable development (Meadowcroft 2009). Second, Lafferty (2004) stresses the importance of 'openness of meaning' of the concept, comparable to terms such as freedom or human rights, valued above all for their propensity to inspire discourse and debate. Third and crucially, sustainable development is introduced as an essentially contingent project. There can be no universal approach to sustainable development for every possible context. This fits in very well within a regional perspective. Regions are diverse social-ecological systems and there can be no single optimal solution to similar problems in different regions. This is an argument that has been strengthened by empirical evidence.Such evidence ranges from examples of optimal crop choice facing a complex mix of ecosystem configurations to participation facing a widely varying set of stakeholder interests depending on the region in question (Lebel et al. 2006).

The contingency of the concept of sustainable development is further illustrated by the fact that sustainable development may guide regional development strategies but contains a global perspective at its core. Thus regions need sustainable development, but sustainable development on a larger scale also needs regions. The importance of regions for overall sustainable development has been highlighted in the past. The regional and local level is where sustainable development 'happens' on the ground, where it is translated into action (Hirschi 2010). Regional authorities often take care of many tasks which stand in direct connection with sustainable development issues such as health, waste management or economic development (Lyons and Deutz 2010). Thus it is not surprising that regional sustainable development is one of the core areas of the general regional policy strategy proposed by the European Union (Sedlacek and Gaube 2010).

1.2   Sustainable regional development as a governance problem

It is argued in this thesis that tackling sustainable development on the regional level must entail questions about proper governance arrangements. Existing forms of governance have to be changed in order to enable development that is at the same time more environmentally sustainable and equitable (Meadowcroft 2009, p. 323). Governance in this view is taken as an enabling condition for sustainable development. It is as an essential element within the overarching normative framework of sustainable development.

The concept of *governance* is often explained along the lines of a story which identifies a shift "from government to governance". Government therein is understood as the traditional state-centered way of societal steering. Governance on the other hand stands for a complex and non-hierarchical interplay among various public and private actors. Although this story has been criticized for being overly simplistic (Lange et al. 2013, p. 4), it still offers a useful heuristic to grasp the concept.

A second relatively simple heuristic situates governance between two opposing poles of societal coordination, state and market. Governance or governance networks thus offer a pluricentric alternative to unicentric state regulation and multicentric competitive market regulation (Torfing 2005, p. 309).

These two understandings may provide an initial approach towards the concept of governance. Beyond this, they provoke a host of conceptual ambiguities though. Recognizing this, Lange et al. (2013, p. 406) propose a definition of governance as "a process of more or less institutionalized interaction between public and/or private entities ultimately aiming at the realization of collective goals".

This definition was specifically developed in the context of governance for sustainable development, which makes it an ideal starting point for the purpose of this thesis. It is at the same time sufficiently broad to encompass a multi-faceted empirical phenomenon but narrow enough to be able to rule out other forms of coordination such as within private firms as subject of study.

Bodin and Tengö (2012, p. 431) offer a welcome addition to this initial definition. They refer to governance as "the management of natural resources, as well as the structures and processes that provide the social and institutional environment in which the management can take place". Their understanding of governance is more explicitly rooted in a natural resource management and a network perspective on governance.

Compared to the first definition, Bodin and Tengö (2012) importantly add a second, more structural component to governance. Thus, governance does not only refer to the actual process of management or realization of collective goals. It also includes the shaping of the environment in which this process takes place.

Taken together, an understanding of governance based on these two definitions offers a first corner-stone for establishing the importance of governance in questions of sustainable regional development.

Sustainable development as a policy objective is a problem of the kind which inspired the governance literature in the first place. It is characterized by a need for societal steering across time-scales, involving changing and ambivalent objectives as well as a variety of stakeholders on multiple levels (Lange et al. 2013). All this also holds true for the regional level and this is what makes it obvious that governance questions are very much a part of sustainable regional development.

1.3 Four main challenges for governance of sustainable regional development

In the following section, challenges are identified that a governance system must overcome in order to enable sustainable regional development. A key challenge for sustainable regional development lies in first connecting the region as an important but ambiguous space to a governance system and then arriving at a suitable governance arrangement. The question is thus about the fundamental functions of governance, which enable it to reach the normative goals of sustainable development. A set of four main challenges generally characterizes sustainable (regional) development.

Cross-scale and cross-level problems

Due to the very nature of the region as a politically contingent space, a regional governance system will include actors across different juridical and institutional scales and levels, as well as environmental ones, These *cross-scale and cross-level problems* highlight a typical characteristic and difficulty of the human-environmental interface (Cash et al. 2006). Many problems of sustainable development can not be solved without coordination across political levels to connect local with national and global perspectives (Lafferty 2004, p. 18). Regions thus need to be connected horizontally and vertically to contribute and make their concerns heard. A special kind of cross-scale problem in sustainable development is its *inter-generational* aspect. Sustainability is a long-term, normative program (Lafferty 2004, p. 21). Governance for sustainable development has to account for the presence of questions of equity across time scales. Such questions of long-term policy problems with potentially long time lags between action and effects are considered very demanding challenges of governance (Underdal 2010).

Uncertainty

As a general feature of governance for sustainable development, a governance network has to deal with the fact that its capacities to be knowledgeable about the future are limited by *uncertainty* (Meadowcroft 2009, p. 323). Comparable to systems such as the climate system, but on a smaller scale, a region constitutes a social-ecological system with a multitude of linkages between social and biophysical processes. Likewise, a region will most surely be characterized by a high degree of complexity. Complex systems make it unavoidable that a large amount of uncertainty will always be present. They require the capacity for constant adaption and readjustment to new dynamics (Underdal 2010, p. 388). A further host of uncertainty on the regional level comes from interactions of the regional scale with entities on different levels, creating a whole new set of dynamics (Lebel et al. 2006).

Substantial participation

In spite of these problems, development still has to relate to desirable societal objectives and development routes, which have to be collectively discovered. This calls for *participation* in an instrumental as well as in a deeper, substantial sense (Meadowcroft 2009, p. 323). In an instrumental sense, involvement of different components of society makes access to dispersed knowledge resources possible and facilitates policy implementation. However, this instrumental aspect of participation is not a challenge. It rather points out the role of participation in answering other challenges.

In a substantial sense or based on an ethical imperative, there exists an argument to involve the whole community (Meadowcroft 2007, p. 160). This connects governance for sustainable development with democratic theory. As a normatively charged project, sustainable development involves societal steering, which necessitates decisions that are sometimes far from mere technical choices. Thus, participation in a substantive sense poses the challenge of ensuring that social actors have a meaningful say in the direction of the steering being done (Meadowcroft 2004, p. 165).

Management of natural/ common pool resources

One of the core tenets of sustainability is physical sustainability, a moral principle which asks for the protection and exploitation of natural life-support systems in a sustainable manner (Lafferty 2004, p. 14). Many issues of sustainable regional development will also include the management of natural resources. Oftentimes, these are *common pool resources* which present special dilemmas in their management (Ostrom 2000, p. 148). In the context of this thesis, it is especially important that landscape can also be understood as a resource (Gerber and Knoepfel 2008), which has to be managed in a sustainable manner, thus enabling equitable, long-term development, which does not degrade their capacity for future use.

Chapter 2

Analytical Perspective: Network Governance

This chapter will describe the analytical framework for the phenomenon which is studied in this thesis. This stands in contrast to the previous chapter, which introduced the challenges posed by the normative demands of sustainable development. Identifying an analytical framework should happen outside of normative considerations. The single most important criteria for choosing an analytical framework should be whether it is suited to adequately capture the phenomenon in question. The phenomenon studied in this thesis is governance on the regional level. To be more precise, it is the characteristics of certain governance arrangement, which strives to achieve the policy objective of sustainable regional development as a collective goal.

This thesis will argue for the benefits of a network perspective on governance to understand this phenomenon. In order to develop network governance as an analytical perspective it proceeds as follows. First, some general arguments for including political networks for the study of political phenomena and specifically governance are elaborated. Second, two differing understandings of network governance are presented. The rationale for choosing network governance as an analytical perspective is developed and policy networks are situated within a broader policy system. Third, various ways to differentiate policy networks are outlined. A last step includes a discussion of social network analysis as the main methodological approach. This is presented in this chapter in order to clearly distinguish social network analysis as a methodology from related approaches, which ascribe it a more theoretical status.

2.1   Political networks

Political science is fascinated by networks and they have recently become a buzzing topic in the field. Much of the fascination has to do with the descriptive potential of network analysis (Ward et al. 2011). But there are more profound arguments for incorporating networks into the analysis of political phenomena.

Thinking about one defining core of the discipline, it is easy to see why political science would be interested in networks. Political science has many subfields, methodologies and a good amount of overlap with neighboring disciplines such as sociology, philosophy or economics. But a common thread is the issue of power and its distribution. No matter how power is conceptualized, it seems clear that it must be a relational concept. Power must describe some sort of relation between at least two entities. Thus, networks fit squarely in the middle of political science as a science which is relational at its core (McClurg and Young 2011).

Stepping down from this more general view, it is the incorporation of policy networks as an integral part of the policy-making process, which is of special importance in the context of this thesis. This can be achieved without retreating to functionalist theorizing and in accordance with the wealth of modern developments in policy theory.

Individual action is embedded in a rich system of social relations. Even phenomena such as markets which have become almost synonymous with rational choice analysis steeped in methodological individualism have been shown to display such *embeddedness* (Granovetter 2005). This must not be ignored but explicitly incorporated into a comprehensive framework. Policy-making for regional sustainable development is therefore understood to happen within a complex system of interdependent interactions. Such network models follow a modern understanding of the policy process (Lubell et al. 2012, p. 352).

Hence, the incorporation of policy networks into a model of policy-making highlights a merit of the social relational approach in the social sciences in general. As a "proper" analytic framework, a network perspective combines elements of methodological individualism with a structural approach (Carlsson and Sandström 2008, p. 39). It marks a way to merge individual agency and social structure, overcoming one of the oldest divides in the social sciences (Bodin et al. 2011, p. 8).

Embeddedness and the complexity of policy systems offer convincing arguments for the importance of networks in determining policy outcomes. It is not surprising that political networks have thus been specifically explored in connection with the governance concept. This implies a specific perspective on governance with a focus on networks in explaining societal coordination and problem solving capacity (Schneider 2009).

2.2   Network governance: Two conceptualizations

A very important differentiation has to be made between two ways of thinking about network governance. This is in order to avoid the "Babylonian" confusion poignantly identified by Börzel (1998).

First, there exists a view of network governance as an *empirical phenomenon* describing a change in the coordination of political systems alternative to state and market models. Network governance thus becomes a phenomenological category. Second, network governance can be seen as an analytical tool. For a variety of reasons, this is the conceptualization used in this thesis. The rationale for this choice is developed below.

Network governance: The phenomenological approach

For proponents of the this perspective (eg. Dedeurwaerdere 2005; Torfing 2005; Jones et al. 1997), network governance represents a distinct mode of governance. This is based on the observation of ongoing changes in the policy-making process since the second world war, including decentralization, sectoralization or the blurring of the lines between public and private spheres (Adam and Kriesi 2007, p. 131). These changes have supposedly given rise to a new way of governance, which differs enough from either state or market governance to deserve a distinct label. Many have even subsequently equated governance (as opposed to government) with networks (Börzel 2011).

According to Torfing (2005, p. 306), who could be said to be one of the proponents of this view, governance networks in this perspective may refer to a particular form of governance but also a particular type of network. The network will consist of various actors such as politicians, administrators, interest organizations or private firms, who will have to demonstrate their stake in the issue at hand as well as their ability to contribute in a way that is valued by other actors. Studies of network governance as an empirical phenomenon also seem to focus on its particular merits as a distinct mode of governance. They outline aspects such as the contribution of network governance to organizational learning (Dedeurwaerdere 2005) or its effects on democratic legitimacy (Boon et al. 2012).

However, this phenomenological view of network governance is not without its critics. At least two fundamental flaws in its arguments can be identified. First, networks have always been present in societal steering and second, networks are not identical to institutions.

The presence of networks is not a unique feature of the new phenomenon the approach tries to describe. It can be argued that there is no governance structure,which is not embedded in some kind of network. Every governance structure relates actors to institutions in some way, creating a network of some sort (Robins et al. 2011, p. 1294). This applies even to older, more "government than governance"-oriented ones.

Describing governance arrangements with a policy network concept is nothing new, then. As Adam and Kriesi (2007, p. 132) put it, "the model of a unitary, state-centered hierarchical political decision making structure has always been a fiction". For example, it has long been a recognized characteristic of the weak state that it must involve private actors in policy making. Lange et al. (2013) also raise similar points, arguing for example that 'new' governance dynamics in some sectors have been long established practices in others and vice versa.

Putting network governance next to state and market equates networks to concepts which operate on an institutional level. But this is a misconceptualization. Networks influence behavior in any policy system or social organization independent of institutions (Lubell et al. 2012, p. 355).

Network governance as an analytical perspective

In light of the criticism leveled at the phenomenological view of network governance, this thesis will adopt a different view. Network governance will be seen as an *analytical perspective*. Networks therein are analyzed as part of a wider policy-making framework. This offers a compelling way to characterize the contribution of the network level to governance for sustainable development.

A first characteristic of approaching policy networks as an analytical tool is a focus on proposing typologies to analyze existing, observable networks. This way of thinking is influenced by comparative public policy analysis. It can be seen as an undertaking aimed at drawing up criteria that distinguish between different sets of relations between state and society (Adam and Kriesi 2007). This drawing up of macro-level categories has been termed the actual "network governance school" by Fawcett and Daugbjerg (2012, p. 196). However, this is not a procedure very well suited for the aims of this thesis. In a governance context, viewing network governance as an analytical tool has a slightly different goal. Here, it means analyzing policy networks,which structure the interaction between actors in a governance arrangement aimed at policy-making (Börzel 1998). Thus it stands more in line with a meso-level "policy network analysis school" concerned with how policy-making outcomes are influenced by policy network characteristics (Fawcett and Daugbjerg 2012, p. 198).

Lubell et al. (2012) offer a persuasive framework for viewing policy networks as a meso-level concept. Therein, they clearly separate the network level from institutions and individual decisions-making. This avoids the problems associated with treating network governance as a distinct phenomenon outlined above.

Policy network structures constitute a meso-level variable in a policy system. The policy network links institutional arrangements to individual behaviour. The interplay of these three levels then lead to policy outputs and outcomes.

The complete model is depicted in Figure 2.1. Institutional arrangements refer to a set of formal rules and informal rules which constrain and enable individual behaviour.
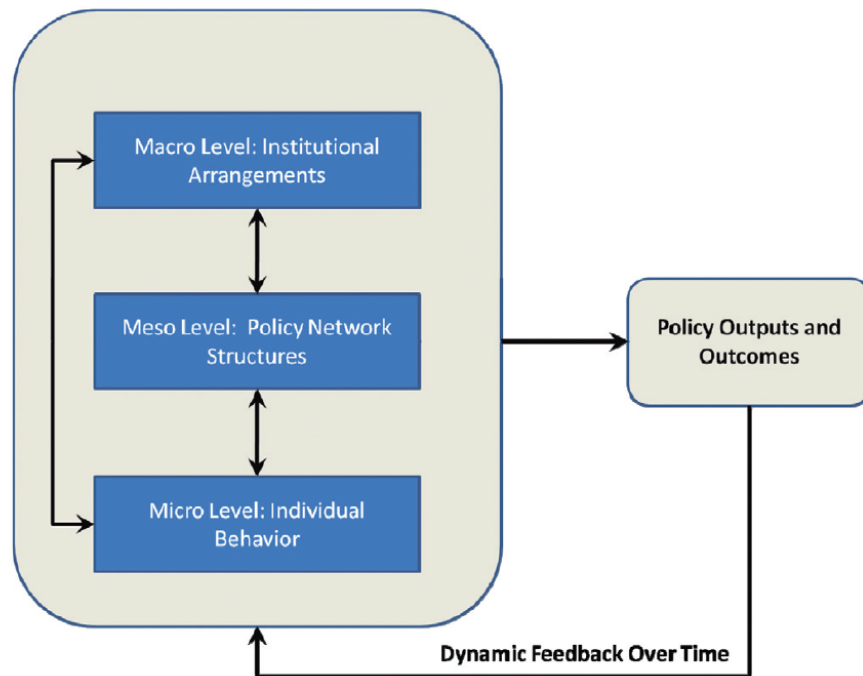
FIGURE 2.1: Conceptual framework for integrating policy networks in a wider policy system (Lubell et al. 2012, p. 354)

This framework offers a useful way for network governance to be used as an analytical perspective. It integrates a network perspective into a view of policy analysis,which has been traditionally dominated by an oversimplifying two-level-view of macrolevel institutions,which place constraints on individual behavior following a set of decision-making rules (Lubell et al. 2012, p. 354). By incorporating networks, aspects of a policy system which have hitherto been ignored can thus be captured. This makes it a promising model, if governance at the regional level is the subject of study. The region, which has been introduced as a contingent and embedded space is exactly a place where network characteristics play an even more vital role than elsewhere. To capture regional governance there seems to be no alternative to including the network level.

2.3 Differentiating policy networks

A range of typologies, ranging from simple to very complex, have been developed to differentiate policy networks (Börzel 1998, p. 256). Adam and Kriesi (2007) build theirs from the fact that there are two kinds of variables in networks. Compositional variables refer to attributes of actors, while structural variables refer to types of ties. This leads to a two-dimensional typology with the distribution of power on the actor level and the type of interaction in the tie dimension. Adam and Kriesi (2007) further argue in favor of harnessing the power of formal social network analysis to shed light on the structural dimension.

Bodin and Crona (2009) do exactly this in their review of social networks in the context of natural resource governance. As a first precursor to analyzing a network, it is important to specify the content of ties that are studied (e.g. advice networks versus collaboration networks). Then networks can be characterized by the different patterns of relational ties they display. These *structural characteristics* are not of interest on their own, but because they influence possible social processes, which play out in a network. An emphasis on structural characteristics based on this reasoning is in line with a general prescription of network governance as an analytical tool, which demands a focus on the pattern of linkages and interactions as the unit of analysis (Börzel 1998, p. 259).

2.4   Social network analysis: Theory or toolbox?

A last point that needs to be considered in the discussion of the analytical perspective of this thesis is social network analysis. This is done in order to establish the use of social network analysis as the main methodological approach for this thesis. It is a toolbox of methods, no more, no less.

The idea that individual actors are embedded in webs of social relations and interactions lies at the heart of social network analysis. Theories accompanying such network thinking attempt to give answers to an old and central question in social philosophy, namely what creates social order (Borgatti et al. 2009, p. 892). The attention given to the relational context is what distinguishes a network perspective in the social science. In classic survey-based approaches, an individual is oftentimes decontextualized (Stegbauer and Häussling 2010).

The study of networks in the social sciences has transpired into many fields and knows many disciplinary peculiarities but according to Knox et al. (2006) two main trajectories can be made out. On the one hand they identify a prominent, sociological and American school of social network analysis, focused on formal mathematical foundations and unified by a set of core methodological procedures. Key figures include sociologists such as Harrison White, Linton Freeman or Mark Granovetter. The rallying point in this trajectory is not so much a common theory but an understanding of social network analysis as a set of tools accompanied by the claim to provide the most detailed scientific description of social networks. From a generalizing view of social theory, many writers in this trajectory could probably be said to have a strong affinity to structuralist thinking, although the field itself is far from homogeneous.

On the other hand, there exists a tradition of network studies in anthropology. Its history is more of a set of sporadic interactions of anthropologists with networks than a continuous narrative, but nevertheless follows a common thrust. The thinking in terms of kinship relations has always been a big component of anthropological research, so the thinking in network terms did not come from nowhere. Still, a big part of anthropological thinking about networks was a critical answer to the structural-functionalist approaches based on Parson which dominated the analysis of class and society from the

1940s on (Knox et al. 2006). Society was recognized as a pattern of relationships between different actors, kinship systems were conceptualized as relational algebras and network-based measurements were for example used to explain social roles (Borgatti et al. 2009, p. 893). Still, from the 1970s on, the anthropological interest in networks diminished as new questions were coming to the forefront in social anthropology. The concern shifted from description of power and agency in social live to issues such as identity, meaning or reflexivity, for which past network thinking did not have much to offer (Knox et al. 2006).

It was during this time that the sociological social network analysis perspective really took off through formal methodological progress. This breakthrough which focused on the description of global properties of social networks was led by a group of researchers at Harvard around Harrison White (Scott 2013). Afterwards social network analysis was ever more institutionalized as a specialized social science subfield (Knox et al. 2006).

Interestingly, Knox et al. (2006) thus summarize the emergence of network thinking in social anthropology and sociology as answers to two exactly opposite developments in their respective fields. The social network analysis tradition can be seen as a structuralist answer to individualistic and rational choice approaches in social science. The social anthropologists, however, challenged a structural-functionalist explanation of society by using networks as a way to recognize fragmentation, conflict and complexity.

What the plethora of partly ambiguous theoretical concepts surrounding the study of social networks suggests, is the need for a clear understanding of what kind of theoretical status a chosen development holds. Thus, due to the unclear status of many concepts in social network analysis, this paper will make use of social network analysis as an analytical tool, representing the established and formalized methods in the sociological trajectory. Social network analysis in this understanding provides a terminology and an array of measures for analyzing relations but does not demand the adoption of a specific theory of social structure (Scott 2013, p. 8). This complements the analogous use of network governance as an analytical framework to describe governance networks.

Chapter 3

Answering the Challenge: Dynamic Functions of Governance Networks

The challenges for governance of sustainable regional development identified in chapter 1 can be answered in a variety of ways, but crucially, "a response strategy must match the challenge" (Underdal 2010, p. 391). In this chapter, matching answers to challenges is done by first reviewing essential functions of governance networks for sustainable regional development identified in the literature. This leads to a set of four governance functions: ability for collective action, adaptive capacity, robustness and participation. These are necessary functions that governance networks must fulfill in order to enable sustainable regional development.

