



Rural innovations in biosphere reserves – A social network approach

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ABSTRACT

Today, peripheral rural areas are indispensable to achieve global and national conservation goals or a post-carbon transition while simultaneously struggling for quality of life and economic development. Biosphere Reserves have the ambition to overcome this dichotomy of environmental protection and regional development by fostering and upscaling (social) innovations within their World Network of Biosphere Reserves (WNBR). This study explores how these innovations resp. innovative firms and projects are stimulated and embedded in practice. A standardized survey and social network analysis (SNA) with these firms in two Biosphere Reserves reveals that innovations in the peripheral regions are multi-level arrangements where the Biosphere Reserves (1) provide platforms for new ideas and needs, (2) foster the development, funding and diffusion of products or services and (3) act as gatekeepers between actors of different areas and spatial scales. We therefore conclude that the role of the Biosphere Reserve in the two regions goes far beyond the protection of nature, providing the ‘institutional thickness’ for successful regional development. Additionally, they are social innovations themselves, which support the co-production of knowledge and learning. However, if UNESCO's Man and Biosphere program truly wants to have an impact on sustainability transitions, the integration of local actors and their projects into their WNBR has to be their top priority for the future.

1. Introduction

Innovations are key drivers for economic growth and job creation (Aoyama et al., 2011). Scholars studying innovations so far have not paid much attention to rural areas because their demographic disadvantages, low education levels, a less diverse economy or problems with the provision of infrastructure (Bronzizio and Le Tourneau, 2016; Grimes, 2016) offer few opportunities for innovative business development. This view however is increasingly called into question (Eder, 2018). Researchers detect various novelties in remote areas around social innovations (Bosworth et al., 2016; Neumeier, 2017), a new rural creative industry (Herslund, 2012), new arrangements for sustainable food systems (Marsden, 2014, 2016; Schermer, 2015; Spaargaren et al., 2012), cross-sector linkages (van Tulder et al., 2016) or farm modernization (Koopmans et al., 2018). Recent contributions to the theoretical discussion of rural development not only recognise innovations as important drivers of sustainable rural development (van der Ploeg, 2008) but also reassess rural innovations as important for global challenges like climate change, food security and a transition to a post-carbon society (Horlings and Marsden, 2014; Knickel et al., 2017; Woods, 2011).

Nevertheless, peripheral areas contribute significantly in other ways

to overall wellbeing. They provide a diversity of species and ecosystems, access to valuable ecosystem services (Díaz et al., 2018), and therefore remain significant for the achievement of global and national conservation goals (Butchart et al., 2015). In this ‘dynamic complexity of rural regional development’ (Horlings and Marsden, 2014, p. 4), more recent approaches of environmental protection like Biosphere Reserves can be of foremost importance. They seek to establish a dialogue between different interests and want to foster novel ideas and actions through networking and experimentation.

Biosphere Reserves have been established since the 1970s by UNESCO's Man and Biosphere Programme (MAB) with the intention to form a global network of protected areas for a better relationship between people and the environment (for the ongoing discussion about whether or not Biosphere Reserves are protected areas as such see e.g. Bridgewater et al. 1996; Kratzer, 2018b; Shafer, 2015). In 2017 the WNBR consisted of 669 sites in 120 countries, organized in various spatial subnetworks with approximately 207 million people living in them (UNESCO MAB, 2017). Biosphere Reserves use a different approach to environmental protection than e.g. national parks. They move away from the classical ‘segregation approach’ in which nature protection and settlement areas are spatially separated, to an ‘integrative approach’ in which people and the environment have to interact in

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order to achieve sustainable development (Mose and Weixlbaumer, 2007; Phillips, 2003). During the history of the programme (see e.g. Batisse, 1986; Ishwaran, 2012), a spatial framework consisting of three interrelated zones and three interconnected functions have been agreed on. One or more core areas with strong regulations guarantee a long-term protection of ecosystems. A buffer zone surrounds the core areas. Here, sound ecological resource use is possible. Third, the transition zone is the area where people usually live and work and where most activities are allowed. The areas correspond to the functions conservation (preserving ecosystems and landscapes, species and genetic resources), development (fostering sustainable economic and human development), and logistic support (demonstration projects, environmental education, research and monitoring) (UNESCO, 2017).

With the Seville Strategy, the Madrid Action Plan and the recently established Lima Action Plan (UNESCO, 1996, 2008; 2017) Biosphere Reserves have developed to multifunctional landscapes. They seek to be model regions for sustainable development and want to “sow the seed for a new type of economic landscape: pilot projects are supported with the specific aim of facilitating the transition to sustainable forms of production and consumption in the long term” (GIZ, 2011, p. 7). In this regard, the ‘Lima Action Plan’ especially calls attention to the importance of local innovations and research with the aim of sharing these innovations within the network.

Biosphere Reserves research has intensified in a variety of disciplines and topics in recent decades (see e.g. Kratzer, 2018a). Even though the study of innovations in rural Biosphere Reserves is highly relevant and high on the agenda of the MAB, little empirical evidence on the linkage between innovations and rural Biosphere Reserves has been published so far. Existing studies mostly relate to regional brands (e.g. Kraus, 2015; Kraus et al., 2014; Mann and Plieninger, 2017). Knaus, Bonnelame, and Siegrist (2017) even address the economic impact of the label ‘Echt Entlebuch’, an innovation that has been studied in this paper as well. Furthermore, studies discuss certain aspects of innovation processes like the role of facilitators in the co-production of knowledge and diffusion of innovations in Canadian Biosphere Reserves (Reed and Abernethy, 2018) or the connection between alternative livelihoods and community based innovations (Adeel and Safriel, 2008). Even though these papers address the outcomes of innovations, they do not provide an in-depth analysis of the role of the Biosphere Reserves in relation to the innovations.

Social Network Analysis (SNA) is a common method to study innovations (van der Valk and Gijsbers, 2014). In Biosphere Reserves however, social networks have only been studied in terms of governance and decision making processes (Rico García-Amado et al., 2012; Speelman et al., 2014). Furthermore, Kratzer (2018a) studied how place-specific elements like actors, networks and proximity influence a Biosphere Reserve's ambitions towards sustainability. The role of social networks for innovations in Biosphere Reserves has not been studied yet.

We would like to fill this research gap by examining the role of social networks for rural innovations in two case studies, the Biosphere Reserves Grosses Walsertal (GWT, Austria) and Entlebuch (ENT, Switzerland) in the European Alps. Specifically we want to

1. Categorize the innovations in the two rural Biosphere Reserves,
2. Investigate the related networks and
3. Determine the role of the regional networks for further innovations.

We also want to contribute to the ambitions of the MAB program formulated in the Lima Action Plan. From the authors point of view it can be of particular interest for the WNBR to give references on how Biosphere Reserve actors induce innovations. The multi-level governance approach of the WNBR (Schliep and Stoll-Kleemann, 2010) would allow that these experiences and knowledge are shared among the Biosphere Reserves and countries. This is in our opinion prerequisite for sustainable development. Hence, we are particularly interested in the

already established multi-level nature of these innovations and their utilization of the MAB network.

2. Background

2.1. Innovations

The term ‘innovation’ is mostly used for the translation of a new idea into a new product or process and its successful commercialization, as well as for new ways to make, market or sell an existing process or product (Castree et al., 2013). There are different opinions about what an innovation process involves (Godin, 2016). Typically, it comprises the three stages invention (development of a new idea), innovation (bringing the invention into commercial use) and diffusion (the spread of the innovation in society). The economic definition mentioned at the beginning of this chapter has broadened over the years, considering not only technological breakthroughs, but also design and marketing innovations as well as new legal arrangements or other changes in process organization. Additionally, scholars classify the impact of an innovation as incremental or radical, the degree of novelty as ‘new to the firm’, ‘new to the region’ or ‘new to the world’ and contrast innovations as technology-push or demand-pull concerning their driving forces (Aoyama et al., 2011; Horbach et al., 2012; Tunzelmann and Acha, 2011). While technology-push pinpoints to the role of science and technology in innovation processes, demand-pull innovations highlight the important role customers, users and the markets have (Di Stefano, Gambardella and Verona, 2012). Still broader is the approach of scholars from the humanities, social and cultural studies. The focus on technological and economic valorisation ignores the diversity of innovations in the fields of everyday practice, science and education, arts and politics. From their point of view, every innovation has social elements and technological and economic innovations are very common special cases of social innovations (Rammert, 2010). Howaldt and Schwarz (2014, p. 54) define a social innovation as an “intentional, goal-oriented recombination or re-configuration of social practices in specific fields of action” in order to solve societal problems (for social practices see Shove et al., 2012). They are therefore non-technological per se but can be highly related to them. The usage of the term ‘social’ hereby is threefold. First, to distinguish these innovations from others with a strong technological perspective and direct market purposes. Second, the term refers to the solution of societal problems through new strategies, ideas or concepts. Third, it connotes the interaction of actors to solve them. Social innovations thus relate to new interactions and practices in order to solve societal problems. Today, the term ‘social innovation’ has gained momentum especially in areas which are related to sustainability issues (Kirwan et al., 2013). Bosworth et al. (2016) note that especially rural areas with their more cohesive and sociable communities are conducive for using the potential of social innovations.