It is important to highlight that these prescribed functions are derived from answering the general challenges introduced by the normative concept of sustainable development. Therefore, they are inherently normative as well. Keeping in mind this important distinction, one can consider how these functions might differ in importance, depending on the phase a governance network finds itself in. This leads to a set of propositions about the functional dynamics in the development of a governance network. To analyze this development, two phases in the implementation of projects aimed at sustainable regional development are differentiated.

3.1 Governance functions as answers to challenges of sustainable regional development

Many of the challenges outlined in chapter 1 have been recognized as general problems of modern governance (Meadowcroft 2009) or new governance (Hogl et al. 2012). Sustainable development is an exemplary case in this perspective (Lange et al. 2013). Many scholars have seen an answer to these

problems in *reflexive governance*. Reflexivity in this sense describes "the capacity for continous and self-conscious societal reflection, assessment, and readjustment"(Meadowcroft 2009, p. 323).

Besides this, answers can be found in the literature surrounding natural resource management or the governance of social-ecological systems. In many ways these are similar to the ones suggested in a reflective governance approach. Still, their slightly narrower focus on physical sustainability can provide some specific insights.

These two sets of literature make it possible to identify four necessary main functions governance networks must fulfill to answer the challenges of sustainable regional development. They are illustrated in figure 3.1).
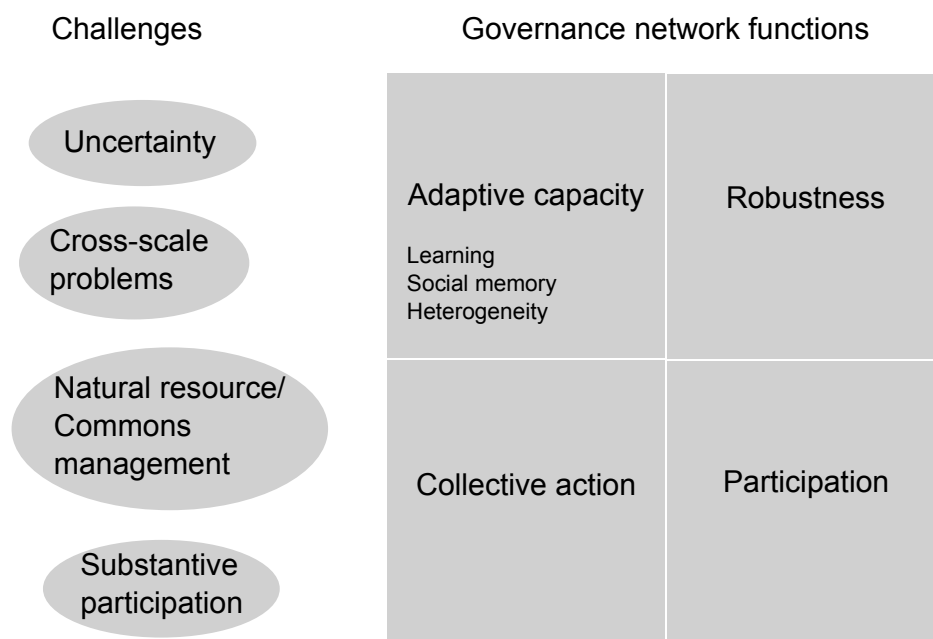
FIGURE 3.1: Governance network functions as answers to challenges of governance for sustainable regional development

Ability for effective collective action

A first and fundamental function is that a governance network must enable collective action. This is already implied by the definition of governance used in this paper which sees governance connected with the realization of collective goals.

The demand for collective action to be effective specifies a refinement of the prescription. This can be understood as the ability of a governance network to not only act but also "achieve pre-set policy targets" (Hogl et al. 2012, p. 280).

Adaptive capacity

The capacity of a governance system to adapt as well as influence unexpected change is a direct answer to the challenge of uncertainty. This capacity has been a feature of the interaction between humans and their environment throughout all of history and is needed more than ever in the current situation. The life-supporting capacity of many ecosystems can not be taken for granted anymore and regions and their ecosystems are ever more interconnected in unforeseeable ways (Folke et al. 2005, p. 442).

Adaptive capacity and resilience are thus often named as key components in this situation. These concepts are surrounded by a fair amount of conceptual unclarity (Walker et al. 2004). Importantly, they can describe different but inherently interconnected aspects of a social-ecological system.

Resilience, as coming from the ecological understanding, can be measured in the amount of disruption that is required to transform a system from one set of mutually reinforcing processes and structures to a different set of such processes and structures (Anderies et al. 2004). In an engineering sense, resilience has often been described as the speed of return to equilibrium, although this understanding does not help in situations with multiple possible equilibrium states. What is clear from the many existing definitions is that the focus is on situations where the system is removed from its modal state, and that resilience is a multi-faceted concept (Walker et al. 2004).

However, resilience is a difficult concept to apply to a partly consciously designed system (Anderies et al. 2004). It is a term which can thus not appropriately describe a governance network. Although Newig and Pahl-wostl (2010) attempt to define network resilience, their definition seems to relate not so much to resilience as to robustness, as introduced by Anderies et al. (2004). This feature of a governance network will be discussed as its own function.

Adaptive capacity (or adaptability) however can be used to link resilience to the social component of a socio-ecological system. This is possible when it is understood as the collective capacity of human actors in a system to influence resilience (Walker et al. 2004). This understanding is very useful in the context of network governance and makes a focus on adaptive capacity possible. In this sense, adaptive capacity does contribute to, but is not equal to resilience.

There is no agreement on a definite list of features of a governance system which would contribute to adaptive capacity. Still, the three features of learning, heterogeneity and enabling access to social memory are repeatedly found.

Their presence is thus understood as a necessary condition for a governance network to display adaptive capacity.

- Learning

  Learning is a foundational building block of adaptive governance (Crona and Hubacek 2010), as it enables governance to be continuously updated and improved (Bodin et al. 2006). Learning in the context of adaptive management is conceptualized as a social process, referred to as social learning, which is elaborated in the literature on organizational learning and happens in formal as well as loosely structured organizations (Folke et al. 2005).

  From a network perspective, Newig and Pahl-wostl (2010) identify two key functions which encourage learning. Information transmission on the one hand refers to the capability of a network to transmit information between the various actors. Deliberation on the other hand describes a situation where ideas and arguments are exchanged in an atmosphere devoid of power asymmetries.

  Learning though can be further disentangled with the addition of single-loop and double-loop learning. Single-loop learning happens when an action has not achieved its intended results and is corrected without changing fundamental values, staying within establish routines. Double-loop learning implies a paradigm shift and a fundamental change in routines (Newig and Pahl-wostl 2010).

  Double-loop learning seems to bear similarities to another important concept in governance for sustainable development, which is transformability. Transformability describes the capacity to introduce a fundamentally new system when the old one is deemed fundamentally unfit (Walker et al. 2004). The ability for double-loop learning is thus a specially important feature of governance for sustainable regional development.

- Social memory

  Social memory describes the collective memories and experience which can be drawn upon in times of change and uncertainty (Bodin et al. 2006). It provides links between the past, present and future, as previous experiences with past adaptions, which are embedded in a deeper level of values, can be accessed when needed. Social networks are the medium through which this access is possible (Folke et al. 2005). From a network governance perspective, a network for sustainable regional development should thus provide a structure which enables decision makers to tap into social memory.

- Heterogeneity

  The collective knowledge base of a network increases with the diversity of actors in a network. Crucially, this makes access to innovation (Bodin et al. 2006) and the development of specialized knowledge possible (Bodin and Crona 2009). In the context of sustainable community development Dale and Newman (2008, p. 9) argue that a suitable network structure has to be open and diverse and connected horizontally as well as vertically. No community has the capacity to implement sustainable community development in isolation. A governance network

should thus include a variety of actors with different viewpoints. This might also contribute toward the better integration of a cross-scale and cross-level perspectives on issues.

Robustness

Anderies et al. (2004) examine robustness in a broader treatment of what makes social-ecological systems robust. They define robustness as "the maintenance of some desired system characteristics despite fluctuations in the behavior of its component parts or its environment". Robustness in this sense is another way for a system to deal with uncertainty. It deals less with adaption but more with "buffering capacity" (Bodin et al. 2006) in times of change. Thus it describes a further prescription for a governance network dealing with sustainable regional development.

A governance network must fulfill different conditions for robustness than an entire social-ecological system though. It operates on a different scale, involving only the social part of the social-ecological system. This is where the definition of network resilience by Newig and Pahl-wostl (2010) seems helpful. They define network resilience as the capacity of a network to remain intact in its basic functions when subject to pressure or sudden change. This will be used as a definition of network robustness in this thesis.

Participation

Substantive participation has been identified as an important imperative in sustainable development. How can this aspect of participation be turned into a functional prescription for network governance?

Meadowcroft (2004) identifies three strands or perspectives on enhancing participation in public decision-making, based on three focal constituencies. These are either citizens, stakeholders or communities. From the perspective of governance for sustainable development, the group-based stakeholder strand offers the most promising way of enhancing participation. Groups accurately represent the views of their members, gather specific knowledge and enable effective deliberative processes. Crucially, they also ensure continuity in a participatory process due to their relative longevity (Meadowcroft 2004, p. 180). This last feature is especially important in the context of sustainable development.

The actors in a network governance perspective are oftentimes organizational actors, representing different stakeholder groups. The connection to the promising stakeholder strand seems obvious. Thus, a governance network can be seen as a way of enhancing stakeholder participation. Therefore, a governance network itself already reaps the instrumental benefits of participation.

However, the substantive imperative for participation is not entirely done justice in this logic. While participation in an instrumental sense can be a way to achieve goals of sustainable development, in

a substantive sense it is also a challenge in itself. This is based on normative demands coming from a perspective rooted in democratic theory. The main challenge thus relates more to the quality of participation in a governance network.

The quality of participation relies heavily on processional criteria such as the perception of fair and inclusive procedures (Meadowcroft 2004, p. 165). This can not be covered by the inherently structural analytical perspective chosen in this thesis. In this way, participation serves to highlight a first limitation of the chosen analytical perspective of this thesis. It will not be further focused on.

The ramifications of this limitation are not that far-reaching though for three reasons. First, the instrumental benefits of participation (such as a wide knowledge base) are already well-covered in a governance network which involves a variety of actors. Second, if a governance network fulfills the conditions for being a stakeholder-based form of participation, it already provides fruitful ground for a mode of substantive participation which is in line with the demands of sustainable development (Meadowcroft 2009). Third, perceptions of fairness in procedures or other assessments of the quality of participation could possibly be augmented in further studies analyzing governance networks.

Beyond this, the case of participation is a clear illustration of another very important argument. Structure can go a long way in exploring the performance of a network - but it is surely not its sole determinant (Robins et al. 2011, p. 1310).

3.2   The importance of a dynamic perspective

A static perspective of governance networks cannot do justice to the challenges posed by sustainable regional development. The main research interest of this thesis is to develop an understanding of how governance networks change during the implementation of sustainable regional development projects. A dynamic perspective of governance networks is of crucial importance in the context of sustainable regional development for three reasons.

First, *dynamic challenges* characterize governance for sustainable regional development. Examples for this can be found in all the main challenges identified for sustainable regional development. Uncertainty increases, the further into the future one looks (Underdal 2010, p. 387). Cross-scale challenges are an essential dynamic element of social-ecological systems and subject to constant change. Beyond this, some cross-scale challenges can explicitly refer to temporal scales (Cash et al. 2006). The management of natural resources in a region is also likely to face constantly evolving conditions depending on the interplay between human and biophysical components of the social-ecological system (Anderies et al. 2004). Ensuring substantive participation is also an ever-evolving challenge because of the dynamic nature of sustainable development as a concept of reflexive societal steering (Meadowcroft 2004, p. 165), involving important questions of intergenerational equity (Lafferty 2004). Thus, the relative weight and importance of the challenges for sustainable regional

development outlined in chapter 1 will change over time. Sustainable development is always set in time. It is crucial to develop an understanding of what this implies for a governance network aimed at enabling it.

Second, examining changes in governance networks for sustainable regional development offers a chance to fruitfully *combine insights of two related literatures*. For one, the general policy analysis literature has been interested in the dynamics of the policy-making process for a long time (Howlett et al. 2009). More recently, this has also been applied specifically to the evolution of policy networks, (Lubell et al. 2012) although not yet very far-reaching. The policy analysis literature can thus bring a dynamic perspective to the table. This especially entails the helpful identification of different phases in a policy-making process. On the other hand, the literature surrounding governance for sustainable development essentially has explored implications of the normative concept of sustainable development for governance (Meadowcroft 2009; Lafferty 2004). This has been used in this thesis to identify essential functions a governance network has to fulfill to enable sustainable regional development. Hypotheses answering the initial research question can thus be derived from a combination of these two literatures. They concern the changes in governance functions during the development of a governance network aimed at sustainable regional development.

Third, there is a clear *lack of empirical studies* of governance networks which adopt a longitudinal perspective and provide adequate data (Janssen et al. 2006). This is especially the case in connection with issues related to sustainable development (Bodin and Crona 2009). Given the obvious but important observation that the sustainable development challenge as well as social networks are "dynamic by nature" (Snijders et al. 2010, p. 44), this can be somewhat surprising. Mostly, the lack of studies is due to the fact that multiple observation periods can be very hard to gather for specific policy networks (Lubell et al. 2012, p. 361). Exploring hypotheses connected to changes in governance networks for sustainable regional development can break new ground and close holes in the existing literature in this regard. There is scant knowledge until now about how these kinds of governance networks develop over time based on an empirical studies.

3.3 Changing functions between two implementation phases

This thesis differentiates between two levels of change in a network. Changes in *function* can be differentiated from changes in *form*. This distinction between two levels of change is inspired by the wording of a well-know functionalist concept in European integration theory (eg. Scharpf 1999). Changes in function are answers to changes in the relative weight challenges of sustainable regional development over time. Thus, changes in functions refer to a corresponding changing relative weighting of the importance of the four main governance function for sustainable regional development outlined in section 3.1.

The current phase of the governance process will dictate which structural characteristics are most likely to be beneficial (Bodin and Crona 2009). In natural resources management, there is a relationship between the evolvement of a network and the structure and performance during different time phases, which adhere to different functions (Carlsson and Sandström 2008, p. 49).

In relation to the concept of the policy cycle (Howlett et al. 2009), the implementation of a project aimed at sustainable regional development can be divided into two phases. These will be called *initiation* and *consolidation* phases. Starting with an initiation phase and after its adoption, a project afterwards has to move towards a phase of consolidation, which differs significantly from the first. The formulated phase distinction is inspired by Bodin and Crona (2009, p. 372) who list initiation, reorganization, consolidation as examples of phases in a governance process.

The initiation phase of a policy overlaps with agenda setting and policy adoption. Initiation is an often overlooked point but very important phase in the broader policy cycle (Crow 2010, p. 144). During the initiation phase, a dedicated policy subsystem is involved in discussing potential policy options (Howlett et al. 2009, p. 12). This coincides well with the understanding of a regional governance network developed in this thesis.

The essential decision making on the adoption of certain policy options might be based on a small number of authoritative actions in a policy subsystem. However, the further process of implementation, which follows after a course of action has been decided upon, again involves the whole policy subsystem (Howlett et al. 2009, p. 13). Now, the decisions have to be put into practice and this usually involves the inclusion of a diverse set of actors (Howlett et al. 2009, p. 160). Again, this fits in well with the view of network governance developed in this thesis. The consolidation phase of a project describes a phase when the initial momentum has to be turned into institutionalized practices which are effective and can endure over time or until a subsequent phase of evaluation and problem formulation is entered.

The two phases can now be related to theoretically expected changing functions. Two main dynamics in functions can be identified and will be further investigated in this thesis.

Maintenance of collective action

The initiation phase is especially important if local governments within a federal system are in focus. Here, the initiation of a new policy requires the coordination of a variety of different actors (Crow 2010, p. 144). To achieve such coordination, a governance network has to perform especially well in fulfilling the function of inducing collective action during the initiation phase. Launching a project aimed at sustainable regional development requires a certain amount of cohesion (Hirschi 2010). Initiation is a phase when "attention turns to action" and actors need to make a certain amount of binding decisions concerning the future of the project (McAllister et al. 2013). Van Buuren et al.

(2014, p. 1030) also found this shift towards an emphasis on increased collaboration in a governance network during the development of a masterplan for a Dutch climate change adaption project. A governance network in the initiation phase is thus mainly expected to provide a setting for enabling collective action.

Berardo and Scholz (2010) develop a general risk hypothesis of network development. They suggest that relatively simple tasks are dealt with by a governance network relatively early on. This requires less substantial investment in structures which enable a network to overcome complex problems of collective action. However, as a network matures, the complexity and risk involved with projects increases. Actors deal with this by developing stronger bonds, enabling more effective collective action. Thus, it is expected that keeping up collective action retains its importance during the consolidation phase.

The theory suggests that enabling collective action is a key function of a governance network during both phases. It can thus be expected that this function retains its importance over time.

Increasing robustness and adaptive capacity

Ensuring robustness and promoting adaptive capacity become more prominent functions during the shift from initiation to consolidation. This can be understood in relation to changing challenges, especially considering uncertainty. Increasing uncertainty is associated with the adoption of a more long-term view. This demands a focus on preparing for possible future disturbances (Luthe et al. 2012, p. 840). As actors adopt a more long-term view, they ready themselves for uncertain times ahead. Even if a consolidation phase is characterized by relative stability, actors might be led to form new ties in anticipation of potential times of change (Bodin and Crona 2009, p. 372). Increasing robustness is thus expected to gain in importance in order to *absorb* disturbances.

In order to *respond* to possible disturbances, learning capabilities and heterogeneity are, however, needed. Accessing social memory also becomes more important, as more knowledge in the network develops (Luthe et al. 2012, p. 840). Increasing adaptive capacity is thus also expected to become increasingly important.

Chapter 4

Connecting Function to Form: A Network Theory of Social Capital

How do changes in functions manifest in the changing form of a network? This is an important question for the further development of the propositions developed in section 3.2 into testable hypotheses. One way of arriving at answers to this question leads via a network theory of social capital. It offers a theoretically grounded way to connect the changes in prescribed normative functions to changes in structural network form.

In a nutshell, social capital has different sources and consequences (Woolcock 2001). Different sources of social capital can enable different network functions. A change in functions should thus lead to changes in required sources of social capital. These changing sources then manifest in hypothesized differences in network form. These can in turn be analyzed using social network analysis.

A network theory of social capital offers an established theory, differentiating two main sources of social capital: closure and structural holes. This is not a novel conceptual development, but based on Carlsson and Sandström (2008), who relate social networks via social capital to outcomes of natural resource governance. Their approach is adapted to sustainable regional development in this thesis. Figure 4.1 illustrates this argumentation and the investment of social capital theory to develop the propositions about changes in network functions into testable hypotheses about changes in network form.

This chapter proceeds by first reviewing the state of social capital theory and introducing a network theory of social capital based on Burt (2000). Second, it reviews which sources of social capital are required to enable the governance functions outlined in chapter 3.1. Third, potential trade-offs between closure and structural holes are discussed. Fourth, a set of dynamic hypotheses can now be developed for the relationship between the phase change during the implementation of a project aimed at sustainable regional development and the change in required sources of social capital.
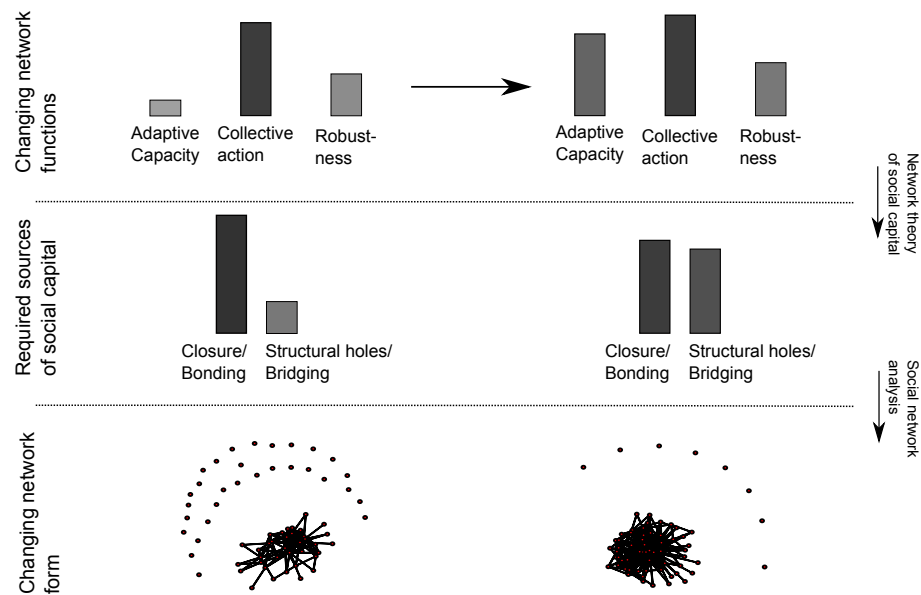
FIGURE 4.1: Illustration of dynamic hypotheses and theoretical investment of social capital theory
to trace changing functions in network form

4.1   A developing theory: From Bourdieu to Putnam

The first ones to use the term social capital in a systematic manner were Pierre Bourdieu and Samuel
James Coleman (Häuberer 2011; Woolcock 1998). For Bourdieu, social capital is one the three kinds
of capital in his theory of praxis and refers to the benefits an individual can secure through relation-
ships, by gathering support and producing trust. Coleman's concept of social capital is more rooted in
rational choice theory. Social capital in his view is a special resource as it is productive as other forms
of capital but shapes the structure of constraints surrounding an individual, facilitating the achieve-
ment of certain goals. Both concepts represent a starting point toward a theory of social capital but
fall short of providing a theory which can be formalized and refuted. Also, they both neglect social
capital in non-institutionalized relationships and potential negative effects of social capital (Häuberer
2011).

Reviewing these gaps in early conceptualizations of social capital, Häuberer (2011, p. 51) identifies
four characteristics of a social capital theory. One important characteristic in the context of this paper
is the fact that social capital can be an individual (private) or public good and therefore has to be
analyzed at micro and macro level of society. Also, social capital may be produced in institutionalized
and non-institutionalized relations of varying types such as trust, authority or formal organization.

In the further development of social capital theory, Putnam et al. (1993) built on Coleman's work
and introduced a 'civic perspective' (Häuberer 2011, p. 53) on social capital. Putnam's perspective
sees social capital as the value that social networks contain for individuals but also for society as a

whole. Social capital enables individuals to reach collective goals. Putnam's perspective therefore recognizes a collective as well as individual value of social capital.

One components of social capital is trust, which increases the level of cooperation in a society. There are two other components of social capital, which are connected to trust. On the one hand, trust grows out of networks of civic engagement, which are associations above the private but below state level, often referred to as civil society. On the other hand, Putnam stresses the importance of reciprocal norms for the emergence of trust (Häuberer 2011). Thus, social capital consists of horizontal relations between people, which have an effect on the performance of a community (Lehtonen 2004), political as well as economic.

In other widely used terminology, social capital can be bridging or bonding. *Bridging* social capital connects people that are quite different, while *bonding* social capital refers to relations between people who are similar.

4.2   A network theory of social capital: Two main sources

There are different types, forms and combinations of social capital (Woolcock 1998, p. 159). If one is interested in the relation between social capital and various measures about the performance of a network, mainly two sources of social capital are of interest (Sandström 2011, p. 294). In a network, Burt (2001) distinguishes these two sources as either based on *structural holes* or *closure*. They stand on opposite sides of a spectrum of network characteristics in many ways. As such they represent two main sources of social capital in networks.

Bridging and structural holes

For Burt (2000), the most relevant source of social capital confirmed in empirical research has been associated with the brokerage across structural holes. Structural holes exist when relationships between two contacts separate nonredundant sources of information in a network. Such relationships span bridges between parts of the network that have access to different information, which people on the other side can't reach. Thus, if a person would lose such a relationship, there would be no way left to reach this information, making it nonredundant. People in a network can now draw benefits from structural holes by bridging them. This way, they play the role of 'tertius gaudens', accessing new information earlier and exercising control over it (Burt 2000). Crucially, this understanding of the source of social capital is most persuasively located at the individual level and not necessarily a structural feature of a network (Häuberer 2011, p. 95). The structural holes argument can be expanded onto an organizational level though, which Burt (2000) mostly discusses in firms. If those are composed of individuals who bridge many structural holes, the organization as a whole becomes more innovative and learns faster.

Bonding and closure

Structural holes are one way of looking at the network structure of social capital. The other one is closure. The closure argument is much stronger connected to Coleman's, Bourdieu's or Putnam's understanding of social capital. It rests on the assumption that cohesive networks, where everyone is connected to everyone else, are the sources of social capital. In such networks, information is easily spread and accessed. Also, as everyone can keep an eye on everyone else, threats of sanctions become credible and lead to increased general trust (Burt 2000). It seems clear that in perfectly cohesive networks, no structural holes exist, as all sources of information for every actor are redundant. They could be easily replaced with another actor who has access to the same source. The closure argument works on the individual level as an individual who is embedded in a more dense network has more social capital. He or she is able to count on trustworthy relations and easy access to information. But closure also works the same way as a structural feature of a network.

The structural holes argument is mainly about the importance of bridging ties (Sandström 2011). Bridging ties span holes in the social structure and and thus provide the benefits of the 'weak ties' made famous by Granovetter (1973). The closure argument on the other hand rests on the importance of strong, bonding ties.

4.3   Connecting function to form

In this section, the governance functions identified in section 3.1 are connected to structural network characteristics (form). This is based on the network theory of social capital outlined in section 4.2. Required sources of social capital are each examined for every function. This leads to an understanding of how social capital sourced from the two distinct sources influences governance network functions, which is displayed in an overview in table 4.1.

Effective collective action

Factors which enable a governance system to overcome problems of collective action have been extensively studied by scholars applying the institutional analysis and development framework (Ostrom 2007). Trust and norms of reciprocity are important prerequisites for collective action (Ostrom 2000, p. 149). The facilitation of collective action is often put forward as a consequence of high social capital (Bodin et al. 2011, p. 16). Mostly, this refers to social capital sourced from closure. This implies dense networks based on a large amount of bonding social capital, connecting similar people, where trust is created and information can spread quickly to all components of the network.

However, there are arguments that bridging social capital also has a role to play. Bridging social capital can potentially give access to vital external resources, which enable collective action that would otherwise not have been possible (Bodin and Crona 2009).

Robustness

The concept of redundancy of ties in a network seems well suited to translate the understanding of network robustness introduced in this paper into a structural characteristic. As discussed in Bodin et al. (2006), redundancy of actors in a network implies that their loss or failure can be compensated by other actors fulfilling the same role. This redundant wiring contributes to the attack tolerance of large networks in general (Albert et al. 2000).

Social capital which provides the benefits of redundancy thus seems to come from closure in networks rather than from the diversity implied by structural holes. Closure within a group of actors implies a higher level of similar, redundant ties.

Adaptive capacity

In section 3.1, adaptive capacity was divided into the three components learning, social memory and heterogeneity. They all represent necessary but not sufficient conditions for a governance network to display adaptive capacity.

Learning

Burt (2000, p. 366) puts forward the hypothesis that organizations with collaboration networks that more often bridge structural holes in their surroundings learn and innovate faster. He identifies a number of empirical studies which have shown this association, although stops short of identifying concrete causal mechanisms. On the network level, this ability of organizations to innovate faster might play an essential role when adaption to fundamental change is necessary. Structural holes offer ways for individuals to bring organizations with different knowledge bases in contact and thus forge new innovative perspectives. Thus, networks rich in structural holes might be more able to engage in double-loop learning, as their members are not "trapped in their own groupthink" (Newig and Pahl-wostl 2010).

However, network characterized by closure also provide some benefits for social learning. Information transmission in cohesive networks is much faster, as information can spread quickly to all parts of the network (Bodin and Crona 2009; Janssen et al. 2006). Social capital sourced from closure might also provide more possibilities for genuine deliberation, leading to the production of new knowledge (Newig and Pahl-wostl 2010).

Social memory

Social memory is understood as cultural capital (Folke et al. 2005), which decision-makers draw upon in times of turbulence through the medium of social networks. Although social memory is an important topic for the adaptive capacity of governance systems, there is scant literature on the structural characteristics of networks which facilitate drawing upon it. Bodin et al. (2006) indicate reachability and density as key characteristics. This seems to hint towards an essential point. If social memory is cultural capital which is widely dispersed within a network, easy access for actors to the whole network enables them to reach it more easily. In fragmented networks with many structural holes, important knowledge might not be easily accessible.

Heterogeneity

The prescription for governance networks to include a heterogeneous set of actors in order to strengthen adaptive capacity indicates an effect of social capital sourced from the bridging of structural holes. It is exactly nonredundant clusters of knowledge which are separated by structural holes and thus are the source of diversity (Burt 2000).

Source of social capital	Governance function		
	Effective collective action	Robustness	Adaptive capacity
Structural holes/ Bridging Open networks with many weak ties	Access to external resources	No effects	Double-loop learning Innovation Wide knowledge base Heterogeneous actors
Closure/ Bonding Closed networks with many strong ties	Information transmission Trust	Redundancy of ties	Deliberation Information transmission Access to social memory

TABLE 4.1: Consequences of closure and structural holes as sources of social capital for three governance functions

4.4   Closure and structural holes - Avoiding trade-offs

There seems to be an inevitable trade-off for network structures which aim at promoting sustainable regional development. At the same time, they must achieve a number of things. They have to be cohesive and based on strong ties to enable collective action, although collective action might also be enhanced by access to external resources from bridging ties to external actors. Similarly, networks must include to a heterogeneous set of actors to expand the collective knowledge base and ensure

adaptive capacity. But again, such high heterogeneity might be detrimental to their robustness and impede genuine deliberation. An illustration of this problem is given in figure 4.2.

However, conceptualizing this dilemma as a trade-off is not necessarily helpful. The benefits of bridging structural holes and closure might not add up to a zero-sum game. This is due to the fact that these benefits may accrue on different levels. It may be that closure might in fact be necessary to effectively profit from the benefits of structural holes (Burt 2000, p. 36). A network may thus span many global structural holes, thereby reaching out to a diverse set of other network constellations. Global structural holes thus refer to benefits gathered by bridging to other networks or the inclusion of actors which are integrated in other important networks. At the same time a network can still locally contain structures characterized by closure (Carlsson and Sandström 2008, p. 41).

In this way, a system for long-term environmental governance can promote the development of knowledge but still transform conflicting interests into effective and sustained collective action. Such a a network structure may "provide a carefully differentiated framework that combines elements of the adaptive governance model – to enhance flexibility, diversity, and learning capacity – with components of the collective action model — to ensure focus, energy, and sustained commitment" (Underdal 2010, p. 392). Thus, trade-offs between structural features related to different sources of social capital may be avoided.
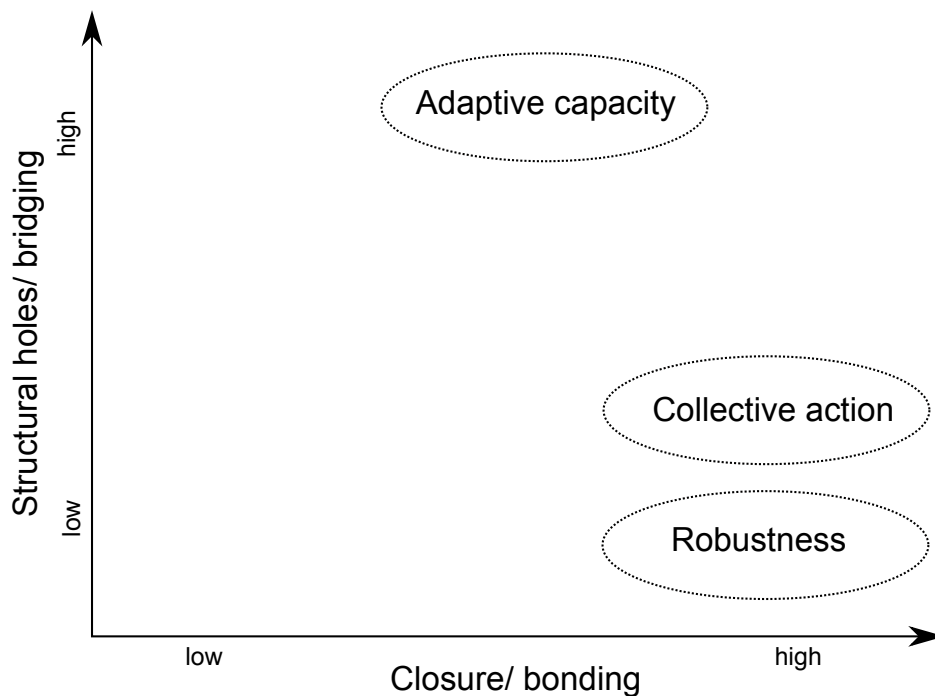

FIGURE 4.2: Two main structural network characteristics as different sources of social capital related to enabling governance functions

4.5   Hypotheses about changing form between two implementation phases

In this thesis, changes in function are understood to reflect in changes in form. Section 3.2 identified theoretically expected changes in functions due to a phase change during implementation. These functions have then been identified as requiring different sources of social capital in section 4.3. In this section, a set of testable hypotheses is derived from these considerations. The main independent variable therein is the phase change between initiation and consolidation phase. The dependent variables are structural changes in network form. These dependent variables refer to the amount of *network self-organization* towards different sources of social capital.

The causes of structural changes can be found in mechanisms which play within the network itself. Identifying such forces has played an increasingly prominent role in recent network research. The underlying assumption is one of perceiving macro-level changes in network structures as dependent on a number of micro-mechanisms (Snijders et al. 2010, p. 44). Network self-organization refers to the fact that ties in networks may change solely because of the distribution of other ties. For example, a strong mechanism of "friends of my friends are my friends", leads ties to self-organize to produce triangular structures (Snijders et al. 2006, p. 101). Important mechanisms in this vein are reciprocity, closure, dispersion of the degree distribution and associations between different networks (Robins et al. 2012, p. 381). The focus of this thesis is to to identify changing dynamics of network self-organization and connect these to changing functional demands. In connection with the theoretical framework, the main focus thus lies on self-organizing dynamics in connection with closure and bridging/ structural holes.

A maintenance of capacities for collective action has been identified as a first expected functional dynamic between the two implementation phases. Based on the effects identified in this chapter, this leads to an expected maintenance of a high amount of social capital sourced from local closure and bonding ties during the development of a network.

A second functional dynamic expects an increasing importance of adaptive capacity and robustness. This leads to a further set of expectations proposing a maintenance local closure. First, based on the positive effects of local closure on access to social memory, information transmission and deliberation, adaptive capacity is accepted to be strengthened by increased local closure. The same positive effect of local closure also applies for the robustness of the network.

> **Hypothesis 1.** During the shift from initiation to consolidation of a project for sustainable regional development, a governance network will maintain a high amount of social capital sourced from local closure in order to enable collective action, adaptive capacity and robustness

However, increasingly cohesive, dense networks have a negative effect on adaptive capacity after a while, through processes such as homophily (Bodin and Crona 2009, p. 368). To further strengthen

adaptive capacity, it is thus necessary that the network "reaches out" to other network constellations. This implies the development of ties spanning global structural holes. The inclusion of a heterogeneous actors set with a wide knowledge base and a capacity for innovation and double-loop learning is guaranteed in this way.

Hypothesis 2. During the shift from initiation to consolidation of a project for sustainable regional development, a governance network will increase social capital sourced from spanning global structural holes in order to increase adaptive capacity

Thus overall, it can be expected that the network becomes locally more dense and reaches out by bridging global structural holes. This would also mark a trend towards the more general structure suggested by Carlsson and Sandström (2008) in section 4.4.

Part III

Empirical Analysis

A NUMBER OF PROBLEMS which face rural regions in Switzerland have been identified in chapter 1. Sustainable regional development has been suggested as a developmental pathway best suited to confront these challenges. It has further been argued that sustainable regional development contains a governance challenge, which can be fruitfully explored from a network perspective.

A number of structural characteristics have been reviewed, which help to enable a governance network to take up the challenge of sustainable development. Introducing a dynamic view, hypotheses about the development of a governance network implementing sustainable regional development have been put forward.

But what does governance for sustainable regional development look like on the ground? What kind of changes can empirically be found in a governance network over the course of its development? Can the hypothesized self-organizing dynamics be found?

This part describes the procedure chosen to investigate the hypotheses developed concerning the development of a governance network for sustainable regional development. The test case chosen for this is the regional nature park of Thal. The part proceeds in three steps.

First, in chapter 5 the design of the empirical analysis is outlined in detail, alongside the methods chosen to analyze the data. The regional nature park of Thal is shortly introduced. It will be argued that it represents a suitable case to explore the hypotheses developed in this thesis. The analysis consists of an exploratory analysis followed by statistical modeling based on exponential random graph models. Second, the results of the performed analyses will be presented in chapter 6. Third, the results will be discussed in relation to the initial hypotheses in chapter 7.

Chapter 5

Research Design and Methods

5.1   Study design

The study design chosen to explore the hypotheses developed in this thesis is a single-case time series study consisting of two observations. The case is the regional nature park of Thal which represents a governance network aimed at promoting sustainable regional development. Conducting a time series study has three main advantages in the context of this thesis. First, the possibility of gathering longitudinal data for a policy network is a rare chance on its own and necessary in the context of this thesis. Second, the time-series structure offers the possibility to control for case-specific variables and explore causal mechanisms in the development of the governance network. This would not be the case in a cross-sectional analysis. Third, exploring a single case offers the possibility to qualitatively understand the development of the park. Exploratory interviews can be conducted and written documentation explored in a more feasible manner, given the limited time available.

To trace the development of the governance network surrounding the regional nature park of Thal, network data from two observations is used. Data for the first observation had been gathered during the initiation of the park project in 2008. Data collection took place right after the region had officially submitted its park project. A cross-sectional analysis of this time period has already been conducted by Hirschi (2010).

For this thesis, data for the second observation was collected in the first half of 2014 to augment the existing data set. By then, the park project had been in existence for more than six years. It had entered a consolidation phase, dominated by readjustments and reflections about goal attainment. The process of applying to the federal government for the extension of the park project, due for every park after ten years of existence, had also already started to become a topic.

5.2   Case selection

In this section, the Swiss regional nature park policy will be briefly introduced. It will be argued that regional nature park projects provide suitable examples in order to examine the implementation of sustainable regional development. Afterwards, the regional nature park of Thal is described as a specific case.

The Swiss regional nature park policy

Regional nature parks are an integral part of the national Swiss park strategy, which in turn is an essential part of Swiss regional development policy. The legal foundations for the establishment of parks can be found in a revision of the federal act on the protection of nature and cultural heritage, enacted in 2007. It gives the federation the power to support the establishment, operation and quality control of parks with global funding. The federation assigns the park label based on a set of criteria and only if the initiative for the establishment of a park is taken by local stakeholders. The parks policy attempts to position park regions as nationally and internationally recognized areas of high landscape and nature quality. At the same time, parks also should guarantee sustainable regional development with broad participation (BAFU 2010).

In order to achieve this goal, three categories of parks were established, of which regional nature parks are one. Regional nature parks hold the principle of sustainable development at their core. They are supposed to strike a balance between advancing sustainable business activities as well as maintaining and enhancing a rich natural and cultural landscape (Art. 23g, Federal Law on the Protection of Nature and Landscape, Federal Authorities of the Swiss Confederation 2014). This landscape orientation has also made them promising policy instruments to achieve coherent regulation of landscapes, which can be seen as difficult resource to manage (Gerber and Knoepfel 2008).

Besides regional nature parks, there are national parks, which are focused on strict nature protection in the classic sense of preserving unspoiled habitats for indigenous species and plants (Art. 23f, Federal Law on the Protection of Nature and Landscape, Federal Authorities of the Swiss Confederation 2014). The third category of parks which can apply for a federal label are nature discovery parks, which are characterized by their proximity to densely populated areas. They are supposed to provide nature experiences and environmental experiences to the public (Art. 23h, Federal Law on the Protection of Nature and Landscape, Federal Authorities of the Swiss Confederation 2014). The geographic location of applying and established parks is shown in figure 5.1.

Regional nature parks are a prime example for studying the implementation of regional sustainable development. First, due to their explicit demand for local participation and the involvement of local actors in their establishment regional nature parks not only foster regional governance networks - these networks are an integral part of their existence. Second, the governance surrounding a regional
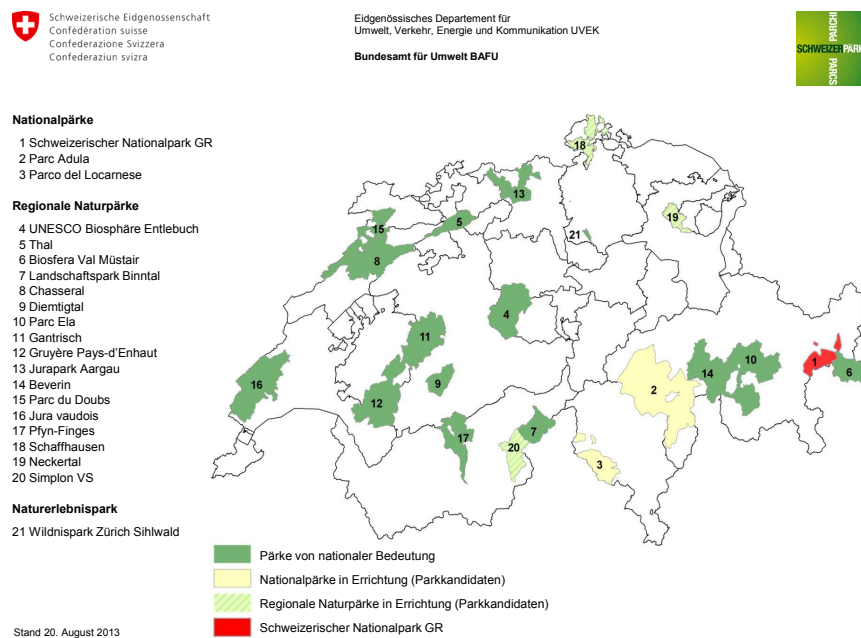
FIGURE 5.1: Map of regional nature, national and nature discovery parks in Switzerland in 2013.
Numbers 4-18 indicate regional nature parks. Number 5 indicates the regional nature park of Thal.
Source: http://www.bafu.admin.ch/ [accessed 15.5.2014]

nature park are built around a label and strategy which holds the principles of sustainable development
at its core.

The regional nature park of Thal

Among the problems facing rural regions, chapter 1 identified the diminishing importance of tradi-
tional economic sectors such as forestry or agriculture, alongside the gravitational pull of urban areas
for the increasingly important service sector. This may lead to the marginalization and depopulation
of rural regions. It leaves Swiss rural regions in a dilemma. Tourism is oftentimes the only area of
potential growth left in many areas, but intensive land use can degrade the very landscape, which is
the source of a region's touristic potential (Hirschi 2010).

The Thal region is no stranger to these processes. Population growth in the region has stagnated over
the last three decades, while there has been continuing, long-term population growth in Switzerland
as a whole as well as in the canton of Solothurn. Job growth has been below the cantonal average in
recent years. The services sector has grown less compared to the total amount of jobs in all sectors.
The unemployment rate in the region is slightly below the cantonal average (Schwaller et al. 2012).