2.2. Innovations, networks and SNA

There are different and often supplementary opinions about what provides a fertile ground for innovations (Florida, 2008; Mazzucato, 2014; Schaltegger and Wagner, 2011). It is generally agreed however, that social networks can foster and constrain innovations and diffusion processes (Callon, 2002; Kastle and Steen, 2014b). Social networks can be defined as a set of actors (e.g. individuals, organizations) connected together by different relationships (e.g. funding, information exchange, collaborations, friendship) (Newman, 2010). They enable the flow of knowledge, ideas or capital (Kolleck, 2013) and highlight the embeddedness of individuals in webs of social relations and interactions across thematic areas, social sectors and spatial scales, (Borgatti et al., 2009). Following Richter (2017), networks are the basis for innovations because they are intangible infrastructure for the exchange of ideas and knowledge. Additionally, network relationships give access to a huge

variety of resources important for the development of entrepreneurship and innovations (Semrau and Werner, 2014). This includes financial resources (Le and Nguyen, 2009; Partanen et al., 2014), access to new technologies or markets (Pérez Pérez and Martínez Sanchez, 2002; Sullivan Mort & Weerawardena, 2006), or new business opportunities (Francioni et al., 2017; Neergaard, 2005). Especially in peripheral regions that often have limited access to different resources, social networks enable actors to implement innovative projects (Escarcia, 2014) and to diffuse the innovations (Peres, 2014).

The network perspective therefore understands innovation processes not as an isolated phenomenon but as the result of connections. SNA has a central role in the study of these connections (Kastelle and Steen, 2014a) and hence has increased greatly in the last decades. It has contributed to understand how social structures have influenced e.g. natural resource management (Bodin & Prell, 2011; Boschet & Rambonilaza, 2018) and socio-ecological systems (Baird et al., 2016), to understand structural dynamics in economic geography (Glückler and Doreian, 2016; Glückler et al., 2017) or in innovation studies (van der Valk and Gijbers, 2014). For Snijders (2016) SNA is always the valuable study of multi-level actions which means that nodes on different multiple levels have ties within and across levels. As a consequence, scholars have recently rediscovered the use of SNA for multi-level studies (e.g. Lazega and Snijders, 2016; Lomi et al., 2016).

Following Kolleck (2013, p. 4) SNA techniques have the capacity to promote innovation processes. They provide the tools to detect actors and their important positions for innovations, can show where and how cooperation exists and how it can be optimized and can reveal strengths and weaknesses by giving insights into knowledge transfer and problems of coordination. By using different metrics, scholars using SNA are also able to describe the structural conditions that are more or less likely to enable innovations in networks. Network **density** measures the number of actual to the number of possible edges. Lower density networks are more suitable in search processes for new ideas, products or alternative actions, as they tend to connect complementary types of information (Burt, 2000). Empirical studies with dense networks however, show that more relations promote collaboration, trust, and joint problem solving (Luthe et al., 2012; Sørensen, 2007; Uzzi, 1997). **Reciprocity** measures the proportion of mutual relationships to the sum of all relationships in a network. Capaldo (2007, p. 598) considers high reciprocity as basis for ‘first-class innovation’ because it supports mutual knowledge of each other’s know-how, resources and routines and therefore is a major motive for collaboration. A **diversity of actors** generates opportunities to access different types of knowledge as well as economic and social prospects (Eagle et al., 2010). Contrary homophile networks with very similar actor-compositions e.g. concerning their profession can limit the success of networks (Newman and Dale, 2007). Centrality measures help to identify the importance of single actors in a network. **Degree centrality** measures the number of ties an actor has. Actors with a high degree (hubs) are important for innovations because they strengthen the spread of information and the speed of diffusion (Peres, 2014). Highly centralized networks also depend on the capabilities of these hubs. First, because new actors often rely on them in order to get access to the network. Second, because their coordination activities and priorities highly influence the direction of collective actions. Both aspects give hubs a certain amount of power to steer governance processes (Fuhse, 2016; Luthe et al., 2012). Decentralized networks ensure a higher diversity of knowledge and promote different learning processes and the development of alternative ideas. **Betweenness centrality** measures the extent to which an actor acts as a bridge along the shortest path between two other nodes. It is a measure for the influence an actor has on the network flows. Actors with high betweenness act as gatekeepers or brokers between individuals, communities or scales (Luthe et al., 2012). They have access to a number of what Burt calls ‘structural holes’ (1995, 2004), i.e. lacks of connection between actors with different information. As a result, they build bridges for different information, receive certain information

earlier and tend to be more creative.

3. Methods and case studies

This section draws attention to the empirical investigations used in the two case studies from Dec. 2015–Dec. 2017. The unit of analysis is the innovative firm or project embedded in regional structures. The methods used to detect, select and analyse innovative firms or projects covered qualitative and quantitative approaches. First, we identified the innovative firms/projects by desk research (e.g. previous studies, awards) and by conducting expert interviews with scientists and actors from the state government (n = 4). An innovative firm or project was defined based on the Oslo Manual (OECD and EUROSTAT, 2005), as a firm or project that has developed

- new or improved products or services for new markets (product innovations)
- new ways of making existing products, e.g. regional value chains or individualization of products (process innovation),
- new ways of marketing and selling existing products, e.g. regional brands; online platforms (marketing innovation) or
- a new goal-oriented collaboration, recombination or reconfigurations of social practices to solve societal problems (social innovation)

in the case study region. This broad definition allowed us not only to include traditional technological and business innovations but also new initiatives, cooperative approaches or charities linked to social innovations. During this process, we particularly paid attention to include firms or projects that are not in contact or even known by the Biosphere Reserve management. A link to a standardized survey (see Annex I) was sent out by email to the key informants (CEOs, managers, farmers) of the 39 identified firms or projects. They were asked to participate in the online survey within two weeks after reception. With 33 completed questionnaires (84,6%) the response rate was quite high.

Subsequently, we used SNA to understand the concrete conditions in which the projects and innovations have originated and how the underlying regional structures support the economic routines in the regions. Following the discussion above, such a network structure supporting innovations has (1) medium density to support collaborations and new ideas, (2) a high amount of reciprocity, (3) high diversity, (4) actors who serve as hubs (high degree centrality) and (5) actors with high betweenness centrality that act as brokers between scales and groups. The paper follows these five aspects in the analysis of the case study networks. Of course, these metrics do not determine whether a person is innovative or creative. They detect structural conditions that are more or less likely to enable innovations or identify missing links for them.

SNA was conducted using ego-centred network analysis (Wasserman and Faust, 1994) with key informants of the firms or projects. In addition, local mayors, representatives and the Biosphere Reserve management (see Table 1) were included in the SNA because these actors affect the innovative activities within the regions in a governance context. Interviewees (= ego) were asked to write down the names of individuals, firms or organizations (= alteri) who are (i) important for them (ii) who they cooperate with. Afterwards they wrote them in different colours (representing the categories ‘economy’, ‘environment and energy’, ‘politics’ and ‘science, culture and education’) around the ‘ego-note’ (interviewee) on a blank paper. The distance between the ego and alteri indicated the frequency of interactions. As a final step of this method, the interviewees drew directed links between the ego and alteri as well as between alteri and alteri. They represent the financial and information exchange flows as well as collaborations. We used a list of topics and additional questions to guide the interviews. An outline of it can be found in the annex II.

Table 1
Range of actors selected for interview in the two regions.

Group	ENTLEBUCH	GROSSES WALSER TAL
Economic actors (e.g. "innovators", value chain actors, representatives of economic chamber)	20	11
Biosphere Reserve Management and national MAB programme	4	4
Municipal council	7	6
(Supra)regional Planning	1	4
Total	32	25

All ego centred networks were aggregated to a full network. For the sake of a more detailed understanding of the firms and networks, we collected secondary data, including business plans, brochures, newspaper articles, publicly available project reports and data from the firm's website. We used this data in order to check facts during the interviews and added actors and relationships to the data afterwards. The results of the interviews were validated, either at a presentation in the region (Grosses Walsertal) or via email (Entlebuch) with the interviewees.

In total, 57 interviews including SNA were conducted. All interviews were recorded, carefully transcribed and analysed with the software f4transkript. We took several pictures of the social networks, analysed the network measures with UCINET 6 (Borgatti et al., 2002) and visualized it with Gephi (<http://www.gephi.org>).

3.1. Case studies

For our study, we carefully selected two case studies (see Fig. 1) based on a literature review and personal contacts. Both Biosphere Reserves have been studied in the past by researchers from the University of Innsbruck. They also have been termed as 'best practice' Biosphere Reserve and received awards in various fields.

3.1.1. Entlebuch (ENT)

The Biosphere Reserve ENT was established in 2001 and has been labelled as very successful (van Cuong et al., 2017). The Biosphere Reserve is congruent to the statistical and planning region ENT and consists of seven municipalities located in the canton of Lucerne in Switzerland (Fig. 1). The region has been classified as a peripheral or marginal rural region between the cities Lucerne and Bern (Hammer, 2007). In 2016, approximately 17,000 people lived there (LUSTAT, 2018). The region covers alpine peatlands and karst mountains, forests, meadows and small settlements. The first economic sector is very pronounced in this remote region while the third sector is below the rest of Switzerland (Knaus et al., 2017; Wallner, 2005). With 6%, the share of organic farming is rather small (Knaus, 2011).

Forty community representatives are involved in the assembly of delegates in the ENT. Both, the number of inhabitants and the areas of the communities determine how many seats a community gets. The elected steering committee has a maximum of eleven members, with each of the seven municipalities as well as the association *Friends of the Biosphere Entlebuch* being entitled to one seat. This committee is responsible for the regional planning and strategic leadership of the Biosphere Reserve. Six so-called fora have been established in order to include different societal groups into the development process. They are

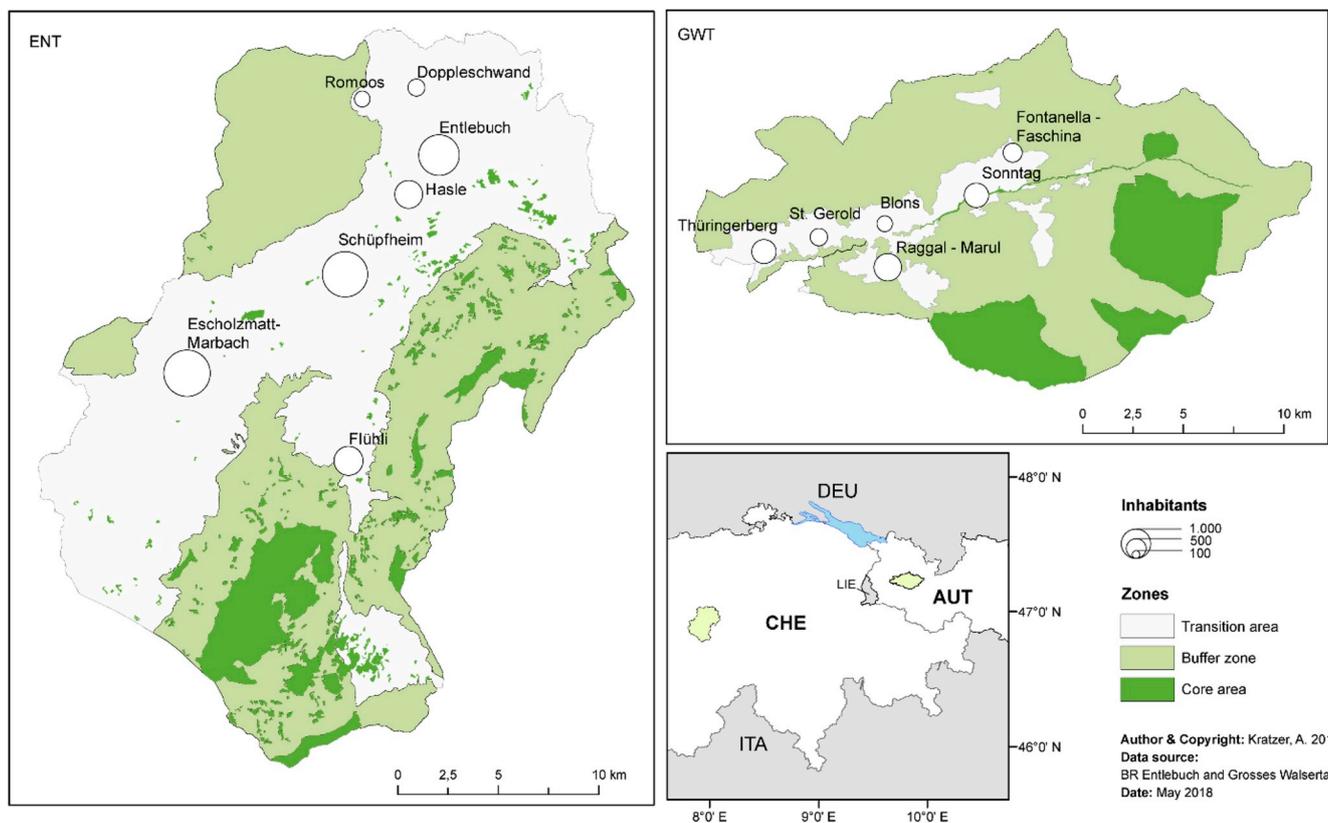


Fig. 1. Map of the two case studies.

small moderated networks, supported by the Biosphere Reserve management, which, among others, seek to identify needs and create innovations. A coordinating council aligns the projects of the various fora, discusses joint activities and synergies and integrates them into the development targets of the region. Finally, the Biosphere Reserve management is responsible for the operational activities in the region.

3.1.2. Grosses Walsertal (GWT)

The Walser people who emigrated from the Swiss Wallis colonized the GWT, a high mountain valley, in the 13th century. The Biosphere Reserve GWT (see Fig. 1, right side) was established in 2000. Around 3500 people (Statistik Vorarlberg, 2017) live within the Biosphere Reserve's six municipalities. Located in the most western federal state of Austria, the Biosphere Reserve GWT is a less favoured region in economic terms (Jungmeier et al., 2011). Other areas in Vorarlberg are famous for their successful transformation from a textile industry to an economy based on mechanical engineering and metalworking, on electronics, timber, and food industry. The GWT however, has not been part of this development. It has sustained its rural and peripheral character throughout the centuries. Even today, there is hardly any industry in the valley. Consequently, around 69% of the employed persons commute to the nearby regions Walgau and the Rhine valley. A lot of workforce in the Biosphere Reserve originates from agriculture (46% organic farming (BAW, 2013)) and tourism.

The regional planning association GWT (REGIO) is the legal entity of the Biosphere Reserve. The board of trustees has an advisory function on the strategic planning of the Biosphere Reserve. It consists of two persons per municipality (not necessarily political representatives), the REGIO chairperson and the Biosphere Reserve management, extended with regional disseminators. An expert advisory board gives content support. In order to address the different topics of sustainable regional development and to develop new ideas for projects, seven sub-committees with advisory functions have been established (e.g. agriculture, environment and energy, economy). They usually consist of one political representative and dedicated citizens.

Summarized, the two case studies share certain similarities but are also quite different (Table 2). They are similar in their remoteness and in their economic structure. This may indicate that innovations could emerge in similar areas. The regions differ when it comes to inhabitants, financial support or staff. Here, the Biosphere Reserve ENT is clearly provided with more human and financial resources. This allows us to discuss the social networks and innovations under different circumstances.

Table 2

Comparison of the biosphere reserves entlebuch (CH) and Grosses walsertal (AUT). Sources: LUSTAT, 2018; Statistik Vorarlberg, 2017; Knaus et al. 2017,.

	Entlebuch	Grosses Walsertal
Area [km²]	394,5	192,3
Inhabitants (Dec. 2016)	17030	3476
Jobs (2011)	5868	824
Workforce in %	2011	2011
production of raw material	25,4	21,4
small and midsize manufacturing enterprises	31,3	27,2
services sector	43,3	51,5
Land use	2007	2016
Forest	42,9	34,23
Agriculture	47,3	48,33
Settlement	3,1	0,32
Unproductive	6,7	17,12
Biosphere Reserve		
Staff	12	3
Budget	2.8 Mio US\$	0.245 Mio US\$

4. Results

4.1. Innovations

In total, 32 innovations resp. innovative small to micro firms and projects were included in the analysis of the two Biosphere Reserves; 12 in GWT and 20 in ENT (Table 3). We found that innovations are most frequently 'new products and services' (n = 15) or new ways of 'marketing and selling' in the areas of 'Agriculture, Food and Drink', followed by 'Tourism' (Fig. 2). There is however an uneven regional distribution of innovations. While in ENT a strong emphasis lies on new products or services (n = 12) and the two areas mentioned above, GWT has a focus on social innovations and the field 'arts & culture'.

In the survey, interviewees assessed the degree of novelty mostly with 'new to the region' (n = 20) and 'new to the firm' (n = 17). 'New to the firm' included farmers that extended their business with new products or services (n = 9) because they could not afford a living with agricultural income alone. Additionally, entrepreneurs and spinoffs which built their firms based on an innovation (n = 5) and local branding initiatives (n = 3) belong to this category. In most cases however, new collaborations between different (types of) actors were taken in order to generate innovations (n = 23).