The region itself is situated in the Swiss canton of Solothurn, within the broader Jura mountain
range. It consists of the nine municipalities Aedermannsdorf, Balsthal, Gänsbrunnen, Herbertswil,

Holderbank, Laupersdorf, Matzendorf, Mümliswil/Ramiswil and Welschenrohr. Together, they form the political district of Thal. The park perimeter conforms to the borders of the political district.
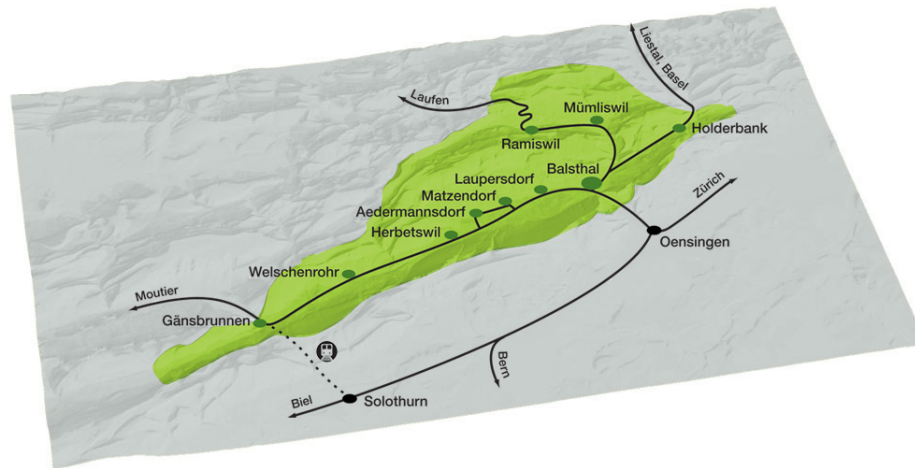
FIGURE 5.2: Border of the regional nature park of Thal. Source: http://www.naturparkthal.ch/ [accessed 30.5.2014]

Biogeographically, the region contains a number of species and habitats of distinct natural value. In terms of habitats, these are especially species-rich dry meadows and sparse woodlands, as well as limestone cliffs which host specific biologic communities. Concerning individual species, the perimeter of the nature park is home to a number of populations, which are of importance in a national context due to their relative size and endangered status. Examples are *Lynx lynx, Teatro urogallus, Iberis saxatilis* or *Lullula arborea* (Verein Region Thal 2005).

Actors in the Thal region recognized the suitability of the region as a regional nature park early on. After efforts had been put underway, the region was the first park to be awarded the regional nature park label in 2009. As the oldest of its kind, the regional nature park of Thal thus makes for a good case in a longitudinal setting.

Some difficult issues during the implementation of the project were named in exploratory interviews before the start of data collection. For one, it proves to be difficult to keep local restaurants and hotels interested in entering labeling partnerships with the park. Identifying and communicating concrete outcomes of the park project to the public also poses a challenge. Some criticized that too much emphasis was laid on promoting regional products. This included nature protection organizations who saw little improvements on protection issues. Further, after the long-serving director of the park management team left his job in 2012, a newly appointed director already left again in 2013, producing some insecurity. The most relevant recent development is the formal integration of the park project management team into the regional development association. Beforehand, the two were separate entities. It was argued that their combination into one organization would serve to better separate strategic and operational responsibilities in connection with the park project (Schwaller et al. 2012). What the practical repercussions of this change will be remains to be seen.

5.3   Data collection

Network boundary

A high focus was laid on ensuring maximum comparability between the two observations. For one, this meant that the boundaries of the two networks were established in a way as to be confident that the same type of network was captured at both points in time. Setting a network boundary is always a theoretically informed decision. The social construction of relations means that social networks do not have boundaries, which can be obviously identified (Scott 2013, p. 44). This meant coming up with a way to get a hold of the relevant actors involved in the governance network surrounding the initiation as well as the consolidation phase of the park project. In both observations, actors were not individuals but collective actors (Fischer et al. 2012), representing organizations such as public agencies, firms and civil society organizations.

To establish the network boundary in the first observation, a positional approach was chosen, which identified actors based on formally defined positions and group memberships (Scott 2013, p. 45). This involved exploring written documentation and exploratory interviews with key actors in the region (Hirschi 2010).

For the second observation, this approach was repeated in the same way. It involved a combination of methods to identify relevant actors. First and as a basis for the further procedure, the existing list of actors was reviewed and checked to ascertain whether the actors still existed. Second, further possible actors involved in the management and development of the park were identified based on written documentation. This involved a list of actors who were involved in a "Zukunftsbild" workshop, which started in the beginning of 2014. The workshop had the goal to develop a common vision and shared goals for the Thal region. This goal linked in well with the overarching aims of the park projects. Third, a reputational approach (Scott 2013, p. 46) was used to refine the final network boundary. The augmented list of actors was reviewed by the project leader of the park and a former scientific advisor to the park project who were asked to identify actors, which were relevant in the current management and development of the park. In cases where both agreed on the irrelevance of an actor, that actor was taken off the list.

Survey design

In 2008, a standardized questionnaire was sent by regular mail. In 2014, a standardized online survey was carried out using Typeform (Typeform 2014). The survey was sent out via email in the beginning of April. After two weeks, the response rate had already exceeded 50%. Later, a first reminder email was followed up by a number of phone inquiries to non-respondents and data collection was finished at the beginning of May. The final response rate was 81%.

Actors were asked to nominate actors from a list of all other actors in the network with whom they *closely collaborated* during the establishment (for 2008) and management of the park or related projects (in 2014). They also had the possibility to identify further relevant actors who they thought were missing. To ensure maximum comparability, the wording of the question for the collaboration network was chosen to be as similar as possible for both observations. The questionnaires of both surveys can be found in tables A.2 and A.3 in the appendix.

Both surveys also contained a small number of almost identical questions relating to the overall satisfaction of the actor with the park project and an assessment of park goal achievement.

The surveys were designed to be maximally comparable in the dimension on which the longitudinal analysis would take place, namely the close collaboration network. Due to a slight change in focus between observations they also contained some differences. For the first observation, the survey contained some measurements for actor reputation, the formation of ties due to the park project and the quality of interaction. These measures were dropped in the second survey, to keep it as simple as reasonably possible. As the network had grown significantly between the observations, keeping the survey simple represented an attempt to maintain good response rates. Also, the formation of new ties had now become observable by comparing the two networks.

The second observation added a measurement of a set of additional ties. This was done to allow for additional statements about sub-group closure based on structural equivalence in a multiplex setting. A multiplex relation means that more than one tie can occur at the same tie in dyadic relation. A governance network is thus seen to constitute of a number of types of ties relating to different developmental issues. An actor can at the same time be tied to another actor through ties centering around multiple issues. Thus, in the second observation, it was attempted to capture different networks beyond the initial collaboration networks. The survey thus contained measurements of three additional *advice* networks. These related to issues of nature protection, tourism and regional products. The three categories reflect the park projects stated main goals. Respondents were asked to nominate actors within the governance network to whom they would turn for advice for each of these three categories.

The questionnaires for the regular mail survey in 2008 and its online complement in 2014 can be found in table A.2 and A.3 respectively in the appendix.

5.4   Exploratory analysis

The exploratory analysis should make it possible to make first statements about the development of the governance network. All network and actor level measurements were carried out with UCINET (Borgatti et al. 2002). For visualizations, NETDRAW (Borgatti 2002) was used.

The collaboration networks in 2008 and 2014 were symmetrized using a maximum procedure. This means that a close collaboration tie was established between two organizations if at least one of the organizations indicated that they had collaborated closely during the previous months. This was done to avoid problems in interpreting the direction of ties, as the concept of collaboration was understood as a reciprocal one at its core. Additionally, it also made it possible to include non-respondent organizations without greatly compromising the analysis. The collaboration networks were thus analyzed as undirected, binary networks.

For the three advice networks in 2014, the direction of ties has a substantial meaning. It indicates that the sender of a tie considers the receiver of a tie worthy of consultation for a given area. The advice networks were thus processed as directed, binary networks.

All organizations were manually coded for the attributes level, type and dimension. Level differentiated between local, regional, cantonal and national actors. Type included the categories public, private and civil society. Dimension referred to dimensions of sustainable regional development based on the stated objectives of the park project. An organization was only assigned a certain dimension if it could be clearly and exclusively placed within one dimension. The regional economic dimension was split up in regional products and restaurants/ hotels to allow for a more fine-grained treatment of these actors representing different economic sectors. Dimensions thus were tourism, nature protection, regional products/ other economic interests and restaurants/ hotels. A complete actor list can be found in the appendix.

For 2014, every actor was also assigned a reputation score in the three areas nature protection, tourism and regional products. This score was based on normalized indegree scores in the respective advice network in 2014. It measured the extent to which other actors had indicated that they would turn to a given actor for advice in each area.

Network level measures

Closure and structural holes are well-discussed concepts in the social network analysis literature. In a first step, the following network level measures for the two networks were computed and compared. The measures reflect different aspects of closure and structural holes in a network. They were thus each examined separately and not combined into a single measure as not to lose information in accordance with the more exploratory nature of this first step.

Heterogeneity is a first measure of the extent in which a network is characterized by global structural holes and bridging. This measure is often suggested in the context of policy networks. Policy networks often consist of strong ties, due to repeated and stable interactions. However, actors within the network might still span structural holes by providing access to other networks, playing a bridging role. However, this view makes a measurement of bridging within a network difficult. One way of

getting around the problem is a focus on attribute data of the actors involved. If a set of actors is heterogeneous in respect to a set of attributes, it is assumed to span many global structural holes (Carlsson and Sandström 2008, p. 42).

The *density* of a network describes a general level of linkage in a network. It includes two components. On the one hand, inclusiveness looks at the proportion of isolates in a network. Isolates are points which are not connected to any others. On the other hand, the sum of degrees of the points which are connected is very important. The *degree* of a point is the number of points to which a single point is adjacent (Scott 2013, p. 84). This part of density can simply be measured by the number of ties present in a graph compared to the number ties which would be present if every node was connected to every other node (Scott 2013, p. 70). It can be assumed that high density leads to closure, while low density leads to more structural holes (Bodin et al. 2006).

Centralization is one of the main indicators of closure in social networks (Burt 2000; Carlsson and Sandström 2008). Centralization is a network-level measure which describes degree in which a graph is centered around a certain focal point (Scott 2013, p. 90). Put another way, it indicates how hierarchical a structure is (Carlsson and Sandström 2008, p. 41).

The measurement of centralization is based on centrality. *Centrality* is the node-level equivalent to centralization, indicating how central an actor is withing a network. There are three possible measures, leading to three corresponding centralization measures based on the works of Linton Freeman. For this thesis, degree and betweenness centrality were used. *Betweenness* on the node-level describes the extent to which a point lies between other points in a graph (Scott 2013, p. 87). Thus it measures the contribution of each node to the minimization of the total distance in a graph. As such it is a node-level measurement. To compute the overall centralization of a graph, a measure is built on the varying centrality scores of all the actors in the graph. The highest centrality score in the network is compared to the centrality scores of all other points. Centralization is the ratio of the sum of differences, which originate from this comparison to the maximum possible sum of differences (Scott 2013).

To assess closure, both the distribution of node-level centrality and network-level centralization have to be assessed. The distribution of actor centrality measures may highlight crucial overall network properties, as the different measures all indicate different properties. Actors with high degree centrality have better chance to make their views heard. Betweenness centrality enables an actor to act as broker or gatekeeper in a network (Luthe et al. 2012, p. 841). For a more thorough understanding of centralization, it can be augmented by various ways which try to find out whether there is a cluster of points which form a structural centre of a graph. One concept in this respect is the core-periphery measure, which uses a computational procedure to divide the network in two parts. A centre or core, which is well connected to the central points of the network is differentiated to a periphery which is less well-connected to the central points (Scott 2013, p. 92).

In general, a high level of centralization is an indicator for closure (Carlsson and Sandström 2008). However, by examing the different centralization measures and centrality distributions, a more fine-grained understanding of the hierarchical structure of a network can be developed.

A very important measure of closure is *transitivity*. Transitivity measures the extent to which members of dyad share partners and those partners are connected to each other (Robins et al. 2011, p. 1297). Transitivity has been a hugely important concept following the works of theorists such as Granovetter (1973). It is inherently connected to the analysis of triangulation or network closure to be captured from the triad level (Prell 2012). Transitivity has long resisted capture in statistical models. However the continuing occupation by analysts with the concept stems from the fact that it is the most essential feature which differentiates random networks from observed data (Snijders et al. 2006, p. 100).

Blockmodeling

The initial explorations on the network level can highlight important general characteristics of network governance development. However, in a subsequent step, a blockmodel of the networks in 2008 and 2014 was used for its ability to complement this with a more in-depth look at the processes of interaction, which are at play in the network. It essentially creates a simplified image of relational structures within a network, based on structural roles and positions. Thus it helps to grasp the overwhelming complexity of interaction patterns even a relatively small network such as the one studied in this thesis already displays.

The analysis of structural holes in blockmodeling is based on the concept of structural equivalence. *Structural equivalence* is a concept focused on positions in the social structure. This stands in contrast to subgroups, which are defined by the patterns of relations of individual actors. Actors in a category of structural equivalence do "the same things in relation to similar others" (Scott 2013, p. 122). An intuitive example is the role of 'father'. Two fathers hold the same structural position. They behave in a same way towards a set of children, even though they do not have to be connected in any way. While this example is culturally codified, an important assumption behind structural equivalence is that there are positions in the social structure which can be identified but are not generally recognized.

Defined in a strict sense, structural equivalence prescribes that actors must be identical in their relations to other members of a network. Because such actors can hardly be found in any social network, an analysis of structural equivalence usually weakens the criterion. The focus lies on trying to find actors which are sufficiently similar in their relations (Scott 2013, p. 123).

An analysis of structural equivalence can provide an overall grasp of the fragmentation in a network by exploring the interaction between structurally equivalent groups within a governance network (for an example, see Robins et al. 2011). This can be can be especially fruitful if an analysis of

network governance is based on a multiplex understanding of network relationship. Multiplexity in this understanding means that multiple types of ties can apply simultaneously to a dyadic relation (Robins et al. 2011). As Newig and Pahl-wostl (2010) point out, actors in a governance network can for example communicate about environmental issues, be friends and have a formal hierarchical relationship, all at the same time.

An analysis of structural equivalence in 2014 was carried out on the multirelational network involving all four relations (close collaboration, tourism advice, nature protection advice, regional product advice) using the CONCOR procedure implemented in UCINET (Borgatti et al. 2002). The measurement of structural equivalence was thus based on correlation. For the subsequent blockmodeling based on the density matrix, oneblock and zeroblocks were coded according to the α procedure. The threshold value α was based on relative relational density. Thus, if a block had a block density greater or equal the overall density of the relation, it was coded as a oneblock (Faust and Wasserman 1992, p. 20). The positions of the resulting groups were interpreted based on actor attributes as well as individual positions and image matrices displaying the whole network (Faust and Wasserman 1992, p. 28).

An equivalent analysis and blockmodeling, but for an unirelational network involving only the close collaboration network, was carried out for the 2008 data.

5.5   Statistical analysis

The exploratory analysis allows for a number of reasoned statements about the development of the network, based on comparing the two observations in 2008 and 2014. Still, it is desirable to rest these conclusions on more firm statistical grounds. This is why in a second step, the analysis turns to statistical modeling which allows for inferences about the presence or absence of structural network characteristics (Robins et al. 2011, p. 1307).

Cross-sectional exponential random graph models

Exponential random graph models (ERGMs) can model network structure and social selection effects. They make it possible to make statistical inferences about the configuration of a network. Such statements can conclude whether a given configuration occurs more than expected by chance, always given all other effects included in the model. A prime example is transitivity. For example, by including a triangle parameter in a model alongside edge and two-path (steps of length two) parameters, one can make a statement about whether there are more triangle configurations in the network than could be expected by change - given the propensity for edges and two-paths to form. For any network with a baseline tendency to form ties, a certain numbers of triangles will naturally occur simply by chance (Robins et al. 2012, p. 386).

But why ERGM? ERGM modeling is a hot topic in social network analysis, which has made considerable advancements over recent years. Crucially, it offers a variety of accessible implementations in open software. Its history comprises decades of research, starting with the simple random graph model proposed by Erdös and Rényi in 1959 (Harris 2014, p. 19).

Beyond this however, the ERGM approach best fits the analytical framework and theoretical underpinnings of this thesis. ERGMs are essentially tie-based models. That is, their main elements are ties embedded in the network and the related probabilities of tie changes (Lusher et al. 2012, p. 138). This differentiates them from their main contenders when it comes to the explanation of network development, which are stochastic actor-based models (SAOMs). As the name implies, SAOMs, while sharing many similarities with ERGMs, base their explanations of network developments primarily on the choices of individual actors based on the maximization of a certain objective function (Robins et al. 2012, p. 395). For this thesis, which has put forward a mainly structural approach to the analysis of governance networks, ERGMs thus provide a fitting way of statistical modeling.

A thorough presentation of the ERGM approach can be found in Lusher et al. (2012), while Harris (2014) provides a helpful hands-on introduction. For this thesis, all calculations were carried out in the R package statnet (Handcock et al. 2003), especially the ergm package (introductions to the packages can be found in Hunter et al. 2009; Goodreau et al. 2008). Loosely, ERGMs can be understood as complex auto-logistic regressions, which predict the presence or absence of a tie in network. However, the main difference from logistic regression models is that network tie variables are not assumed to be independent. The presence or absence of a tie is thus predicted from the patterns of other ties. This makes network ties predictors and response variables at the same time (Robins et al. 2011, p. 1307).

ERGMs allow for the inclusion of structural effects, such as tendencies towards closure or centralization. These can precisely capture the network self-organizing tendencies of interest as dependent variables in this thesis. However, isolating the dynamics of structural network self-organization from other sources of change in the network is not a simple task. A large set of mechanisms, which are the source of change in a network, are not structural. Dynamics of network change may be largely based on actor attributes (Snijders et al. 2006, p. 101).

Generally, these mechanisms can be divided into two groups. These are *social selection* and *social influence* effects (Robins et al. 2012, p. 380). This division relates to one of the oldest puzzles of social science seeking to explain homogeneity (Lewis et al. 2012). Do similar people flock together, thus attributes of actors lead to ties (selection)? Or do interconnected people become similar over time, thus the presence of ties leads to changes in attributes (influence)? One of the most well-discussed observations in this line of research is homophily. *Homophily* is the principle that a contact between similar people occurs at a higher rate than among dissimilar people (Mcpherson et al. 2001, p. 416). This means that similar people will have a higher tendency to form contacts. They also might become more similar over time as well in a self-reinforcing dynamic (Newman and Dale 2006). One reason

for this is that common norms and values develop in deepening social relationships (Bodin and Crona 2009, p. 372).

The beauty of the ERGM approach now lies in the fact that these actor-based variables can be controlled for. This makes it possible to separate dynamics of structural network self-organization from other sources of change and organization in a network (Snijders et al. 2006, p. 100).

Based on this, attribute effects were used as controls for the presence of residual structural effects (Lubell et al. 2012, p. 388). The case of transitivity offers a good illustrative example. A descriptive analysis of transitivity in a network might indicate high network level metrics for transitivity. However, this still does not allow for statements about forces of transitivity present in the network. The high number of triangles in the network might just as well be an artifact of a very high popularity effect of a few actors, leading to many triangles which appear in the core of a network (Snijders et al. 2006, p. 101). Thus, to complement the exploratory analysis, two cross-sectional ERGMs were specified for the 2008 and 2014 close collaboration networks and compared. It is important to note that such a comparison can only ever be of a very general nature, as parameter estimates of two separate ERGMs cannot be meaningfully compared in an absolute sense.

Separate temporal ERGMs

All previous steps rested on qualitative comparison for the assessment of changes in the network. While offering a wealth of insights for every observation, analyses conducted on these grounds will always face limitations. Simply put, whether the differences in network configurations have simply occurred by chance cannot be ruled out with confidence based on comparisons of snapshots in time. To overcome this limitation, a separate temporal ERGM (STERGM) was fitted in a last step. This marked the final transition towards a longitudinal statistical analysis of changes in the network.

STERGMs mark a recent refinement in the modeling of dynamic networks. In a technical as well as theoretical development, STERGMs differentiate between *incidence* and *duration* in fitting a model to longitudinal data. Other models cannot make this distinction. They will always be limited to providing snapshot of the *prevalence* of network properties (Krivitsky and Handcock 2014). Understanding prevalence as a composite of incidence and duration offers valuable insights into the development of a network. It makes it possible to specify different effects which govern the formation and dissolution of ties.

In the context of this thesis, the STERGM model can provide answers to what governs the creation and breaking up of ties. One of many examples would be an answer to the question of whether ties are more likely to be formed if they contribute to closure or centralization. Such an answer can be attempted while controlling for social selection tendencies on a variety of actor attributes such as local level homophily or activity of government actors.

Chapter 6

Results

6.1 Data collection

	Year	N	Respondency Rate
T1	2008	36	89%
T2	2014	58	81%

TABLE 6.1: Survey response rates

Of the 58 organizations contacted in the the 2014 survey, 47 responded within the allotted time frame (see table 6.1). One organization explicitly stated an unwillingness to participate in the survey. In sum, this led to a good response rate of 81%. The 2014 survey also showed no obvious systematic patterns in non-respondent attributes. The overall respondent rate of 81% was evenly distributed among actor types, as 82% of public, 84% of private and 79% of civil society actors answered the survey. This is especially remarkable as a high level of participation among small local companies cannot be taken for granted. A similar picture emerges for the distribution of non-respondency rates along institutional levels. Here, respective respondency rates on local, cantonal and regional level are also all within an interval of 70-80%. Although, a 100% respondency rate for national level actors was achieved, this is very likely due to the small number of only four national level actors.

The approach chosen to establish the network boundary seems to have captured the network in question well. Respondents were explicitly asked to name relevant organizations which were missing from the list. Only nine respondents reported further actors which had not been included in the survey. Among those, only the major supermarket chain in the region and a regional product distributor were listed several times. This indicates two possibly relevant actors not captured in the establishment of the initial network boundary.