Responses concerning the impact of the innovation largely depend on what entity this impact relates to. In general, innovations in both regions are incremental regarding the impact on a wider society (n = 30). However, two thirds of interviewees rate them as radical concerning the impact on the firm or on the regions. The implementation of new technologies, the rearrangement of supply chains or regional production networks and the risk-taking proved to be radical compared to the way they worked before. On the other hand, we found that almost 80% were demand-pull induced. Thus, science and new technologies play a very limited role for the peripheral innovations compared to customers and potential markets. The majority of actors (n = 18) tend to stay within their main expertise. Nevertheless, their experiences of some actors in incumbent firms or in other regions has led to disappointment with the current products and, subsequently, to ideas for new business opportunities. Social innovations in the regions are quite different in these respects. Only one interviewee stated that the demand was important for the innovation. Most of them are non-profit firms or projects. They seek to change attitudes, induce learning processes or create novel partnerships between public and private actors and are therefore radical in their scope. They address regional shortcomings, e.g. cultural infrastructure or the undersupply with internet, influenced by greater challenges like energy security, digitalization or climate change. For that, they have to break open established ways of using materials and images and rearrange them into new practices. This implies that the actors involved extend their knowledge and go beyond their routines.

4.2. Embeddedness of innovations

This chapter deals with the embeddedness of innovations in the social networks within the two Biosphere Reserves. With 328 nodes, the ENT network is almost twice as large as the GWT network with 173 nodes (Table 4). Interestingly, the total amount of edges in the ENT network with 964 edges is only slightly higher than the 935 edges of the GWT network. This means that the density of both networks is rather low with 3,1% (GWT) and 0,9% (ENT). The distribution of degree centrality (Fig. 3) is also very uneven among actors following a power law where few nodes have many edges while the majority has only few. This has been referred to as 'scale-free networks' in the literature (Barabasi and Bonabeau, 2003; Fuhse, 2016; Luthé et al., 2012). The top 10% of the nodes in GWT (n₁₀ = 17) with the highest degree

Table 3
List of studied innovative firms/projects and their innovations (alphabetically ordered).

Nr.	Name	Innovation/description	Biosphere Reserve
1	Alchemilla	Non-profit women initiative for herbology and organic cosmetics	GWT
2	Alpbusse	Alternative public hiking transport	GWT
3	Bergholz	Biodegradable timber houses	GWT
4	Bergtee	Mountain tea	GWT
5	Biosphäre Bergheumilch	Cheese and chocolate niche products and milk label	ENT
6	Biosphäre Berg-Käserei Entlebuch AG	New cheese cooperation (milk producers, dairies, shops)	ENT
7	Biosphäre Markt AG	Marketing and logistics platform for Echt Entlebuch products	ENT
8	Biosphere CSR activities	Companies can conduct Corporate Social Responsibility actions in the Biosphere Reserve	ENT
9	Breitbandinitiative St.Gerold	Community based broadband initiative	GWT
10	Brennholzbörse	Online platform to collect firewood; new arrangements between GWT residents and forest owners	GWT
11	Choba Choba	Biosphere Reserve chocolate	ENT
12	Echt Entlebuch	Label	ENT
13	Edelwhite Ginn	Craft Gin	ENT
14	Emscha	Organic sheep products	ENT
15	Energierama	Energy platform	ENT
16	Entlebucher Bier	Craft beer	ENT
17	Entlebucher Waldholz GmbH	Coordination of sustainable timber value chain	ENT
18	Fidirulla	Organic pasta	ENT
19	Kräuteranbaugenossenschaft	Herbs cooperative	ENT
20	Holzforum	New cooperation of firms for Echt Entlebuch timber	ENT
21	Kuhlift	Technological products for cattle farming	ENT
22	Verein Wassertal	Several projects about special water places (e.g. mobile sauna and open air sulphur bath)	GWT
23	Mooraculum	Moor adventure park (creating awareness about moors and their importance)	ENT
24	Paraplegiker- Skifahren	Special infrastructure and skiing instructors for paraplegic people	ENT
25	Partnerbetriebe/hotels	Label for Biosphere Reserve tourism businesses	GWT
26	Plastik raus	Upcycling of old clothes, replacement of plastic bags with recycled cloth bags	GWT
27	Schintbühl glace	Local organic ice cream	ENT
28	Swissmassiv	Bamboo skis	ENT
29	Walser Kostbarkeiten	Local online sharing and sales platform	GWT
30	Walserherbst	Local arts festival	GWT
31	Walserstolz (alpine dairy cooperation)	New dairy cooperation and label	GWT
32	Zyberliland	New recreation area	ENT

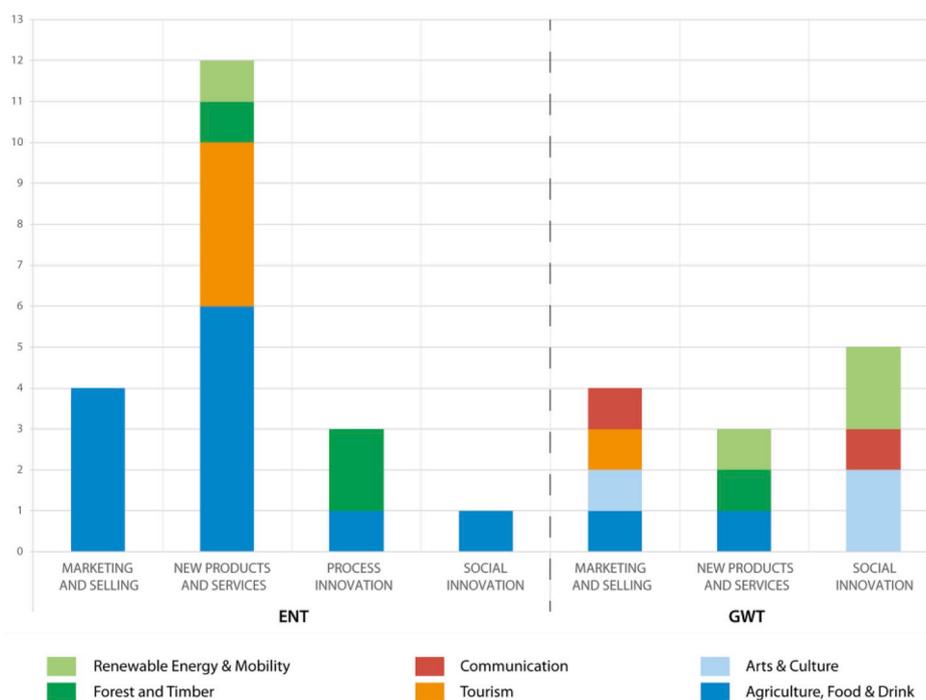


Fig. 2. Areas and categories of Innovations in the two Biosphere Reserves 2017. Source: Own Data 2018

receive 47,9% of all edges, in ENT ($n_{10} = 33$) even 55,9%. Conversely, 50% of the nodes with the lowest degree in GWT ($n_{50} = 86$) obtain only 10,3%, in ENT ($n_{50} = 166$) 13.8%.

Fig. 4 shows a visualization of these Biosphere Reserve networks.

Both networks have clearly visible hubs with high degree centrality. Among the top 15 actors (Table 5), especially political actors are of high importance as they are well integrated and closely connected within each region but play a more significant role within the GWT. Especially

Table 4
Network characteristics of the two Biosphere Reserves 2017. Source: Own Data 2018

		ENT	GWT
<i>Metrics</i>	Nodes	328	173
	Edges	964	935
	Density	0,009	0031
	Reciprocity	0,609	0746
	Average degree centrality	2939	5405
	Average path length	3733	2911
<i>Actor Diversity [%]</i>	Economy	66,16	42,77
	Environment and Energy	15,42	17,34
	Science, Culture and Education	11,28	22,54
	Politics	7,23	17,34
<i>Spatial Diversity [%]</i>	Region	65,55	61,27
	Federal state	6,40	20,23
	National	15,55	6,94
	International	12,50	11,56

the municipality of Sonntag has a high degree centrality because the mayor connects actors in and outside the valley via family ties. With 74,6% (GWT) and 60,95%(ENT), reciprocity is rather high in both cases, indicating a high amount of trust and strong ties.

While the managements of the two Biosphere Reserves are important in every aspect of the analysis, political actors are not that prominent when it comes to betweenness centrality. Economic actors gain importance here, as they act as brokers between different groups like producers, retailers, customers and other value chain actors. Here again the stronger focus on the production and distribution of local products in ENT is visible.