N	Year	Local	Regional	Cantonal	National	Public	Private	Civil society
59	2008	39%	22%	25%	11%	58%	11%	25%
36	2014	51%	17%	20%	12%	29%	31%	32%

TABLE 6.2: Change in the distribution of actor attributes among actors in the governance network

6.2 Exploratory Analysis

Network level measures

A very first look at the development of the governance network begins at its composition. Between 2008 and 2014, seven actors left the network, 31 actors remained involved and 27 new actors entered the network. The new actors display certain regularities. First, a very important new and bound to be central actor is the park project management team itself, which took up its task after 2008. Second, a crucial group of new actors consists of local restaurants and hotels as well as producers of regional products who have entered labeling partnerships with the nature park management. Beyond this, a number of interest and advocacy groups on all levels have gotten involved over the years. The actors who left the network are mostly national and cantonal level actors. The enlargement of the network could be seen as a first indicator of the governance network "reaching out" and extending its collaboration to a group of actors beyond the original initiators. A list of all actors included in the study can be found in table A.1 in the appendix.

The new actors also bring about a greater diversity of actor types as shown in table 6.2. During the initiation of the project, the network was characterized by public actors and a very small involvement of the private sector. This distribution has evened out almost to an equal share of participation in the network among the different actor types in 2014. Changes can also be found in terms of horizontal levels. A quite prominent shift occurred toward the local level. Roughly half of the actors in the network are now local actors. These results indicate an increased network heterogeneity based on actor type attributes and an extension of the initial network towards more open/ bridging-type global network characteristics. Also the envisioned grounding of the governance network on a more local level seems to have happened.

	Average Degree	Density	Transitivity	Degree Centralization	Betweenness Centralization
2008	6.8	0.20	22.26	45.88	29.20
2014	9.7	0.17	15.90	77.28	40.71

TABLE 6.3: Development of network level measures for the close collaboration network

A next step involves looking at aggregate network level measures. The most important ones are summarized in table 6.3. There are a few pointers towards two general developments on this level.

The overall network density decreases slightly over time, which can be seen as a first indicator of less closure. However, this measure should be taken with a grain of salt, as density may depend on changes in network size. Beyond this, the decreased transitivity measure gives a clear indication of a network development in direction of a more open structure.

A second obvious development is reflected by the two centralization measures. The network became much more centralized between 2008 and 2014. High degree centralization means that central actors exist who can reach out directly to a very large proportion of the network. High betweenness centralization also implies that central actors exist who can control information flow and coordination between less central actors.
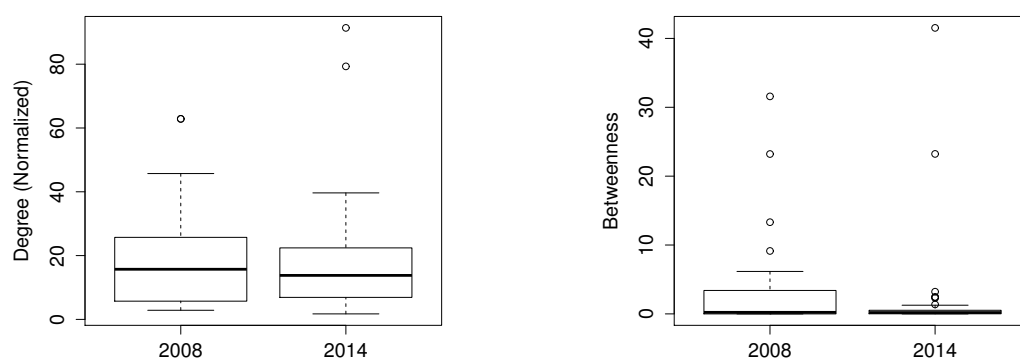
FIGURE 6.1: Normalized degree and betweenness distribution in close collaboration network in 2008 and 2014

What does this mean for an overall assessment of closure? A look at the normalized degree and betweenness distributions among actors presented in figure 6.1 sheds further light on the progress of centralization in the network. It is evident that the high overall degree of centralization in 2014 is mainly driven by two extremely central actors, which were identified as the park project management team and the regional development association. Beyond these however, the spread as well as the median of the two distributions has actually decreased! This is especially the case for betweenness centrality, where only two actors remain who are in a position to effectively assume a general brokerage role in the network.

Core-periphery structure

The degree distributions indicate a move towards a structure with a fewer number of central actors while the rest of the network becomes less hierarchical. This kind of structure might point towards a core-periphery structure, which disintegrates at the border between core and periphery. Exactly this can be found if the network is partitioned into core and periphery. Both the 2008 and 2014 network are well captured by an overall core-periphery division. But in 2008, the picture is quite extreme, with
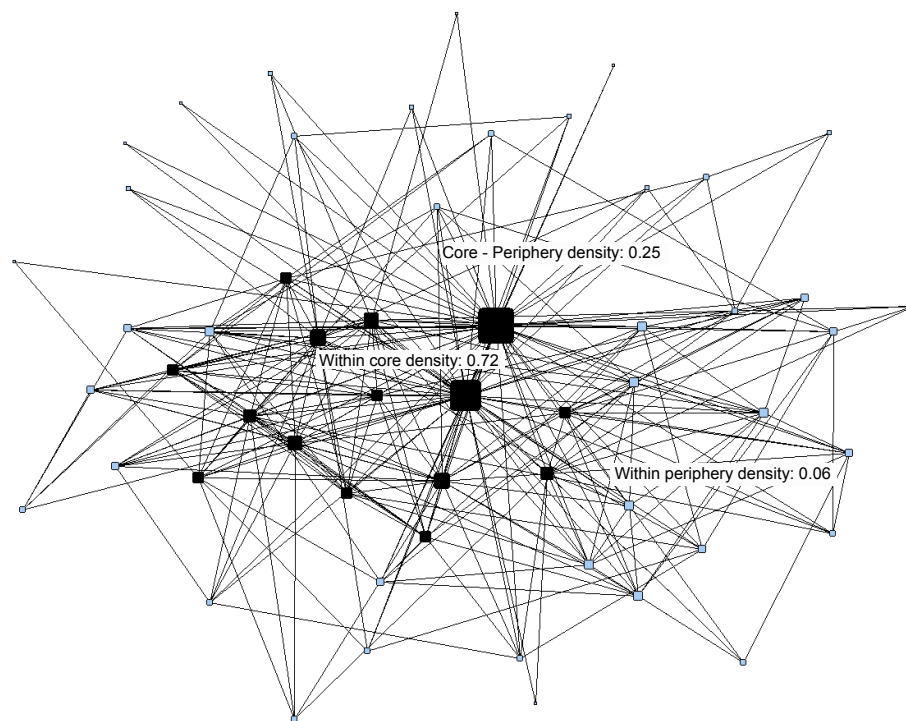
FIGURE 6.2: Graph of close collaboration network in 2014. Core-periphery, within periphery and within core densities are displayed. Node size set by degree centrality, black nodes belong to core

a core density of almost 90% and a core-periphery density of low 17%. This indicates very strong local closure in the core and a low amount of collaboration between core and periphery. Figure 6.2 shows the situation in 2014. Now, the network is still characterized by a clear core-periphery structure, but the density measures point towards a core which has less internal closure indicated by the decreased within core density. The core also displays more interaction with the periphery than in 2008. This seems to imply a group of central actors who managed to uphold a certain amount of core closure and control over the network, while the network in general has become more engaged with the core.

Blockmodeling

This section will first describe the network roles identified during the blockmodeling. In sum, the analytic procedure, which rested solely on relational data, was able to identify groups of actors which are meaningful in terms of composition and actor attributes. In a second step the interaction between roles and changes therein will be interpreted.

In 2008, five main network roles were identified. A *main initiation* group is composed of a number of highly central actors who are maximally interconnected between themselves. This includes the main initiators of the park: the regional development association, four municipalities and a member of parliament who was highly involved in the establishment of the park. A *secondary initiation* group
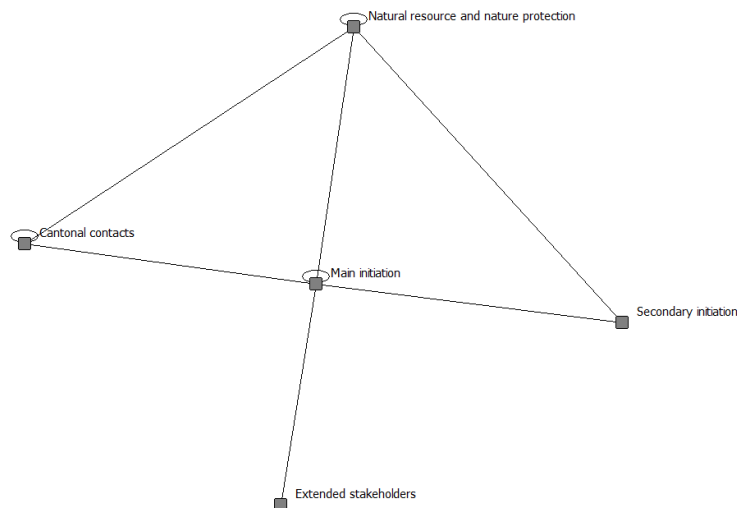
FIGURE 6.3: Blockmodel of close collaboration network in 2008

contains central actors in the creation of the park who are important but not as highly integrated as the main initiators. This includes four municipalities, the federal office for the environment and two local business and civil society organizations. An *extended stakeholder* group involves a number of tourism and business advocacy organizations on various levels as well as two hardly integrated federal offices. A *cantonal contact* group contains five of six relevant cantonal agencies and the cantonal agriculture organization. A *natural resource and nature protection advocacy* group is composed of actors who are either nature protection advocacy groups or involved in natural resource management, such as forestry and local agriculture.

In 2014 eight network roles were identified. A *central park management* group contains many core actors for the management of the park. They include the park project management team, four relevant state government agencies and two active nature protection groups. This group displays very high mean levels of reputation throughout all advice areas and especially for nature protection. A *regional development* group includes the most central actor, the regional development association, as well as a homogeneous group of six local non-restaurant businesses and business associations. A *local municipalities* group includes all local park municipalities as well as the regional bank and the Swiss park network. An *extended advocacy* group consists of a number of organizations focused on a diverse set of advocacy interests ranging from hunting to business associations, agriculture and landscape protection. Actors in this group are a mixture of core and peripheral actors of varying centrality. A *peripheral nature protection* group is composed of a number of peripheral nature protection interest organizations. With the exception of a local land management association, they are all on the cantonal
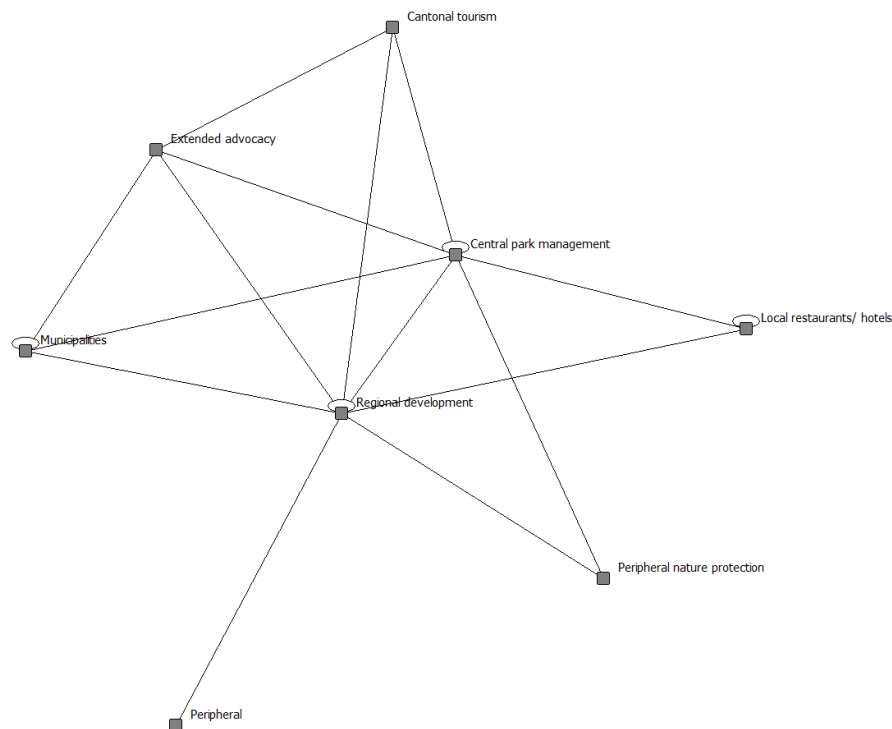
FIGURE 6.4: Blockmodel of close collaboration network in 2014

and national level. A *local restaurant and hotel* group contains a homogeneous group of eight local restaurants and hotels. A *cantonal tourism* group includes only two actors, the two cantonal tourism organizations, which have by far the highest reputation for tourism advice. A *peripheral* group can be seen as a 'rest' category to some extent. It contains six very marginal actors with low involvement and reputation.

Block	Nature Protection	Tourism	Regional Products
Municipalites	5.9	9.4	4
Extended advocacy	3.4	7.3	4.5
Peripheral nature protection	5.3	0.73	0.24
Central park management	28	13	9.5
Local restaurants and hotels	4.5	10	11
Regional development	7.2	7	17
Peripheral	2	1.4	2.5
Cantonal tourism	1.7	22	4.2

TABLE 6.4: Advice reputation scores (normalized indegree from advice networks) for eight blocks in 2014

Table 6.4 provides an illustration of the basis of how the different blocks were interpreted in terms of network roles. Here, different mean reputation scores in the relative blocks made it easier to see what kind of position a block took up in the overall structure. Other actor attributes were treated in likewise manner.

In both blockmodels, the conclusions about a network which is characterized by a clear but slightly weakening core-periphery structure seems to hold. In 2009, only the main initiation group had direct links to all other groups and thus played an important coordination role. In 2014, the central roles in the network are filled out by two groups. These two groups still account for most of the ties in the network. However, the fact that there are two groups with different tie profiles indicates that central actors share control over the network to a greater extent. The two central groups now fulfill different roles. This is also apparent in the blockmodels of the individual advice relations (see figures A.1, A.2 and A.3 in the appendix). In these advice blockmodels, the centralizing tendencies are further weakened and bridging ties which "skip" the two most central groups are more prominent.

Overall, the close collaboration network in 2014 is also distinguished by the fact that there are no isolate groups. This holds even if the α value is lowered significantly. This is not the case for 2008, which speaks for a further development in the direction of a governance network which reaches out and involves a larger amount of subgroups, contributing to more closure.

Summary of the exploratory analysis

The governance network surrounding the regional nature park of Thal has been and still is heavily characterized by a clear core-periphery structure. This has to be the most important result of the exploratory analysis. It is backed up not only by network level measurements but also through the blockmodeling analysis. This structure seems to be driven by a small number of very active actors in the core of the network. These insights provide an important backdrop from which to analyze the development of the network.

In terms of network development within this overarching core-periphery structure, the exploratory analysis tentatively identified two main tendencies.

A first tendency points towards a more open network characterized by more structural holes/ bridging. It is manifested in increasing actor heterogeneity, lower density and transitivity and a weakening core-periphery structure. Beyond the two most central actors and in terms of sub-group interactions, the network has become less centralized. This is apparent in the centrality distributions and further backed up by the blockmodel analysis.

Looking at closure and centralizing tendencies, a more ambiguous picture emerges. The differences between the two most central actors and the rest of the network have become much larger between the two observation. This implies a centralizing trend in the network. Still, the blockmodeling analysis points towards a more even mode of dense subgroup-interaction, which seems to imply potentially larger levels of local closure, but not necessarily centralization.

6.3   Statistical analysis

Cross-sectional ERGMs

In keeping with the current state of the art for the identification of network self-organization based on tie dependence variables, a basic social circuit dependence model was applied. Thus, model terms were specified based on the geometrically weighted statnet variants of configurations (developed in Snijders et al. 2006) suggested in Robins et al. (2012, p. 387). The models contain four structural parameters for network self-organization.

- An *edge* parameter represents the baseline propensity for ties to form in a network. This parameter is usually negative for most observed networks, indicating a network density below 50% (Harris 2014).

- An *activity spread* (centralization) parameter, based on k-star (degree) effects. Here, a positive parameter indicates a skewed degree distribution. A negative parameter suggests a more even sharing of degrees among actors (Robins et al. 2012, p. 387). Thus, for a positive parameter value, ties from low degree to high degree actors are more probable. However, due to the geometrical weighting, the gains in this effect decrease rapidly for ever higher degrees (Snijders et al. 2006, p. 114).

- A *multiple triangulation* (closure) parameter, which is based on k-triangles or alternating triangles. A positive estimate is an indicator of transitive closure effects (Robins et al. 2012, p. 388).

- A *multiple connectivity* parameter is based on alternating independent two-paths. It is useful to include this parameter alongside the multiple triangulation parameter. For the multiple triangulation parameter to capture transitive closure, it is necessary that it can be interpreted as the effect for a tie to form on the base of a k-triangle. However, specified on its own, it can also capture the propensity of sides of k-triangles to form. These sides can be understood as prerequisites of k-triangles and are captured by the multiple connectivity parameter. In other words, including the effect makes it possible to separate transitive closure from an accumulation of many two-paths happening by chance (Snijders et al. 2006, p. 122). Beyond this, a positive value of the parameter can tentatively capture non-closure and structural holes in a network (Robins et al. 2012, p. 388).

Three groups of parameters are used to control for effects based on actor attributes. *Homophily* parameters control for social selection effects influencing the propensity of ties to form among actors which share the same type, level or dimension. *Activity* parameters control for groups of actors based on actor attributes who display a higher or lower than average baseline propensity to form ties. *Across*

level parameters reflect the consideration that ties might be more difficult to establish or uphold the more vertical levels they cross. For example, a tie between actors from the local to the regional level (across one level) might be easier to establish than a tie from the local to the cantonal level (across two levels).

The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) measures are measures of model fit which can be used to compare different models on the same dataset. A lower value indicates better fit of the model. Both measures are preferable to log-likelihood estimates as they penalize models with more parameters. In this, they are comparable to R^2 in linear regression models. However, they have no obvious direct interpretation and thus cannot be used to compare models across different datasets (Harris 2014, p. 63). To further analyze goodness of fit, a simulation procedure can be applied, where a large number of networks based on the model statistics are compared to the observed network (Hunter et al. 2009, p. 2).

Close collaboration network in 2008

The results of the 2008 model are displayed in table 6.5. Three models were specified. The first model includes only an edge parameter and serves as a base model from which to assess the other two models. The homophily model includes the structural parameters but controls for homophily and cross-level ties. The final model adds additional activity parameters in order to increase model fit.

For the geometrically weighted structural terms, a scaling parameter α needs to chosen. This parameter can either be fixed or estimated during model estimation in a so called curved exponential family model (Hunter 2007). For the models described, the selection of α was based on a procedure suggested in Harris (2014, p. 72). This implied starting by fixing α at .1 and increasing the parameter until the log-likelihoods stops improving. This resulted in α values of .3 for model 1 and .6 for model 2. These conforms well with general suggestions about reasonable α values (Harris 2014, p. 31).

Overall, the model converged well upon an analysis of log-likelihood improvements during model estimation as well as graphical examination of MCMC diagnostics.

Adding the activity parameters in the final model alongside the homophily parameters results in the best model fit. Crucially, it does not change the overall direction and magnitude of the structural terms substantially. Rather, they are further substantiated. As an aside, it gives an indication that some homophily terms interact with activity. For example, controlling for the general level of actors on the cantonal level identified a homophily effect between cantonal actors which is masked in the first model.

A further exploration of model fit should include a look at how well the model manages to reproduce the full range of observed network statistics in simulation runs (Goodreau et al. 2008, p. 12). This yields mixed results based on the simulation of 100 randomly generated networks for the final model

Parameter	Base	Homophily	Final
Structural			
Edges	−1.4*** (0.1)	−3.4*** (0.6)	−3.2*** (0.6)
Activity spread (centralization)		−1.6 (1.1)	−1.1 (1.1)
Multiple triangulation (closure)		0.9*** (0.3)	0.5* (0.3)
Multiple connectivity (Structural holes)		0.1*** (0.05)	0.2*** (0.03)
Actor attributes: Homophily			
Government		0.8*** (0.2)	1.3** (0.7)
Civil society		0.5 (0.4)	−0.1 (0.8)
Local		0.7* (0.4)	0.8 (0.8)
Regional		0.8* (0.5)	−0.3 (1.2)
Cantonal		0.3 (0.4)	3.8*** (1.1)
Nature protection		24.3*** (0.0)	66.0
Regional products		−1.0 (1.0)	0.7 (1.2)
Ties across levels:			
One level		−0.02 (0.3)	−0.1 (0.7)
Two levels		−2.1*** (0.5)	−1.9*** (0.6)
Three levels		−15.9*** (0.0)	−16.0*** (0.0)
Actor attributes: Activity			
Government			0.2 (0.5)
Civil society			1.2** (0.5)
Local			0.1 (0.5)
Cantonal			0.2 (0.7)
Regional			−1.7*** (0.6)
Nature protection			−1.2** (0.5)
Regional products			−1.0*** (0.3)
Tourism			−1.1** (0.5)
AIC	624.1	510.4	458.8
BIC	628.5	572.7	561.1

Significance levels: $^*p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

TABLE 6.5: Parameter estimates (standard errors in brackets) for three exponential random graph models for close collaboration network in 2008

(see figure A.4 in the appendix). An examination of goodness of fit statistics shows that especially triangles and geodesic distances are well captured. However, the model slightly overestimates edge-wise shared partners for lower numbers of partners, while underestimating them for higher numbers. High degrees and degrees of two are also overestimated, while on the other hand, degrees of three and four are underestimated.

For the structural terms, the models indicate a number of interesting properties of the close collaboration network in 2008. As expected, the edge term is significant and negative, remaining so throughout the models. There is no significant estimate for the activity spread parameter. This suggests that centralization is not an essential structural characteristic of the network. Looking at the highly significant and positive multiple triangulation and connectivity parameters, it becomes clear that the main structural force can instead be found in an overall tendency for transitive closure. The small positive value of the connectivity parameter should probably not be overinterpreted but it indicates that there could be a small tendency towards brokerage in the network as well.