4.3. Innovation networks

The average innovation respectively innovative firm in our sample has a network of 7,35 actors. With a maximum number of 49 actors, the herbs cooperative has the most contacts, followed by the regional brand ‘Echt Entlebuch’ and the marketing and selling company ‘Biosphäre

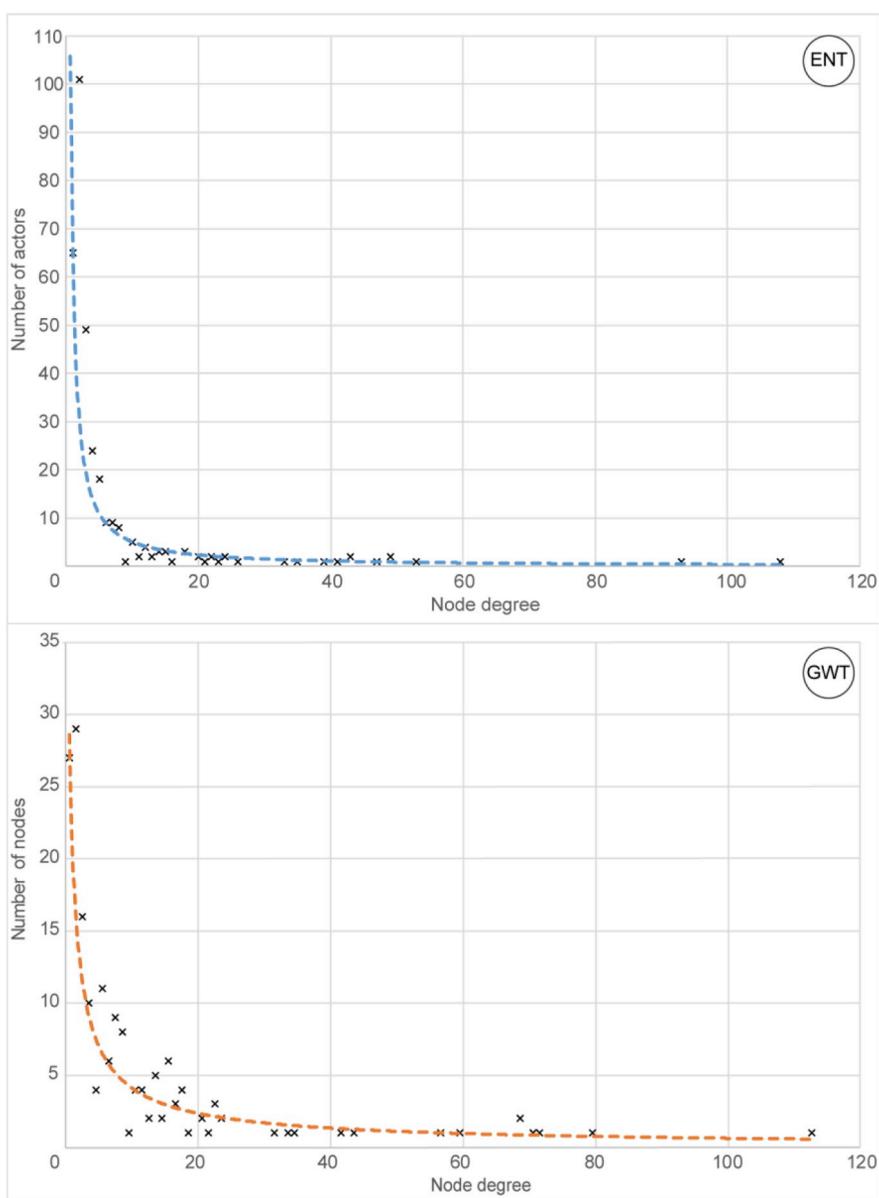


Fig. 3. Relationship between the number of nodes and their degrees in the two Biosphere Reserves. The black crosses stand for single nodes; the blue and orange line indicates the power law Source: Own Data 2018

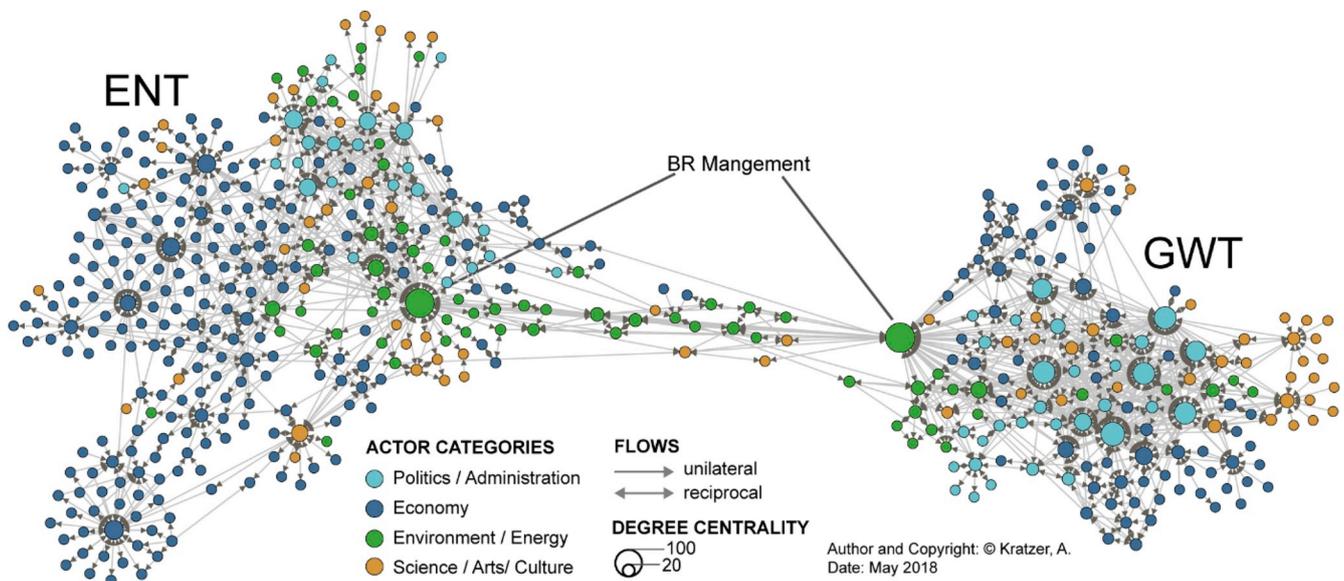


Fig. 4. Network of the two Biosphere Reserves. Source: Own Data 2018

Markt AG’. On the other end of the spectrum, there are a number of bilateral innovations like the tourism innovation for paraplegic people between the mountain cableway Sörenberg and the paraplegic centre in Nottwill (Switzerland). The innovative firms were provided with financial and natural resources, got access to supplier products and markets and had information exchange or informational support by their networks. In GWT, the European Union and its various programs like LEADER, LIFE or INTERREG are very important because most innovations started as externally funded projects. In ENT, the national and cantonal level as well as the Biosphere Reserve are much more important. Especially within the category ‘new products and services’ we found classical supply chain arrangements with providers of raw material, suppliers, and customers involved in the development of the innovations. Spinoffs (n = 2) had an advantage compared to the new entrepreneurs – which worked in completely different professions before – as they at least to some extent still had access to their previous networks. They knew suppliers and customers during the innovation process, which made it easier for them to customize and improve their products.

For most of the innovations however, new networks had to be built. Here, strategic and sometimes temporal alliances to work on a common

goal were predominant (n = 21). They were established between different firms of the same line of business to sell existing products/services under a new label (n = 4) or between firms from different fields in order to experiment and to produce special complementary niche products (n = 10). There are also strategic alliances between the firms and the Biosphere Reserves, especially in ENT. The Biosphere Reserves are important for the firms as financial support, marketing as well as sales partner. On the other hand, Biosphere Reserves provide certain labels so the firms are willing to produce in a regional and environmentally friendly way.

The SNA also revealed that the studied innovations are embedded in a multi-level network (Fig. 5). In most cases this does not include any actors or spaces of the multi-level MAB network from outside the case study areas. The strongest focus lies upon the regional scale. However, an accumulation of national and international actors in the ENT is apparent. Economic arrangements to produce and sell products that permeate different spatial scales is one explanation for this. Another one is the important role of national and international institutions like myclimate, alparc or the swiss parks network for the Biosphere Reserve. In GWT, the relations are much denser to the state of Vorarlberg, their funding organizations and political actors. The Biosphere Reserve

Table 5

Fifteen most central actors in terms of degree centrality and betweenness centrality in the Biosphere Reserves ENT and GWT. Source: Own Data 2018

#	Degree centrality			Betweenness centrality		
	Case Study	Actor name	Category	Case Study	Actor name	Category
1	GWT	Management Biosphere Reserve GWT	Environment/Energy	ENT	Management Biosphere Reserve ENT	Environment/Energy
2	ENT	Management Biosphere Reserve ENT	Environment/Energy	GWT	Management Biosphere Reserve GWT	Environment/Energy
3	GWT	Municipality Sonntag	Politics/Admin.	ENT	Herb growers cooperative	Economy
4	GWT	REGIO	Politics/Admin	ENT	Echt Entlebuch	Economy
5	GWT	Municipality Thueringenberg	Politics/Admin	ENT	BBS AG	Economy
6	GWT	REGIO chairperson	Politics/Admin	ENT	Biosphaere Markt AG	Economy
7	GWT	Municipality St.Gerold	Politics/Admin	ENT	Biosphäre Teammember	Environment/Energy
8	GWT	Municipality Blons	Politics/Admin	ENT	Biosphäre Teammember	Environment/Energy
9	GWT	Municipality Raggal	Politics/Admin	GWT	REGIO chairperson	Politics/Admin
10	ENT	Echt Entlebuch	Economy	ENT	Municipality Entlebuch	Politics/Admin
11	ENT	Biosphaere Markt AG	Economy	ENT	Municipality Fluehli	Politics/Admin
12	ENT	Municipality Entlebuch	Politics/Admin	ENT	Municipality Romoos	Politics/Admin
13	ENT	Herb growers cooperative	Economy	ENT	Chruetlimacher (firm)	Economy
14	ENT	BBS AG	Economy	GWT	Business association GWT	Economy
15	ENT	Municipality Schuepfheim	Politics/Admin	ENT	Municipality Schuepfheim	Politics/Admin

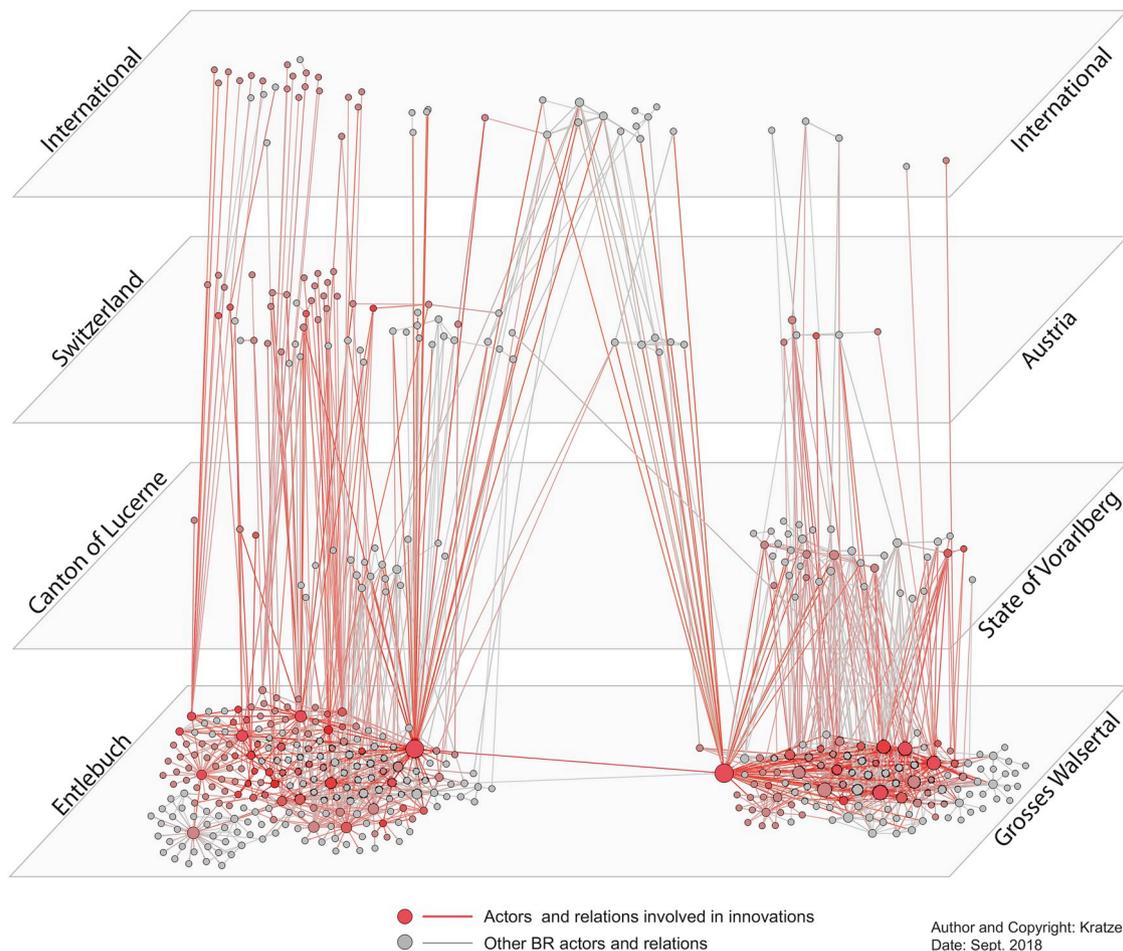


Fig. 5. Multi-level embeddedness of innovations (red circles) in the regional network (grey); the size of the circles represents the betweenness centrality of an actor. Source: Own Data 2018

managements, the national MAB commissions and some universities act as brokers between the two Biosphere Reserves. This highlights the Biosphere Reserve managements function as the most central gate-keeper.

5. Discussion

5.1. Limitations

Various limitations concerning the data collection process and the used methods have to be taken into account. First, our study is a snapshot of the network. It is tied to the spatial and temporal boundaries we chose prior to the analysis. Second, the interviewees limit the 'usefulness' of the study. For example, the memory of involved actors and their willingness to communicate determined the role in the network. Finally, our chosen methods potentially underestimate the influence of higher level actors. For example, the European Union has a very low centrality but of course highly influences policies and the day-to-day work of the other actors.

5.2. Innovations and the Biosphere Reserves

Despite the environmental roots and aspirations of the MAB program, innovations in the two Biosphere Reserves are not predominately environmental i.e. profit-oriented innovations of 'ecopreneurs' (see [Schaltegger, 2002](#)) contributing to solve environmental problems. We detected innovations connected to environmental issues and firms that engage with pro-environment practices. Be that as it may, their core

motivation and main goals were not the improvement of the environment but regional value creation. We therefore consider them as 'regional innovations'. They are based on regional natural resources like timber, herbs or cereals and on regional actors and relationships. For the GWT, interviewees referred to the state of Vorarlberg as 'their region' not the GWT. This is understandable given the small size and limited resources of the valley. Furthermore, the innovations in the two Biosphere Reserves are regional because innovators are firmly rooted in the regions. Consequently, an important goal for most of them is to create jobs, increase regional value added so that people do not migrate into cities and stay in or come back to the region for the long term. Finally, the high reciprocity and thus trust between actors is very pronounced between actors of the same region. This suggests a high amount of territorial embeddedness. This of course is in line with the development function of Biosphere Reserves. However, it also shows that economic actors are more closely related to the social pillar of sustainable development than to the environmental. The Biosphere Reserve management or higher-level actors tackle most environmental subjects.

The stronger focus on new products and services in ENT might be explainable by two things. First, because there are far more farmers searching for an extra source of income and entrepreneurs dissatisfied with their previous jobs. They were more willing to take risks to start a new business. Far more important is the promotion of new products by the Biosphere Reserve management, especially their financial support. The good practice examples of the 'Echt Entlebuch' label and the 'Biosphäre Markt AG' prove this aspect. Both projects focus on sales and marketing and have been initiated by the Biosphere Reserve

management. They help connect producers and consumers and induce trust between them. Additionally, they secure the efficient management of regional products. As a consequence, the ‘Biosphäre Markt AG’ can act as an equal partner for the big Swiss retailers and thus becomes more interesting for the local producers. In a recently published article [Knaus et al. \(2017\)](#) support this by showing that a considerable amount of added value can be generated in agriculture and forestry in ENT through these channels. The stronger focus on social innovations in GWT is probably due to several reasons. One might be that in GWT different groups try to provide services (e.g. internet) that people need but are no longer supported by the state government. Another reason might be the strong regional history and involvement of cultural and arts actors that are interested in societal challenges and interpret the Biosphere Reserve as a tool for local solutions.

The study showed that both Biosphere Reserves are important for the innovation processes in several ways. First, in the invention phase because in their different governance models, interested people have the possibility to identify needs, problems or ideas. Then in the innovation phase because they developed and funded projects and finally in the diffusion of them. In all stages but especially in the final phase, the Biosphere Reserve is an important institution that solves coordination problems and supports co-operation among rural actors. Therefore, the central role of the Biosphere Reserve management in the networks is not surprising. With their high degree and betweenness centrality, with their bridging function between scales and groups, the Biosphere Reserve acts as intermediary, as multiplier and as tool for the alignment and spread of regional capacities. The Biosphere Reserves through their hub and betweenness function support collaboration and learning processes at different spatial levels. Indeed, as a local artisan in ENT put it *“at first people hated the idea of living and especially working in a protected area. After some time, when they understood that the regulations and restrictions were not that high, they started talking and they used the concept to identify challenges and business opportunities. If there is one thing that the Biosphere Reserve has increased, it is knowledge exchange and increased collaborations.”* The low density of the networks however, suggests two things. First, that their structure stimulates search processes for new ideas or products in general. Here, the probability that actors with different types of information collaborate – if they collaborate – is high while social pressure for network appropriate behaviour is low. Secondly, there is still great potential for more knowledge sharing and joint problem solving. Structural holes exist e.g. between different sectors of economy as well as between environmental and business actors. The development path of the GWT network is highly influenced of and dependent on the different municipalities and the REGIO chairperson. It is also very regionally aligned, which can be explained partly by the history of the Walser people and their peripheral location (see [Zinsli, 2002](#)). The connections to the state of Vorarlberg are a product of the state’s responsibility for environmental protection in Austria, the good relations to regional development agencies and funding opportunities. The already mentioned strong economic focus of the Biosphere Reserve ENT is visible in the diversity of actors with 2/3 being economic actors. These actors, however, have few connections to political representatives or environmental actors and tend to more homophily. This could limit the capacity of the network to foster radical or disruptive innovations, as they tend to operate in their own values. The main effect of increased communication is also not as pronounced as in the GWT.