Close collaboration network in 2014

The results of the 2014 model are displayed in table 6.6. The cross-level tie effects are all insignificant and thus not displayed. The model specifications mirror the 2008 models, with a slightly larger number of attribute-based parameters. Again, this results in continuous improvements of model fit over the three models. The α parameter for the geometrically weighted structural parameters was fixed at 0.3 for both models with structural effects.

The homophily model showed some signs of poor convergence, first indicated by inconsistent log likelihood improvements during model estimation. Also, only about half of the measures are captured reasonably well, based on an examination of graphic MCMC diagnostics. Especially the multiple triangulation (closure) and activity spread (centralization), as well as some homophily effects are not captured well by the model.

The activity effects added in the final model lead to much better convergence. All structural characteristics are now captured very well. The final model also makes large improvements in capturing homophily. This indicates that a lot of residual structural and homophily effects measured in the homophily model are due to variance in activity. For example, this can be seen in the changes in parameter estimates for regional level activity and homophily. It seems that regional actors are not especially prone to homophily - they are just generally very active. Of all effects, only nature protection and restaurant/hotel homophily remain poorly captured by the model.

A further exploration of model fit was again based on the simulation of 100 randomly generated networks for the final model yielded satisfactory results (see figure A.5 in the appendix). The model produces networks which capture the minimum geodesic distances, triangles and degree remarkably

Parameter	Base	Homophily	Final
Structural			
Edge	−1.6*** (0.1)	−5.2*** (0.9)	−10.1*** (1.1)
Activity spread (centralization)		−11.3*** (4.0)	−16.0*** (2.7)
Multiple triangulation (closure)		1.5 (0.9)	2.7*** (0.5)
Multiple connectivity (Structural holes)		0.3*** (0.1)	0.5*** (0.1)
Actor attributes:			
Homophily			
Government		1.5*** (0.3)	1.5*** (0.4)
Civil society		−0.7** (0.3)	−0.6 (0.5)
Private sector		0.4* (0.3)	1.5*** (0.5)
Local		0.9*** (0.2)	0.9** (0.4)
Regional		2.8*** (0.4)	−0.6 (0.8)
Cantonal		1.2*** (0.3)	1.7*** (0.6)
National		2.0*** (0.5)	2.9*** (0.8)
Nature protection		0.4 (0.8)	0.9 (1.0)
Regional products		−0.2 (0.5)	0.9 (0.6)
Restaurants and hotels		3.5*** (0.5)	2.9*** (0.7)
Actor attributes:			
Activity			
Government			1.1*** (0.4)
Civil society			0.4 (0.4)
Local			0.8** (0.4)
Regional			2.6*** (0.6)
Cantonal			0.5 (0.5)
Nature protection			−0.04 (0.3)
Regional products			−0.5 (0.3)
Restaurant/ hotel			0.3 (0.3)
Tourism			2.2*** (0.5)
AIC	1,524.9	1,142.3	1,029.6
BIC	1,530.3	1,239.7	1,175.6

Significance levels: *p<0.1; **p<0.05; ***p<0.01

TABLE 6.6: Parameter estimates (standard errors in brackets) for three exponential random graph models for close collaboration network in 2014

well. However, the model overestimates edge-wise shared partners for lower numbers of partners and underestimates them for higher numbers of partners up to 13 somewhat.

All of the structural effects were highly significant. A large and negative activity spread parameter estimate indicates that, controlling for all other effects, there is a strong tendency for a rather homogeneous sharing of degree among nodes, implying very low centralization. Further, there is also a strong tendency towards transitive closure. Interestingly, controlling for all these effects, a highly significant positive estimate for multiple connectivity remains, pointing towards a small amount of brokerage and structural holes in the network.

STERGM

A STERGM model finally allows us to assess the effects of structural network self-organization in a longitudinal model, while still controlling for various actor attribute related parameters. The parameter estimates of the model are displayed in table 6.7. Once again, the modeling procedure started by specifying a most parsimonious model and sequentially adds effects to increase model fit. For the sake of illustration, only the best fitting model is displayed in the table.

In a single STERGM modeling procedure, two models are always specified. The formation model makes it possible to assess what governs the creation of ties between the two observations. The dissolution model does the same for the likelihood of ties to be broken. As there was much more variance in the formation of ties, the formation model does contain a larger number of attribute based parameters to account for this variance.

The α parameter for the geometrically weighted structural parameters was fixed at .2 for both the formation and dissolution model. The model converged well upon graphical examination of MCMC diagnostics. An examination of goodness of fit measures based on a simulation of 100 randomly generated models also generally shows good fit, although less so for the dissolution model. This was to be expected, based on the small amount of variance in tie dissolution. Still, only edgewise shared partners really stand out as badly captured by the dissolution model (see figure A.7 in the appendix). The formation model is only slightly off the mark in reproducing the statistics, even the wildly varying log-odds for degree (see figure A.6 in the appendix).

The parameter estimates for tie formation show significant estimates for all structural effects. Tie formation seems to be mainly driven by tendencies towards closure. This is implied by the positive multiple triangulation and connectivity estimates. This tendency towards closure is complemented by a drive towards a more even sharing of degrees among nodes. This is indicated by the negative activity spread (centralization) parameter, although the estimate is not highly significant.

For the control variables, some interesting results emerge as well. Homophily effects are strongest among actors of the same type, such as government or private sector actors. Beyond this, the model

Parameter	Formation		Dissolution	
	Estimate	Standard Error	Estimate	Standard Error
Structural				
Edges	−7.99***	1.25	−19.33***	2.47
Activity spread (centralization)	−5.3*	2.36	−3.26*	1.43
Multiple triangulation (closure)	3.24***	0.89	0.06	0.45
Multiple connectivity (structural holes)	0.15***	0.04	0.1	0.12
Actor attributes:				
Homophily				
Same type	0.83***	0.2	−0.37***	0.7
Same dimension	0.51*	0.23		
Local	−1.52	0.8	16.29***	1.24
Regional	−2.3	1.23	−17.14***	1.25
Cantonal	−0.59	1.03	13.34	1.8
Actor attributes:				
Activity				
Government	0.55**	0.17	1.34	0.86
Private sector	2.12***	0.44	0.91	0.9
Local	0.79*	0.34	0.95	1.19
Regional	1.95***	0.56	16.85***	0.68
Cantonal	0.81	0.44	2.07	1.29
Nature protection	0.18	0.23		
Regional products	−1.9***	0.48		
Restaurant/ hotel	−0.97*	0.49		
Tourism	0.17	0.34		
Across-level ties				
One level	−1.89*	0.92		
Two levels	−1.72*	0.8		
Three levels	−2.64***	0.7		
Significance levels:			*$p<0.1$; **$p<0.05$; ***$p<0.01$	

TABLE 6.7: Parameters estimates for separate temporal random graph model of close collaboration network

captures a higher propensity for private sector and regional level actors to form ties. As could be expected there is a lower than average propensity for ties to form across levels, especially so for ties between local and national level actors.

As for the dissolution model, it is important to note that the parameters are measures of persistence. Negative parameters thus imply shorter tie duration (Krivitsky and Handcock 2014, p. 41). The only significant estimate for structural effects occurs for activity spread. Here, the negative estimate implies that ties were more likely to be broken, if they contributed to centralization, although the parameter is not very significant. Considering this, the general picture for the tie dissolution model suggests that actor attribute effects are far more important in explaining tie dissolution. There

is a strong tendency for ties of local and regional level actors to last longer. Interestingly, this does not imply that ties between regional level actors last longer as well. Here, the opposite effect can be found. However, the results of the dissolution model should not be overinterpreted, mostly because of the small variance in tie dissolution.

Summary of the statistical analysis

The statistical analysis sought to clarify whether the results of the prior exploratory analysis could be upheld in a more rigorous setting of statistical inference. In general, this turns out to be the case. Still, the statistical modeling not only confirms but helps to identify further interesting properties of the observed network development.

A comparison of two cross-sectional ERGMs yields results, which allow for a more fine-grained analysis of the two main tendencies identified in the comparison carried out during the exploratory analysis.

The first tendency towards a globally more "equal" network can be found again. There is a statistically significant effect implying a structural force towards less centralization in the 2014 network, which is not found for 2008. This mirrors the analysis of the blockmodels. The high levels of centralization in the 2014 network seem to be due to other effects, mainly based on actor attributes, but there is no independent force of centralization.

The interaction between transitive closure and centralization in the network is further clarified in the statistical analysis. Strong tendencies towards transitive closure can be found for the 2014 network. Controlling for social selection and other attribute related effects, the network is characterized by a more significant and stronger self-organizing mechanism towards closure than in 2008. This gives further evidence to what was hinted at in the exploratory analysis. There seems to be a clear tendency towards self-organization for transitive closure in the network.

The STERGM model finally provided a true longitudinal model. What has been observed throughout the statistical analysis can be upheld. Tie formation in the network is much more likely when it leads to transitive closure and less centralization. For brokerage across structural holes, a significant and positive but only very small effect can be found.

Chapter 7

Discussion

The analysis of the governance network involved in the management of the regional nature park of Thal offers an interesting test case for the hypotheses developed in this thesis. The development of the network in terms of structural characteristics and self-organizing dynamics generally do conform to the intuition of the hypotheses.

The evidence suggests that the governance network changed from a network first and foremost characterized by local closure to a network which has reached out and is set up well to gather the benefits of bridging global structural holes. Beyond this, the network has crucially upheld a continuing drive towards further local closure. This is important in two ways. First, it enables it to reap the benefits of bridging global structural holes. Second, increasing local closure further strengthens the ability to enable effective collective action.

7.1 Initiation: Effectiveness and hierarchy

The governance network in 2008 is one characterized by structural characteristics which are very much in line with the demands of an initiation phase. It is characterized by a clear core-periphery structure. A core group of actors take up a central position in the network and are therefore ready to initiate and coordinate collective action.

Still, much of the closure in the network is not due to a self-organizing dynamic. Rather, an overarching core-periphery structure seems to account for most closure and beyond the core, many actors are not well integrated into the network. This makes the network generally less robust, as there are many central and non-redundant actors.

In terms of adaptive capacity, the network displays some weaknesses in 2008. The overall structure is one which risks a lack of diversity of knowledge. Heterogeneity among actors is low, as are

connections which bypass the core actor group. This has negative consequences for social learning capacities. On the other hand, fast access to knowledge and social memory is enhanced by the overall core-periphery structure, even if only for core actors (Bodin and Crona 2009, p. 371).

Thus, what can be seen is that the initiation network is a network optimally set up to achieve what was intended at the time, namely enabling collective action towards establishing the project. However, based on hypothesis 2 of this thesis, a shift in network dynamics would have to be expected, for the network to be able to achieve sustainable regional development in the long run.

7.2   Consolidation: The benefits of reaching out

The prescribed shift in network dynamics seems to have happened in the six years between 2008 and 2014. The network has entered a phase of consolidation. This change in function is accompanied by changes in form. The governance network in the consolidation phase is characterized by a more diverse actor constellation and a weakened core-periphery structure. Most of all, strong self-organizing tendencies towards local closure and less centralization can be made out.

The network now seems better set up to display adaptive capacity in the long run. A strong self-organizing dynamic towards less centralization provides a fitting answer to problematic risks of homogenization of knowledge and improves social learning capacities. This is further bolstered by a increased heterogeneity of actors. An inclusion of a more diverse actor set contributes to the spanning of global structural holes (Carlsson and Sandström 2008, p. 41). In this way, they give access to a broader knowledge base.

The overall self-organizing dynamic towards less centralization is a key factor contributing to more robustness of the network. Coupled with a trend towards more local closure, it implies more redundancy and "double wiring" in the network. Less centralized networks are much more resistant to the removal of individual actors (Bodin and Crona 2009, p. 371). Still, there are two very central actors in the network, on which the network is dependent to a great extent.

The ability of enabling collective action retains its importance during the consolidation phase. It should not be forgotten that the network can generally still be characterized as a core-periphery network. The self-organizing dynamics point towards process leading away from this characteristic. This may imply less effective and slower central steering capacities for the core group of actors (Bodin and Crona 2009, p. 371). However, this could be compensated by the generally increasing local closure in the network. This conforms to hypothesis 1 of this thesis. Increasing closure beyond the core group of actors strengthens the ability for effective collective action through increased trust in the long run (Robins et al. 2011, p. 1297).

One key element of the network development is surprising in its strength. The simultaneous drive towards more transitive closure and less centralization indicates an unexpected and theoretically interesting trend. The two dynamics of centralization and transitive closure are generally understood as different indicators pointing towards social capital sourced from closure. However, in the empirical example, they develop in opposite directions. Thus, the development of social capital sourced from local closure displays an additional dimension. There is a clear differentiation between dynamics of hierarchy and transitivity.

A possible explanation for this unexpected development might be the need of the network to combine bridging and bonding while still minimizing trade-offs between the two. This can be achieved by combining local closure with bridging confined to global structural holes. But apparently, this can only go so far. An increasingly heterogeneous set of actors seems prone to connect beyond established hierarchical structures. This weakens overall centralization. At the same time, heterogeneity among actors could also lead to a perception of more unstable and risky collaboration patterns. According to a general risk hypothesis of network development (Berardo and Scholz 2010), this would lead actors to seek transitive, bonding structures, which create trust and minimize risk.

7.3   Limitations

The combination of an exploratory analysis followed up by a statistical analysis has allowed the development of a fine-grained picture of network development. Changes in the variables of interest can be identified within reasonable limits of doubt. Still, a set of limitations persists, based on the design of the empirical study .

First, the study cannot identify causal mechanisms without some remaining doubt. It controls for case-specific variables due to its single-case time series design and for attribute effects in the statistical analysis. However, the direction of causality cannot be asserted. Changes in implementation phases are assumed to require different functions, which in turn rely on different sources of social capital. But it might as well be that a proportion of the causal effect points in the opposite direction. For example, it might be possible that some changes in network dynamics lead to faster progress during implementation. Such a process would be closer to a dialectic view of the relationship between structural contexts and outcomes as suggested by Marsh and Smith (2000).

Second, it is hard to base broad generalizations on the basis of this study, which is based on one empirical test case. In this, its approach is comparable to the cross-sectional study by Robins et al. (2011), although in this thesis some general benefits of a time-series setting apply. Thus, while the results of the study lend themselves well to a number of general statements, a replication in a different settings would be necessary to further back them up.

Third, there might have been an unidentified change in the content of network ties between observations. The content of ties is one aspect of networks, which can evolve besides its structure (Bodin and Crona 2009). The design aims to maximize comparability between two observation periods on this count by various means. Still, the meaning of close collaboration in the specific context might have undergone a transformation with unknown implications for the overall structure.

Fourth, difficult ties are not covered by the analysis. This again concerns the content of network ties. The analysis did not specifically explore whether there were relationships characterized by very difficult or negative close collaboration. An integration of difficult or negative ties however can illuminate interesting questions about fragmentation and difficulty in a network (Robins et al. 2011). Exploring the quality and content of interaction in this way could also serve to address issues of substantial participation which are of utmost importance in the context of sustainable development.

Fifth, the analysis undertaken has mostly stayed on a "birds-eye" level of overall structural characteristics. It could also be complemented by exploring more qualitative attributes of network structure. This could involve a more detailed profiling of actor attributes of central organizations, listing their preferred strategies or characteristics of board members. Such attributes have been shown in the past to play a role in the outcomes of network governance (Bodin and Crona 2009, p. 370).

Part IV

Conclusions

F INDING GOVERNANCE SYSTEMS which are fit to enable sustainable development is one of the great challenges of our time. The overarching story of this thesis should be seen in this context. It is a story of adding depth to an existing and promising concept, the concept of network governance.

There is more to networks in governance for sustainable regional development than simply their presence. There is also more to networks in sustainable regional development than an idealtypical mode of governance. Governance networks differ, change and evolve. In doing so, they affect the performance of a given governance system.

The performance of a governance system in enabling sustainable regional development is based on finding answers to challenges which are bound to change over time. In response, governance functions will have to change as well. For the implementation of a project aimed at sustainable regional development, two dynamics have been proposed. Between the initiation and the consolidation of a project, it is expected that enabling collective action maintains a high importance. At the same time, adaptive capacity and robustness become more important functions.

Changing functions imply changes in the structural form of a governance network. In essence a move towards a network structure as suggested by Carlsson and Sandström (2008) is expected. Therein, a network bridges structural holes on a global level, reaching out to a diverse set of network constellations. At the same time, it develops and maintains local closure.

The regional nature park of Thal has provided a rare chance to gather empirical data for the development of a governance network aimed at sustainable regional development. The empirically observed governance network generally shows the expected development patterns. It has been characterized by a continuing drive towards local transitive closure, promoting its ability to enable collective action and securing robustness. At the same time however, new actors have been integrated into the network and it shows a tendency towards less centralization. This contributes to learning and innovation, key functions of adaptive capacity.

A limited assessment of the development of the regional nature park project in Thal can also be provided by this study. From a sustainable development perspective, the structural development of the governance network conforms to the expected path derived from the normative framework. This is in itself a positive development, but only one of many aspects the project. It is also possible to compare the network development to some of the general goals of the federal regional nature park policy. Two points stand out in this regard. First, the goal of a strong local anchoring of the project has been achieved. In this way, the park is a good example of a successful combination of bottom-up and top-down approaches to the implementation of public policies (Howlett et al. 2009, p. 163). Second, there is a clear trend towards achieving broader participation of a diverse set of societal actors. This has been put forward as an explicit goal of the regional nature park policy.

The near future of the park project will be dominated by a fast approaching phase of evaluation and reformulation of goals. This is due to the upcoming mandatory process of applying to the federal

government for the extension of the park project. Now, actors in the park will have to prove whether they will make use of capacities for learning, adaptation and innovation. In the longer run, another interesting aspect will concern the development of the hierarchical structure. The project is very dependent on the very central regional park association and the park project management team. A middle ground will have to be constantly found between the effectiveness of this hierarchical structure and advantages of distributing responsibilities among a larger group of actors.

Studies of network governance for sustainable regional development still face many open questions. This thesis has shed light on some of them. It has also served to gather at least three interesting possibilities for further research.

First, an extension of the approach to different cases could give further indications of causal mechanisms at play. The large number of regional nature park in development at the time of writing could provide ample opportunities for this. It would also be interesting to broaden the scope of what qualifies as a governance network for sustainable regional development to different cases such as more urban or industrialized settings.

Second, the connection between successful implementation and network structure has thus far been treated from a theoretical perspective. However, there is a literature of sustainability assessment studies which could be fruitfully explored in connection with network governance. In an empirical setting, linking sustainability assessments to an analysis of network structure would undoubtedly be a very complex undertaking. On the other hand, it could provide a way of testing the validity of statements about the effectiveness of prescribed governance functions derived from theory.

Third, this study and most of the literature surrounding network governance has been confined to the social component of social-ecological systems. However, there is a whole dimension of interplay between social and ecological networks. The exploration of this interplay with network methods seems far-fetched at first. But there is at least one study which has already broken new ground in this regard, developing a framework for social-ecological interdependences and testing it in a case study setting (Bodin and Tengö 2012).

If the story of this thesis has been one of adding depth to network governance, it is also important not to get lost in that depth. Network structure is one factor among many if it comes to explaining the performance of a governance system. Macro-level institutions, individual decision-making and networks all interact to produce outcomes. And they do it in a complex setting of social-ecological interdependences and cultural framing. But the tools and theory available to grasp the part of social reality that is networks are continuously developing, fascinating and still underapplied. Thus, there is still room for adding more depth - helping to find answers to the great challenge of governance for sustainable development.

Appendix A

Appendix

Acronym	Actor	Level	Type	T1	T2
Aedermannsdorf	Einwohnergemeinde Aedermannsdorf	Local	Government	x	x
Anti_Wind	Verein Thaler Landschaft ohne Windräder	Regional	Civil Society		x
BAFU	Bundesamt für Umwelt	National	Government	x	x
BAG	Bundesamt für Gesundheit	National	Government	x	
Balsthal	Einwohnergemeinde Balsthal	Local	Government	x	x
Berghilfe	Schweizer Berghilfe	National	Civil Society		x
BuergWald_Thal	Bürgergemeinden- und Waldeigentümerverband Thal	Regional	Civil Society	x	x
Eintracht_Bals	Restaurant Eintracht, Balsthal	Local	Private Sector		x
Flurgen_Welsch	Flurgenossenschaft Welschenrohr	Local	Civil Society		x
Fonds_Landschaft	Fonds Landschaft Schweiz	National	Civil Society		x
Gaensbrunnen	Einwohnergemeinde Gänsbrunnen	Local	Government	x	x
Gasser_Oel	Gasser Rapsöl	Local	Private Sector		x
Gewerbe_Bals	Gewerbeverein Balsthal-Klus	Local	Private Sector	x	x
Gewerbe_Muem	Gewerbeverein Mümliswil-Ramiswil	Local	Private Sector	x	x
Gewerbe_Thal	Gewerbeverein Thal	Local	Private Sector	x	x
GOV_SO_LaWi	Amt für Landwirtschaft Kanton SO	Cantonal	Government	x	x
GOV_SO_Raum	Amt für Raumplanung Kanton SO	Cantonal	Government	x	x
GOV_SO_UmWe	Amt für Umwelt Kanton SO	Cantonal	Government	x	x
GOV_SO_VerT	Amt für Verkehr und Tiefbau Kanton SO	Cantonal	Government	x	x
GOV_SO_WaJa	Amt für Wald, Jagd und Fischerei Kanton SO	Cantonal	Government	x	x
GOV_SO_WiAr	Amt für Wirtschaft und Arbeit Kanton SO	Cantonal	Government	x	x
HAAR	Museum HAARUNDKAMM	Regional	other	x	
Herbertswil	Einwohnergemeinde Herbertswil	Local	Government	x	x
Holderbank	Einwohnergemeinde Holderbank	Local	Government	x	x
Holzhandwerk_Thal	Unternehmen Holzhandwerk Thal	Local	Private Sector		x
Hotel_Bals	Hotel Balsthal	Local	Private Sector		x
IGNT	Interessengemeinschaft Naturschutz Thal	Regional	Civil Society	x	x
Industrie_Thal	Industrie- und Handelsverein Thal-Gäu-Bipperamt	Local	Private Sector	x	x
Jagdverein_Thal	Vereinigung Thaler Jagdgesellschaften	Regional	Civil Society	x	x
Kreisforstamt	Kantonales Kreisforstamt Thal	Local	Government	x	x
Kreisschule_Thal	Kreisschule Thal	Regional	other		x
Krone_Laup	Restaurant Krone Laupersdorf	Local	Private Sector		x
Landfrauen_Muem	Landfrauenverein Mümliswil	Local	Civil Society		x
Landfrauen_Thal	Landfrauenverein Thal	Local	Civil Society		x
Landfrauen_Welschen	Landfrauenverein Welschenrohr	Local	Civil Society		x
Laupersdorf	Einwohnergemeinde Laupersdorf	Local	Government	x	x
LaWiVerein_Thal	Landwirtschaftlicher Bezirksverein Thal	Regional	Civil Society	x	x
Matzendorf	Einwohnergemeinde Matzendorf	Local	Government	x	x
Montpelon_Gaens	Berghof Montpelon, Gänsbrunnen	Local	Private Sector		x
Muemliswil	Einwohnergemeinde Mümliswil-Ramiswil	Local	Government	x	x
Naturmuseum	Naturmuseum Solothurn	Cantonal	other		x
Naturpark	Projektteam Naturpark Thal	Regional	Civil Society		x
Netzwerk_Park_CH	Netzwerk der Schweizer Pärke	National	Government	x	x
NRBad	Nationalrätin Elvira Bader	National	Government	x	
Ochsen_Muem	Landgasthof Ochsen, Mümliswil	Local	Private Sector		x
Other_Parks	Einzelne andere Schweizer Pärke	National	Civil Society		x
PH_SO_BerUW	Pädagogische Hochschule Solothurn	Cantonal	other		x
PostAuto	PostAuto Schweiz AG	National	Private Sector		x
ProNatura_SO	Pro Natura Solothurn	Cantonal	Civil Society	x	x
Raiffeisen	Raiffeisenbank Balsthal-Laupersdorf	Regional	Private Sector		x
Region_Thal	Verein Region Thal	Regional	Civil Society	x	x
Region_Thal_Kultur	Arbeitsgruppe Kultur Verein Region Thal	Regional	Civil Society	x	x
Roessli_Matz	Gasthof zum Rössli, Matzendorf	Local	Private Sector		x
Schnyder_Muehle	Schnyder Mühle, Laupdersdorf	Local	Private Sector		x
SECO	Staatssekretariat für Wirtschaft	National	Government	x	
SoBV	Solothurner Bauernverband	Cantonal	Civil Society	x	
SoloPasta	SoloPasta GmbH	Local	Private Sector		x
Sternen_Matz	Gasthof Sternen, Matzendorf	Local	Private Sector		x
Stuebi_Metzg	Stübi Metzgerei	Local	Private Sector		x
SUS	Stiftung Umwelteinsatz Schweiz SUS	National	Civil Society		x
Tourismus_JuraDrei	Tourismus Jura Drei-Seen-Land	Cantonal	other		x
Tourismus_SO	Kanton Solothurn Tourismus	Cantonal	other	x	x
VVBK	Verkehrs- und Verschönerungsverein Balsthal-Klus	Local	Civil Society	x	
VVS	Vogelschutzverband Solothurn	Cantonal	Civil Society		x
Wechten_Muem	Berggasthaus Obere Wechten, Mümliswil	Local	Private Sector		x
Welschenrohr	Einwohnergemeinde Welschenrohr	Local	Government	x	x

TABLE A.1: Actor list with level and type attributes for both observation periods

Regular mail questionnaire 2008

Survey item	Wording

Name der Dienststelle/Organisation:

Kontaktperson für Rückfragen (Postadresse, Telefon, e-mail):

Wie im Begleitbrief erwähnt, untersuche ich für meine Forschungsarbeit die Zusammenarbeit zwischen den verschiedenen Organisationen und Dienststellen bei der Erarbeitung des Projektdossiers Naturpark Thal. Meine Fragen beziehen sich somit auf diese Erarbeitungsphase des Dossiers vom Herbst 2004 bis Ende 2007.

Der Fragebogen ist in drei Teile gegliedert:

Teil 1 befasst sich mit der Rolle der verschiedenen Akteure, die an der Erarbeitung des Projektdossiers Naturpark Thal in irgendeiner Weise beteiligt waren.

Teil 2 fragt nach Ihren Kontakten zu diesen Akteuren, die für die Erarbeitung des Projektdossiers von Bedeutung waren.

In Teil 3 werden Sie schliesslich noch gebeten, einige Fragen bezüglich der Zielsetzungen des Projektes Naturpark Thal zu beantworten.

1   Rolle der Akteure

Untenstehend finden Sie eine möglichst vollständige Liste mit verschiedenen Institutionen und Organisationen, die in unterschiedlicher Form mit der Erarbeitung des Bewerbungsdossiers Naturpark Thal in Verbindung stehen.

Sollten wichtige Akteure auf der Liste fehlen, können Sie diese am Schluss der Liste ergänzen.

Bitte kreuzen Sie an, welche Akteure bei der Erarbeitung des Dossiers besonders einflussreich waren. Bitte kreuzen Sie ebenfalls an, wenn ein Akteur dabei keine Rolle gespielt hat.

2a   Kontakte

Bei der Erarbeitung des Projektdossiers kam es zu verschiedenen Formen von Kontakten zwischen den beteiligten Stellen und Organisationen. Ich möchte Sie zuerst fragen, mit welchen Stellen und Organisationen Sie im Zusammenhang mit der Erarbeitung des Projektdossiers eng zusammengearbeitet haben und wie diese Zusammenarbeit verlief.

Mit welchen dieser Akteure haben Sie im Hinblick auf die Erarbeitung des Projektdossiers Naturpark Thal eng zusammengearbeitet?

Survey item	Wording

Form der engen Zusammenarbeit

- neu entstanden
- bestand schon früher
- eher kooperativ
- eher konfliktreich

2b　　　　　Manchmal werden für die eigene Tätigkeit Informationen benötigt, die nur von anderen Organisationen bereitgestellt werden können. Andere Organisationen können sich aber auch an Ihre Organisation wenden, um spezifische Informationen für deren Tätigkeit zu erhalten.
Bitte kreuzen Sie unten an, von wem Sie im Zusammenhang mit der Erarbeitung des Projektdossiers Naturpark Thal wichtige Informationen erhalten haben respektive wem Sie solche zukommen liessen.

3　　　　　Projektspezifische Fragen

Im Zusammenhang einer nachhaltigen Entwicklung der Region Thal wurden für den Naturpark Thal sechs strategische Ziele formuliert. Welchen Beitrag vermag der Naturpark Thal Ihrer Ansicht nach tatsächlich zur Erreichung dieser Ziele zu leisten?
Zielsetzung

Der Naturpark Thal leistet zur Erreichung dieses Ziels. . .

- einen grossen Beitrag
- einen mittleren Beitrag
- einen kleinen Beitrag
- keinen Beitrag

Die hohen Naturwerte der Region erhalten und vermehren

Die regionale Zusammenarbeit zur koordinierten Raumentwicklung nutzen

Die gesunde Lebensweise in einer intakten Umwelt fördern

Wertschöpfung durch qualitativ hochwertige Produkte aus Land- und Forstwirtschaft sowie der Jagd generieren

Sanften Tourismus entwickeln

Eine hohe Lebens- und Wohnqualität in einer intakten Umwelt erhalten

Questionnaire 2008

Survey item	Wording
	Wie gut oder schlecht sind Ihrer Meinung nach Ihre Anliegen bei der Erarbeitung des Projektdossiers berücksichtigt worden?

- Gut berücksichtigt
- Teilweise berücksichtigt
- Schlecht berücksichtigt

Weitere Bemerkungen:

TABLE A.2: Questionnaire of regular mail survey in 2008

Online questionnaire 2014

Survey item	Wording
Welcome screen	Vielen Dank für Ihre Mitarbeit bei dieser Umfrage Die Umfrage steht im Rahmen eines Masterarbeits-projekts zu regionalen Naturpärken. Dabei geht es um die Entwicklung der Zusammenarbeit zwischen Verwaltung, Bevölkerung und Unternehmen im regionalen Naturpark Thal. Das Projekt schliesst an ein vergangenes Forschungsprojekt aus dem Jahr 2008 an. Dadurch soll die Entwicklung des Parkprojekts dokumentiert werden. Das Ausfüllen der Umfrage dauert ca. 10 Minuten. Durch Ihre Mithilfe leisten Sie einen essentiellen Beitrag zum Gelingen meiner Masterarbeit.
1	Wie heisst die Organisation, für die Sie tätig sind?
2	Für allfällige Rückfragen bitte ich Sie, Ihren Namen und wenn möglich eine Email-Adresse und/ oder Telefonnummer anzugeben.
3	Ihre Zusammenarbeit mit anderen Stellen und Organisationen im Naturpark Thal In einem Naturpark arbeiten verschiedene Stellen und Organisationen auf unterschiedliche Arten zusammen. Ich würde Sie daher zuerst gerne nach ihren wichtigsten Kontakten im Zusammenhang mit dem Naturpark Thal fragen.
3a	Mit welchen der folgenden Ämtern und Gemeinden haben Sie in den letzten 12 Monaten beim Betrieb des Naturparks oder in Projekten mit Verbindung zum Naturpark eng zusammengearbeitet?
3b	Mit welchen der folgenden Vereine und Verbände haben Sie in den letzten 12 Monaten beim Betrieb des Naturparks oder in Projekten mit Verbindung zum Naturpark eng zusammengearbeitet
3c	Mit welchen der folgenden Unternehmen haben Sie in den letzten 12 Monaten beim Betrieb des Naturparks oder in Projekten mit Verbindung zum Naturpark eng zusammengearbeitet?
3d	Gibt es weitere Organisationen oder Stellen, mit denen Sie im Betrieb des Naturparks oder in damit in Verbindung stehenden Projekten eng zusammengearbeitet haben, welche nicht erwähnt wurden?
4	Gibt es weitere Organisationen oder Stellen, mit denen Sie im Betrieb des Naturparks oder in damit in Verbindung stehenden Projekten eng zusammengearbeitet haben, welche nicht erwähnt wurden?

Questionnaire 2014

Survey item	Wording
	Die Förderung von regionalen Produkten ist ein Weg um regionale Wertschöpfung in einem Naturpark zu fördern. Stellen oder Organisationen in einem Naturpark verfügen hierzu über spezialisiertes Wissen oder spezifische Zuständigkeiten. Ein konkretes Beispiel für ein Projekt zur Förderung von regionalen Produkten ist der Naturpark Märet in Balsthal, wo regionale Produkte von Brot bis Keramikkrügen angeboten werden.
4a	Welche der folgenden Ämter und Gemeinden würden Sie im Falle einer Frage zu regionalen Produkten aus dem Naturpark Thal um Rat fragen?
4b	Welche der folgenden Vereine und Verbände würden Sie im Falle einer Frage zu regionalen Produkten aus dem Naturpark Thal um Rat fragen?
4c	Welche der folgenden Unternehmen würden Sie im Falle einer Frage zu regionalen Produkten aus dem Naturpark Thal um Rat fragen?
5	Ansprechspartner für Fragen zum Naturschutz im Naturpark Thal
	Die Erhaltung einer intakten Natur ist ein zentrales Ziel von regionalen Naturpärken. Auch hierzu verfügen unterschiedliche Stellen und Organisationen über spezialisiertes Wissen und spezifische Zuständigkeiten. Im Naturpark Thal betrifft dies beispielsweise die Zusammenarbeit von Naturschutz und Landwirtschaft oder die Einrichtung von Schutzzonen für seltene Tiere.
5a	Welche der folgenden Ämter und Gemeinden würden Sie im Falle einer Frage zu Naturschutz im Naturpark Thal um Rat fragen?
5b	Welche der folgenden Vereine und Verbände würden Sie im Falle einer Frage zu Naturschutz im Naturpark Thal um Rat fragen?
5c	Welche der folgenden Unternehmen würden Sie im Falle einer Frage zu Naturschutz im Naturpark Thal um Rat fragen?
6	Ansprechspartner für Fragen zum Tourismus im Naturpark Thal
	Die Entwicklung eines sanften Tourismus ist ein weiterer Weg, um Wertschöpfung in einem Naturpark zu generieren und gleichzeitig Natur und Landschaft zu schonen. Wiederum verfügen hierzu unterschiedliche Stellen und Organisationen über spezialisiertes Wissen und spezifische Zuständigkeiten. Im Naturpark Thal gibt es verschiedene Projekte im Rahmen der Tourismusförderung. Darunter fällt beispielsweise ein geplanter Wanderweg zum Thema Holz in der Nähe von Balsthal oder ein Angebot an geführten Exkursionen im Park.
6a	Welche der folgenden Ämter und Gemeinden würden Sie im Falle einer Frage zum Thema Tourismus im Naturpark Thal um Rat fragen?
6b	Welche der folgenden Vereine und Verbände würden Sie im Falle einer Frage zum Thema Tourismus im Naturpark Thal um Rat fragen?

Survey item	Wording
6c	Welche der folgenden Unternehmen würden Sie im Falle einer Frage zum Thema Tourismus im Naturpark Thal um Rat fragen?
7	Wie gut oder schlecht sind Ihrer Meinung nach ihre Interessen beim bisherigen Betrieb des Naturparks Thal berücksichtigt worden? • gut • eher gut • eher schlecht • schlecht
8	Wie gut oder schlecht werden Ihrer Meinung nach ihre Interessen in der Weiterführung und Weiterentwicklung des Naturparks Thal berücksichtigt? • gut • eher gut • eher schlecht • schlecht
9	Erreicht der Naturpark Thal seine Ziele? Für den Naturpark Thal wurde eine Reihe von Zielen formuliert. Zu dreien davon möchte ich Sie abschliessend fragen, inwiefern der Naturpark diese Ziele erreichen konnte.
9a	Natur und Landschaft: Der Naturpark Thal will sowohl Schutz als auch Nutzung der grossflächigen Wald- und Weidegebiete fördern. Welchen Beitrag hat der Naturpark Thal bis jetzt zur Erreichung dieses Ziels geleistet? • grossen • mittleren • kleinen • gar keinen

Questionnaire 2014

Survey item	Wording
9b	Tourismus und Gewerbe: Der Naturpark Thal will einen sanften und nachhaltigen Tourismus. Welchen Beitrag hat der Naturpark Thal bis jetzt zur Erreichung dieses Ziels geleistet? • grossen • mittleren • kleinen • gar keinen
9c	Land- und Forstwirtschaft: Der Naturpark Thal will Wertschöpfung durch qualitativ hochwertige Produkte aus Land- und Forstwirtschaft sowie der Jagd generieren. Beispiel: Unter dem Naturpark-Label vermarktete Produkte.Welchen Beitrag hat der Naturpark Thal bis jetzt zur Erreichung dieses Ziels geleistet? • grossen • mittleren • kleinen • gar keinen
10	Haben Sie weitere Bemerkungen zur Umfrage?

TABLE A.3: Questionnaire of online survey in 2014
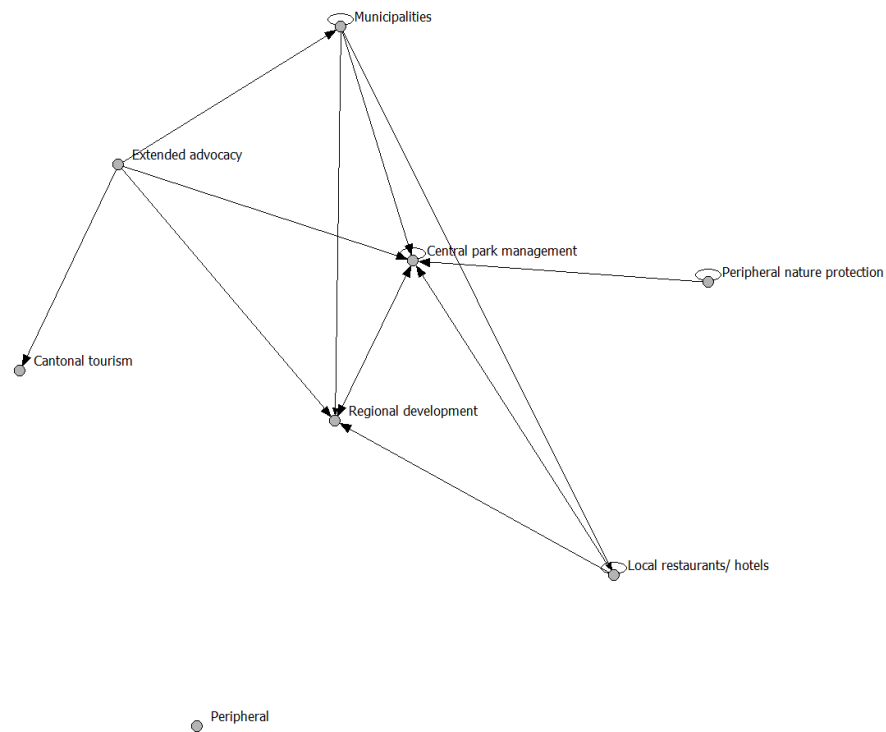
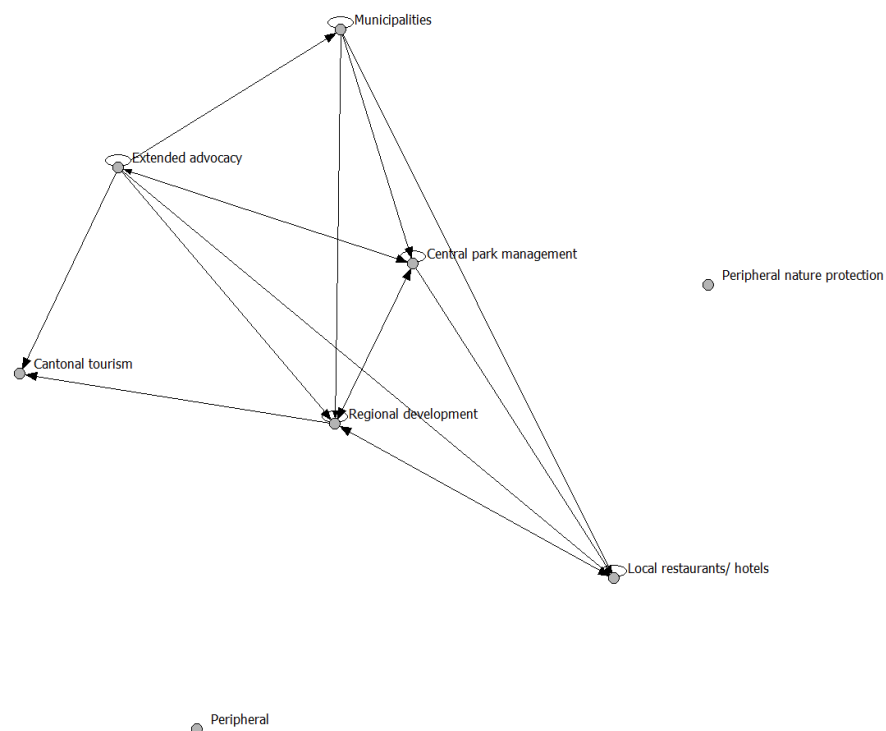FIGURE A.1: Blockmodel of nature protection advice network in 2014

FIGURE A.2: Blockmodel of regional products advice network in 2014
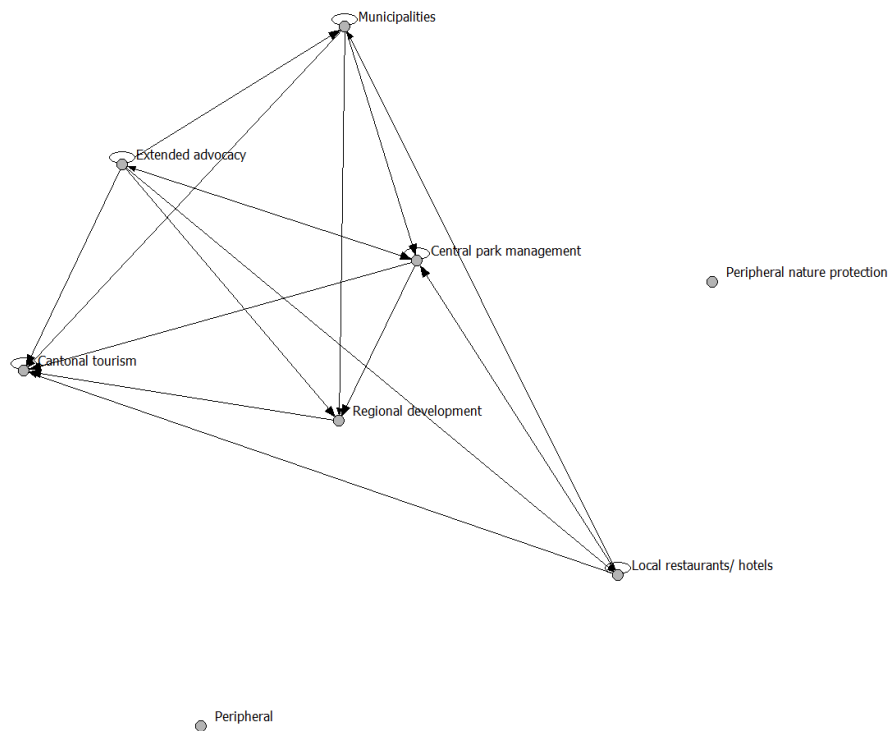
FIGURE A.3: Blockmodel of tourism advice network in 2014
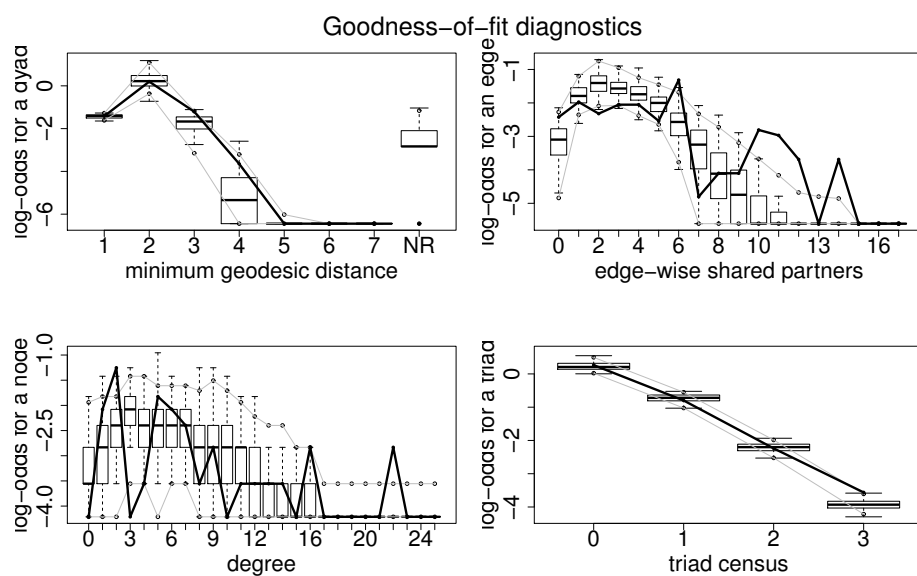