A relatively new phenomenon are connections between urban, peri-urban and rural area innovations. Some of them take place in the context of diverging changes of the food regime (see [Scherner, 2015](#)) mainly concerning the support of new producer–consumer relations. Further linkages derive from the product supply chains. For example, innovations that are more complex have supply connections to firms close to urban areas and universities with the needed knowledge and technologies. Additionally, social entrepreneurs or larger companies located in urban areas use rural ingredients with the Biosphere Reserve

label to produce more sustainably.

To sum up, we argue that the Biosphere Reserve networks provide a certain amount of what [Amin and Thrift \(1995\)](#) have called ‘institutional thickness’. A strong local institutional presence, high levels of interactions between organizations, different coalition patterns and the awareness of being involved mobilizes the regions potentials for innovations. The development trajectories of the regions however, are not only shaped by the Biosphere Reserve but by the interplay of institutions at different levels, especially from the state level. We argue that universities play a crucial role in this context because they are intermediaries between scales and institutions. As such, they are able to define multi-scalar problems and avoid conflicts, initiate and support experimentation or demonstration projects, mobilize actors and engage in the transfer of good practices and knowledge. Concerning the up-scaling of innovations within the WNBR, we found that the WNBR is very important for the Biosphere Reserve actors (management, national MAB program, individual supporters) but insignificant for almost anybody else. There are also no communication and governance tools to better integrate the actors, let alone the financial resources. However, the good practice of Choba Choba, a company that connects ENT with a Peruvian Biosphere Reserve, shows that the WNBR could act as an alternative economic space or production network. The search for innovations could be a way to exchange more ideas and to achieve a broader impact with it.

6. Conclusions

This paper has used a SNA approach to study innovations in two peripheral Biosphere Reserves. In doing so, we contribute to the understanding of how place specific conditions and global ambitions may lead to innovations, new economic arrangements and transcend the purely local to induce global sustainability transitions. However, our study is focused on a quantitative analysis of the social networks in the Biosphere Reserves and calls for more in-depth research. First, more qualitative data should be integrated into the quantitative SNA approach. In doing so, different mechanisms of support and motivations could reveal a more nuanced picture of the involved individuals. Second, besides the Biosphere Reserve an additional non-Biosphere Reserve ‘control region’ should be analysed. This could offer clues to the role a Biosphere Reserve has in the region or what kind of alternative arrangements support the regional development and innovations in peripheries.

Nevertheless, we conclude that the Biosphere Reserves in the two different regions have a similar role that goes far beyond the protection of nature. They are social innovations themselves, which enable the co-production of knowledge and learning. They address global and local challenges alike, and provide the ground for more regional value added in times of a global competition of business locations. Empirical evidence of the two Biosphere Reserves provides useful insights into this regional value added that is actually based on multi-level innovations. The strengthening of local networks and the support for local actors remain a crucial task for an intermediary organization like Biosphere Reserves to create new development paths and economic opportunities. It is also crucial however, to integrate local actors and their projects into their WNBR if the MAB truly wants to have an impact in terms of a transition to a more sustainable society.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jrurstud.2019.01.001>.