FIGURE A.4: ERGM goodness of fit plots for final model in 2008 close collaboration network
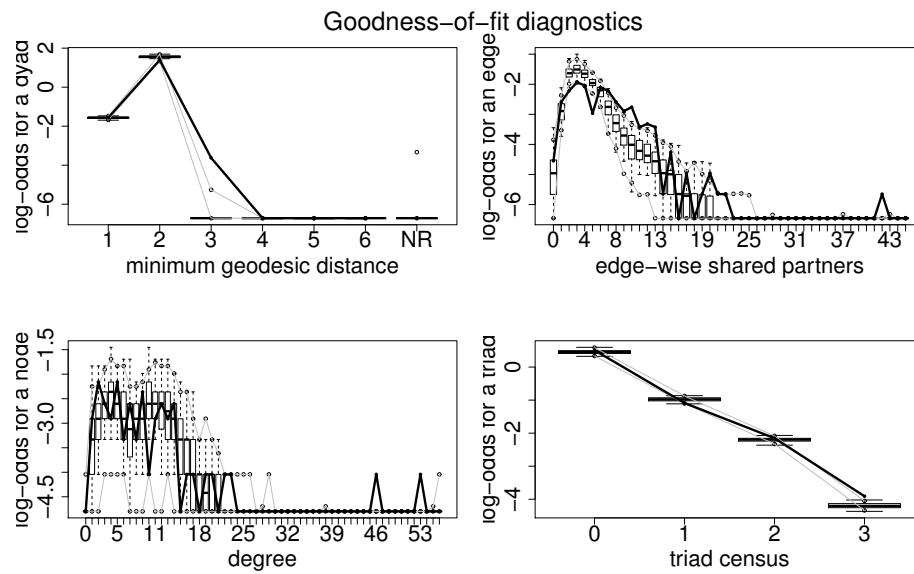
FIGURE A.5: ERGM goodness of fit plots for final model in 2014 close collaboration network
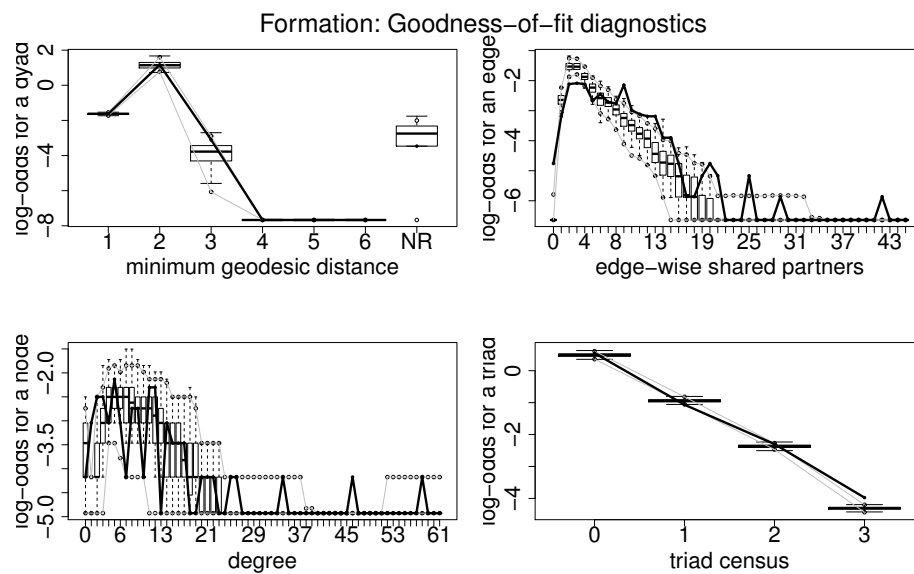

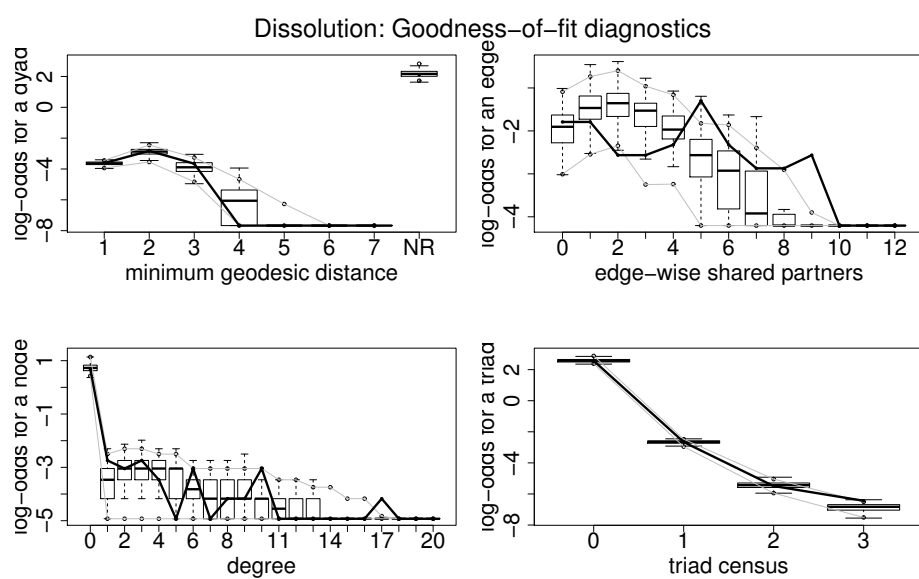FIGURE A.6: STERGM goodness of fit plots for formation model

FIGURE A.7: STERGM goodness of fit plots for dissolution model

Bibliography

Adam, S. and H. Kriesi (2007). "The network approach". In: *Theories of the Policy Process*. Ed. by P. A. Sabatier. 2nd. Boulder: Westview Press, pp. 129–154.

Albert, R., H. Jeong, and A.-L. Barabasi (2000). "Error and attack tolerance of complex networks". In: *Nature* 406 (6794), pp. 378–82.

Anderies, J. M., M. A. Janssen, and E. Ostrom (2004). "A Framework to Analyze the Robustness of Social-ecological Systems from an Institutional Perspective". In: *Ecology and Society* 9 (1).

BAFU (2008). *Pärke von nationaler Bedeutung, Richtlinie für Planung, Errichtung und Betrieb von Pärken*. Bern: Bundesamt für Umwelt.

— (2010). *Pärke von nationaler Bedeutung: Markenhandbuch – Teil 1. Mitteilung des BAFU als Vollzugsbehörde an Gesuchsteller. Anleitung zur Kommunikation der Marke.* Bern.

Berardo, R. and J. T. Scholz (2010). "Self-Organizing Policy Networks: Risk, Partner Selection, and Cooperation in Estuaries". In: *American Journal of Political Science* 54 (3), pp. 632–649.

Bodin, O. and B. I. Crona (2009). "The role of social networks in natural resource governance: What relational patterns make a difference?" In: *Global Environmental Change* 19 (3), pp. 366–374.

Bodin, O. and M. Tengö (2012). "Disentangling intangible social–ecological systems". In: *Global Environmental Change* 22 (2), pp. 430–439.

Bodin, O., B. Crona, and H. Ernstson (2006). "Social Networks in Natural Resource Management: What Is There to Learn from a Structural Perspective?" In: *Ecology and Society* 11 (2), r2 [online].

Bodin, O. et al. (2011). "A social relational approach to natural resource governance". In: *Social Networks and Natural Resource Management. Uncovering the Social Fabric of Environmental Governance*. Ed. by O. Bodin and C. Prell. Cambridge, UK: Cambridge University Press, pp. 3–28.

Boon, T. E., I. Nathan, and D. H. Lund (2012). "The national park process in Denmark - a network governance approach to democratise policy making?" In: *Environmental Governance. The Challenge of Legitimacy and Effectiveness*. Ed. by K. Hogl et al. Cheltenham, UK/ Northhampton, MA: Edward Elgar, pp. 89–108.

Borgatti, S. P. (2002). *NetDraw Software for Network Visualization*. Lexington, KY.

Borgatti, S. P., M. G. Everett, and L. C. Freeman (2002). *Ucinet for Windows: Software for Social Network Analysis*. Harvard, MA.

Borgatti, S. P. et al. (2009). "Network Analysis in the Social Sciences". In: *Science* 323 (5916), pp. 892–895.

Börzel, T. A. (1998). "Organizing Babylon - On the Different Conceptions of Policy Networks". In: *Public Administration* 76 (2), pp. 253–273.

— (2011). "Networks: Reified metaphor or governance panacea?" In: *Public Administration* 89 (1), pp. 49–63.

Burt, R. S. (2000). "The network structure of social capital". In: *Research in Organizational Behavior* 22 (0), pp. 345–423.

— (2001). "Structural Holes versus Network Closure as Social Capital". In: *Social Capital: Theory and Research*. Ed. by N. Lin, K. S. Cook, and R. S. Burt. New Brunswick, NJ: Transaction.

Carlsson, L. and A. Sandström (2008). "Network governance of the commons". In: *Internation Journal of the Commons* 2 (1), pp. 33–54.

Cash, D. W. et al. (2006). "Scale and Cross-Scale Dynamics: Governance and Information in a Multilevel World". In: *Ecology and Society* 11 (2), 8 [online].

Crona, B. and K. Hubacek (2010). "The Right Connections: How do Social Networks Lubricate the Machinery of Natural Resource Governance?" In: *Ecology and Society* 15 (4), 18 [online].

Crow, D. A. (2010). "Local Media and Experts: Sources of Environmental Policy Initiation?" In: *Policy Studies Journal* 38 (1), pp. 143–164.

Dale, A. and L. Newman (2008). "Social capital: a necessary and sufficient condition for sustainable community development?" In: *Community Development Journal* 45 (1), pp. 5–21.

Dedeurwaerdere, T. (2005). "The contribution of network governance to sustainable development". In: *Les séminaires d l'Iddri* 13, pp. 1–15.

Faust, K. and S. Wasserman (1992). "Blockmodels : Interpretation and evaluation". In: *Social Networks* 14 (1-2), pp. 5–61.

Fawcett, P. and C. Daugbjerg (2012). "Explaining Governance Outcomes: Epistemology, Network Governance and Policy Network Analysis". In: *Political Studies Review* 10 (2), pp. 195–207.

Federal Authorities of the Swiss Confederation (2014). *Official Compilation of the Swiss Federal Law*. URL: http://www.admin.ch/ch/e/rs/rs.html.

Fischer, M. et al. (2012). "Impacts of Market Liberalization on Regulatory Network: A Longitudinal Analysis of the Swiss Telecommunications Sector". In: *Policy Studies Journal* 40 (3), pp. 435–457.

Folke, C. et al. (2005). "Adaptive Governance of Social-Ecological Systems". In: *Annual Review of Environment and Resources* 30 (1), pp. 441–473.

Gerber, J.-D. and P. Knoepfel (2008). "Towards Integrated Governance of Landscape Development". In: *Mountain Research and Development* 28 (2), pp. 110–115.

Goodreau, S. M. et al. (2008). "A statnet Tutorial". In: *Journal of Statistical Software* 24 (9), pp. 1–27.

Granovetter, M. (2005). "Impact of Social Structure on Economic Outcomes". In: *The Journal of Economic Perspectives* 19 (1), pp. 33–50.

Granovetter, M. S. (1973). "The Strength of Weak Ties". In: *American Journal of Sociology* 78, pp. 1360–1380.

Handcock, M. S. et al. (2003). *statnet: Software tools for the Statistical Modeling of Network Data*. Seattle, WA. URL: http://statnetproject.org.

Harris, J. (2014). *An introduction exponential random graph modeling*. London: Sage Publications, p. 119.

Häuberer, J. (2011). *Social Capital Theory. Towards a Methodological Foundation*. Wiesbaden: VS Verlag für Sozialwissenschaften, p. 330.

Hirschi, C. (2010). "Strengthening Regional Cohesion : Collaborative Networks and Sustainable Development in Swiss Rural Areas". In: *Ecology and Society* 15 (4), 16 [online].

Hogl, K. et al. (2012). *Environmental Governance. The Challenge of Legitimacy and Effectiveness*. Cheltenham, UK/ Northhampton, MA: Edward Elgar, p. 304.

Howlett, M., M. Ramesh, and A. Perl (2009). *Studying Public Policy. Policy Cycles and Policy Subsystems*. Oxford: Oxford University Press, p. 336.

Hunter, D. R. (2007). "Curved Exponential Family Models for Social Networks". In: *Social networks* 29 (2), pp. 216–230.

Hunter, D. R. et al. (2009). "ergm: A Package to Fit, Simulate and Diagnose Exponential- Family Models for Networks". In: *Journal of Statistical Software* 24 (3), pp. 1–29.

Janssen, M. A. et al. (2006). "Toward a Network Perspective of the Study of Resilience in Social-Ecological Systems". In: *Ecology and Society* 11 (1), 15 [online].

Jones, C., W. S. Hesterly, and S. P. Borgatti (1997). "A General Theory of Network Governance: Exchange Conditions and Social Mechanisms". In: *The Academy of Management Review* 22 (4), pp. 911–945.

Knox, H., M. Savage, and P. Harvey (2006). "Social networks and the study of relations: networks as method, metaphor and form". In: *Economy and Society* 35 (1), pp. 113–140.

Krivitsky, P. and M. Handcock (2014). "A separable model for dynamic networks". In: *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 76 (1), pp. 29–46.

Lafferty, W. M. (2004). "Introduction: form and function in governance for sustainable development". In: *Governance for Sustainable Development*. Ed. by W. M. Lafferty. Cheltenham, UK: Edward Elgar. Chap. 1, p. 377.

Lange, P. et al. (2013). "Governing Towards Sustainability - Conceptualizing Modes of Governance". In: *Journal of Environmental Policy & Planning* 15 (3), pp. 403–425.

Lebel, L. et al. (2006). "Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems". In: *Ecology and Society* 11 (1), 19. [online].

Lehtonen, M. (2004). "The environmental-social interface of sustainable development: capabilities, social capital, institutions". In: *Ecological Economics* 49 (2), pp. 199–214.

Lewis, K., M. Gonzalez, and J. Kaufman (Jan. 2012). "Social selection and peer influence in an online social network". In: *Proceedings of the National Academy of Sciences* 109 (1), pp. 68–72.

Lubell, M. et al. (2012). "Testing Policy Theory with Statistical Models". In: *Policy Studies Journal* 40 (3), pp. 351–374.

Lusher, D., J. Koskinen, and G. Robins (2012). *Exponential Random Graph Models for Social Networks: Theory, Methods, and Applications*. Ed. by D. Lusher, J. Koskinen, and G. Robins. Cambridge, UK ; New York: Cambridge University Press, p. 337.

Luthe, T., R. Wyss, and M. Schuckert (2012). "Network governance and regional resilience to climate change: empirical evidence from mountain tourism communities in the Swiss Gotthard region". English. In: *Regional Environmental Change* 12 (4), pp. 839–854.

Lyons, D. I. and P. Deutz (2010). "Regional sustainable development: Making development work in politically contingent space". In: *Sustainable Development* 18 (4), pp. 183–186.

Marsh, D. and M. Smith (2000). "Understanding Policy Networks: towards a Dialectical Approach". In: *Political Studies* 48 (1), pp. 4–21.

McAllister, R., R. McCrea, and M. Lubell (2013). "Policy networks, stakeholder interactions and climate adaptation in the region of South East Queensland, Australia". In: *Regional Environmental Change*, pp. 1–13.

McClurg, S. D. and J. K. Young (2011). "Political Networks". In: *PS: Political Science & Politics* 44 (1), pp. 39–43.

Mcpherson, M., L. Smith-Lovin, and J. M. Cook (2001). "Birds of a Feather: Homophily in Social Networks". In: *Annual Review of Sociology* 27 (1), pp. 415–444.

Meadowcroft, J. (2004). "Participation and sustainable development: modes of citizen, community and organisational involvement". In: *Governance for Sustainable Development*. Ed. by W. M. Lafferty. Cheltenham, UK: Edward Elgar. Chap. 6, pp. 162–190.

— (2007). "National sustainable development strategies: features, challenges and reflexivity". In: *European Environment* 17 (3), pp. 152–163.

— (2009). "What about the politics? Sustainable development, transition management, and long term energy transitions". In: *Policy Sciences* 42 (4), pp. 323–340.

Newig, J. and C. Pahl-wostl (2010). "Synapses in the Network: Learning in Governance Networks in the Context of Environmental Management". In: *Ecology and Society* 15 (4), 24 [online].

Newman, L. and A. Dale (2006). "Homophily and Agency: Creating Effective Sustainable Development Networks". In: *Environment, Development and Sustainability* 9 (1), pp. 79–90.

Ostrom, E. (2000). "Collective Action and the Evolution of Social Norms". In: *The Journal of Economic Perspectives* 14 (3), pp. 137–158.

— (2007). "Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework". In: *Theories of the Policy Process*. Ed. by P. A. Sabatier. Boulder: Westview Press, pp. 21–64.

Prell, C. (2012). *Social Network Analysis*. London: Sage Publications.

Putnam, R. D., R. Leonardi, and R. Nanetti (1993). *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton: Princeton University Press.

Robins, G., L. Bates, and P. Pattison (2011). "Network Governance and Environmental Management: Conflict and Cooperation". In: *Public Administration* 89 (4), pp. 1293–1313.

Robins, G., J. M. Lewis, and P. Wang (2012). "Statistical Network Analysis for Analyzing Policy Networks". In: *Policy Studies Journal* 40 (3), pp. 375–401.

Sandström, A. (2011). "Social networks, joint image building,and adaptability: the case of local fishery management". In: *Social Networks and Natural Resource Management. Uncovering the Social Fabric of Environmental Governance*. Ed. by O. Bodin and C. Prell. Cambridge, UK: Cambridge University Press, pp. 288–321.

Scharpf, F. (1999). *Governing in Europe. Effective or Democratic?* Oxford: Oxford University Press.

Schneider, V. (2009). "Die Analyse politischer Netzwerke: Konturen eines expandierenden Forschungsfelds". In: *Politiknetzwerke*. Ed. by V. Schneider et al. Wiesbaden: VS Verlag für Sozialwissenschaften, pp. 7–28.

Schwaller, T. et al. (2012). *Region Thal: Jahresbericht 2012*. Balsthal.

Scott, J. (2013). *Social Network Analysis*. London ; Thousand Oaks, Calif.; New Delhi: Sage Publications, p. 199.

Sedlacek, S. and V. Gaube (2010). "Regions on their way to sustainability: the role of institutions in fostering sustainable development at the regional level". In: *Environment, Development and Sustainability* 12 (1), pp. 117–134.

Snijders, T., G. G. van de Bunt, and C. E. Steglich (2010). "Introduction to stochastic actor-based models for network dynamics". In: *Social Networks* 32 (1), pp. 44–60.

Snijders, T. A. B. et al. (2006). "New specifications for exponential random graph models". In: *Sociological Methodology* 36 (1), pp. 99–153.

Stegbauer, C. and R. Häussling (2010). *Netzwerkanalyse und Netwerktheorie. Ein neues Paradigma in den Sozialwissenschaften*. Wiesbaden: VS Verlag für Sozialwissenschaften, p. 596.

Torfing, J. (2005). "Governance Network Theory: Towards a Second Generation". In: *European Political Science* 4 (3), pp. 305–315.

Typeform (2014). *Typeform, computer program*. Barcelona. URL: http://www.typeform.com/.

Underdal, A. (2010). "Complexity and challenges of long-term environmental governance". In: *Global Environmental Change* 20 (3), pp. 386–393.

Van Buuren, A. et al. (2014). "Toward legitimate governance strategies for climate adaptation in the Netherlands: combining insights from a legal, planning, and network perspective". English. In: *Regional Environmental Change* 14 (3), pp. 1021–1033.

Verein Region Thal (2005). *Regionaler Naturpark Thal. Machbarkeitsstudie.* Balsthal.

Walker, B. et al. (2004). "Resilience, Adaptability and Transformability in Social-ecological Systems". In: *Ecology and Society* 9 (2), 5 [online].

Ward, M. D., K. Stovel, and A. Sacks (2011). "Network Analysis and Political Science". In: *Annual Review of Political Science* 14, pp. 245–264.

Woolcock, M. (1998). "Social capital and economic development: Toward a theoretical synthesis and policy framework". In: *Theory and Society* 27, pp. 151–208.

Woolcock, M. (2001). "The Place of Social Capital in Understanding Social and Economic Out-
comes". In: *The contribution of Human and Social Capital to Sustained Economic Growth and Well-
Being. International Symposium Report.* 2000. Human Resources Development Canada (HRDC);
OECD, chapter 5, 65–88.
World Commission on Environment and Development (1987). *Our Common Future*. New Haven, US
and Oxford (UK): Oxford University Press.