References

- Adeel, Z., Safriel, U., 2008. Achieving sustainability by introducing alternative livelihoods. *Sustainability Science* 3 (1), 125–133.
- Amin, A., Thrift, N.J., 1995. *Globalization, Institutions, and Regional Development in Europe* (1. Issued New as Paperback).
- Aoyama, Y., Murphy, J.T., Hanson, S., 2011. Key Concepts in Economic Geography. Key Concepts in Human Geography. SAGE, Los Angeles, Calif, London.
- Baird, J., Jollineau, M., Plummer, R., Valenti, J., 2016. Exploring agricultural advice networks, beneficial management practices and water quality on the landscape: a geospatial social-ecological systems analysis. *Land Use Pol.* 51, 236–243.
- Barabasi, A.L., Bonabeau, E., 2003. Scale-free networks. *Sci. Am.* 288 (5), 60–69.
- Batisse, M., 1986. Developing and focusing the biosphere reserve concept. *Nat. Resour.* (22), 2–11.
- BAW, 2013. Gemeindedatenbank.
- Bodin, O., Prell, C., 2011. Social networks and natural resource management: Uncovering the social fabric of environmental governance. Cambridge University Press, Cambridge, UK, New York.
- Borgatti, S.P., Everett, M.G., Freeman, L.C., 2002. Ucinet for Windows: Software for Social Network Analysis. Analytic Technologies, Harvard, MA.
- Borgatti, S.P., Mehra, A., Brass, D.J., Labianca, G., 2009. Network analysis in the social sciences. *Science* 323 (5916), 892–895.
- Boschet, C., Rambonilaza, T., 2018. Collaborative environmental governance and transaction costs in partnerships. Evidence from a social network approach to water management in France. *J. Environ. Plann. Manag.* 61 (1), 105–123.
- Bosworth, G., Rizzo, F., Marquardt, D., Strijker, D., Haartsen, T., Aagaard Thuesen, A., 2016. Identifying social innovations in European local rural development initiatives. *Innovat. Eur. J. Soc. Sci. Res.* 1–20.
- Bridgewater, P., Phillips, A., Green, M., Amos, B., 1996. Biosphere Reserves and the IUCN System of Protected Area Management Categories. [S.l.]. IUCN.
- Bronzizio, E.S., Le Tourneau, F.-M., 2016. ENVIRONMENT. Environmental governance for all. *Science* 352 (6291), 1272–1273.
- Burt, R.S., 1995. paperback ed. Structural Holes: the Social Structure of Competition, vol. 1 Harvard Univ. Press.
- Burt, R.S., 2000. The network structure of social capital. *Res. Organ. Behav.* 22, 345–423.
- Burt, R.S., 2004. Structural holes and good ideas. *Am. J. Sociol.* 110 (2), 349–399.
- Butchart, S.H.M., Clarke, M., Smith, R.J., Sykes, R.E., Scharlemann, J.P.W., Harfoot, M., ... Burgess, N.D., 2015. Shortfalls and solutions for meeting national and global conservation area targets. *Conservation Letters* 8 (5), 329–337.
- Callon, M., 2002. From science as an economic activity to socioeconomics of scientific research: the dynamics of Emergent and consolidated techno-economic networks. In: Mirowski, P. (Ed.), *Science Bought and Sold: Essays in the Economics of Science*. Univ. of Chicago Press, Chicago, pp. 277–317.
- Capaldo, A., 2007. Network structure and innovation: the leveraging of a dual network as a distinctive relational capability. *Strat. Manag. J.* 28 (6), 585–608.
- Castree, N., Kitchin, R., Rogers, A., 2013. A Dictionary of Human Geography. In: Oxford Paperback Reference, first ed. Oxford Univ. Press, Oxford.
- Di Stefano, G., Gambardella, A., Verona, G., 2012. Technology push and demand pull perspectives in innovation studies: current findings and future research directions. *Res. Pol.* 41 (8), 1283–1295.
- Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R.T., Molnár, Z., ... Shirayama, Y., 2018. Assessing nature's contributions to people. *Science* 359 (6373), 270–272.
- Eagle, N., Macy, M., Claxton, R., 2010. Network diversity and economic development. *Science* 328 (5981), 1029–1031.
- Eder, J., 2018. Innovation in the periphery. *Int. Reg. Sci. Rev.* 93 (4), 016001761876427.
- Esparcia, J., 2014. Innovation and networks in rural areas. An analysis from European innovative projects. *J. Rural Stud.* 34, 1–14.
- Florida, R.L., 2008. *Cities and the Creative Class* (Transferred to Digital Printing). Routledge, New York, NY [u.a.].
- Francioni, B., Vissak, T., Musso, F., 2017. Small Italian wine producers' internationalization: the role of network relationships in the emergence of late starters. *Int. Bus. Rev.* 26 (1), 12–22.
- Fuhse, J.A., 2016. *Soziale Netzwerke: Konzepte und Forschungsmethoden*, first ed. UTB; UVK, Konstanz, Konstanz.
- GIZ, 2011. Biosphere Reserves: Model Regions for a Green Economy. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
- Glückler, J., Doreian, P., 2016. Editorial: social network analysis and economic geography—positional, evolutionary and multi-level approaches. *J. Econ. Geogr.* 16 (6), 1123–1134.
- Glückler, J., Lazega, E., Hammer, I., 2017. *Knowledge and Networks*, vol. 11 Springer International Publishing, Cham.
- Godin, B., 2016. The linear model of innovation. *Sci. Technol. Hum. Val.* 31 (6), 639–667.
- Grimes, S., 2016. The digital economy challenge facing peripheral rural areas. *Prog. Hum. Geogr.* 27 (2), 174–193.
- Hammer, T., 2007. Biosphere reserves: an instrument for sustainable regional development? The case of Entlebuch, Switzerland. In: Mose, I. (Ed.), *Ashgate Studies in Environmental Policy and Practice. Protected Areas and Regional Development in Europe: towards a New Model for the 21st Century*. Ashgate, Aldershot, England, Burlington, VT, pp. 39–54.
- Herslund, L., 2012. The rural creative class: counterurbanisation and entrepreneurship in the Danish countryside. *Sociol. Rural.* 52 (2), 235–255.
- Horbach, J., Rammer, C., Rennings, K., 2012. Determinants of eco-innovations by type of environmental impact — the role of regulatory push/pull, technology push and market pull. *Ecol. Econ.* 78, 112–122.
- Horlings, L.G., Marsden, T.K., 2014. Exploring the 'new rural paradigm' in Europe: eco-economic strategies as a counterforce to the global competitiveness agenda. *Eur. Urban Reg. Stud.* 21 (1), 4–20.
- Howaldt, J., Schwarz, M., 2014. "Soziale Innovation" im Fokus: Skizze eines gesellschaftstheoretisch inspirierten Forschungskonzepts. *Sozialtheorie*. s.l. transcript Verlag.
- Ishwaran, N., 2012. Science in intergovernmental environmental relations: 40 years of UNESCO's Man and the Biosphere (MAB) Programme and its future. *Environmental Development* 1 (1), 91–101.
- Jungmeier, M., Paul-Horn, I., Zollner, D., Borsdorf, F., Grasenick, K., Lange, S., Reutz-Hornsteiner, B., 2011. Biosphere reserves as a long-term intervention in a region - strategies, processes, topics and principles of different participative planning and management regimes of biosphere reserves. *ECO MONT-JOURNAL ON PROTECTED MOUNTAIN AREAS RESEARCH* 3 (1), 29–36.
- Kastelle, T., Steen, J., 2014a. Are small world networks always best for innovation? *Innovation* 12 (1), 75–87.
- Kastelle, T., Steen, J., 2014b. Networks of innovation. In: Dodgson, M., Gann, D.M., Phillips, N. (Eds.), *Oxford Handbooks in Business and Management. The Oxford Handbook of Innovation Management*. Oxford Univ. Press, Oxford, pp. 102–120.
- Kirwan, J., Ilbery, B., Maye, D., Carey, J., 2013. Grassroots social innovations and food localisation: an investigation of the Local Food programme in England. *Adding Insult to Injury: Climate Change, Social Stratification, and the Inequities of Intervention* 23 (5), 830–837.
- Knaus, F., 2011. Monitoring der Natur und Landschaft in der UNESCO Biosphäre Entlebuch. ([[Internet Bericht]]).
- Knaus, F., Bonnelame, L.K., Siegrist, D., 2017. The economic impact of labeled regional products: the experience of the UNESCO biosphere reserve entlebuch. *Mt. Res. Dev.* 37 (1), 121–130.
- Knickel, K., Redman, M., Darnhofer, I., Ashkenazy, A., Calvão Chebach, T., Šūmane, S., ... Rogge, E., 2017. Between aspirations and reality: making farming, food systems and rural areas more resilient, sustainable and equitable. *J. Rural Stud.* <https://doi.org/10.1016/j.jrurstud.2017.04.012>. Advance online publication.
- Kolleck, N., 2013. Social network analysis in innovation research: using a mixed methods approach to analyze social innovations. *Eur. J. For. Res.* 1 (1), 25.
- Koopmans, M.E., Rogge, E., Mettepenningen, E., Knickel, K., Šūmane, S., 2018. The role of multi-actor governance in aligning farm modernization and sustainable rural development. *J. Rural Stud.* 59, 252–262. <https://doi.org/10.1016/j.jrurstud.2017.03.012>.
- Kratzer, A., 2018a. Biosphere reserves as model regions for sustainability transitions? Insights into the peripheral mountain area Grosses Walsertal (Austria). *Appl. Geogr.* 90, 321–330.
- Kratzer, A., 2018b. Biosphere Reserves research: a bibliometric analysis. *Eco.Mont (Journal on Protected Mountain Areas Research)* 10 (2), 36–49.
- Kraus, F., 2015. Nachhaltige Regionalentwicklung im Biosphärenreservat Rhön: Regionale Wertschöpfungsketten diskutiert am Beispiel der Dachmarke Rhön. Würzburger Geographische Arbeiten, vol. 114 Würzburg University Press, Würzburg.
- Kraus, F., Merlin, C., Job, H., 2014. Biosphere reserves and their contribution to sustainable development: a value-chain analysis in the Rhön Biosphere Reserve, Germany. *Z. für Wirtschaftsgeogr.* 58 (2/3), 164–180.
- Lazega, E., Snijders, T.A.B. (Eds.), 2016. *Methodos Series. Multilevel Network Analysis for the Social Sciences: Theory, Methods and Applications*.
- Le, N.T.B., Nguyen, T.V., 2009. The impact of networking on bank financing: the case of small and medium-sized enterprises in Vietnam. *Entrep. Theory Pract.* 33 (4), 867–887.
- Lomi, A., Robins, G., Tranmer, M., 2016. Introduction to multilevel social networks. *Soc. Network.* 44, 266–268.
- LUSTAT, 2018. Ausgewählte Bevölkerungszahlen seit 1991: analyseregion Entlebuch. Retrieved from. https://www.lustat.ch/files_ftp/daten/arl/09/w011_001t_arl09_zz_d_0000.html.
- Luthe, T., Wyss, R., Schuckert, M., 2012. Network governance and regional resilience to climate change: empirical evidence from mountain tourism communities in the Swiss Gotthard region. *Reg. Environ. Change* 12 (4), 839–854.
- Mann, C., Plieninger, T., 2017. The potential of landscape labelling approaches for integrated landscape management in Europe. *Landsc. Res.* 42 (8), 904–920.
- Marsden, T., 2014. *Sustainable Food Systems: Building a New Paradigm*. Routledge.
- Marsden, T., 2016. Exploring the rural eco-economy: beyond neoliberalism. *Sociol. Rural.* 56 (4), 597–615.
- Mazzucato, M., 2014. The entrepreneurial state: debunking public vs. private sector myths. In: *Anthem Other Canon Economics*, Revised edition. Anthem Press, London, New York.
- Mose, I., Weixlbaumer, N., 2007. A new paradigm for protected areas in Europe? In: Mose, I. (Ed.), *Ashgate Studies in Environmental Policy and Practice. Protected Areas and Regional Development in Europe: towards a New Model for the 21st Century*. Ashgate, Aldershot, England, Burlington, VT, pp. 3–19.
- Neergaard, H., 2005. Networking activities in technology-based entrepreneurial teams. *Int. Small Bus. J.* 23 (3), 257–278.
- Neumeier, S., 2017. Social innovation in rural development: identifying the key factors of

- success. *Geogr. J.* 183 (1), 34–46.
- Newman, L., Dale, A., 2007. Homophily and agency: creating effective sustainable development networks. *Environ. Dev. Sustain.* 9 (1), 79–90.
- Newman, M.E.J., 2010. *Networks: an Introduction*. Oxford University Press, Oxford, New York.
- OECD, EUROSTAT, 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. The Measurement of Scientific and Technological Activities*, 3. ed. OECD, Paris.
- Partanen, J., Chetty, S.K., Rajala, A., 2014. Innovation types and network relationships. *Entrep. Theory Pract.* 38 (5), 1027–1055.
- Peres, R., 2014. The impact of network characteristics on the diffusion of innovations. *Phys. Stat. Mech. Appl.* 402, 330–343.
- Pérez Pérez, M., Martínez Sanchez, A., 2002. Lean production and technology networks in the Spanish automotive supplier industry. *Manag. Int. Rev.* 42 (3), 261–277.
- Phillips, A., 2003. *Turning Ideas on Their Head: the New Paradigm for Protected Areas*, vol. 2.
- Rammert, W., 2010. Die Innovationen der Gesellschaft. In: Howaldt, J., Jacobsen, H. (Eds.), *Soziale Innovation: Auf dem Weg zu einem postindustriellen Innovationsparadigma*. VS Verlag für Sozialwissenschaften, Wiesbaden, pp. 21–51.
- Reed, M.G., Abernethy, P., 2018. Facilitating Co-production of transdisciplinary knowledge for sustainability: working with Canadian biosphere reserve practitioners. *Soc. Nat. Resour.* 31 (1), 39–56.
- Richter, R., 2017. Rural social enterprises as embedded intermediaries: the innovative power of connecting rural communities with supra-regional networks. *J. Rural Stud.* <https://doi.org/10.1016/j.jrurstud.2017.12.005>. Advance online publication.
- Rico García-Amado, L., Ruiz Pérez, M., Iniesta-Arandia, I., Dahringer, G., Reyes, F., Barrasa, S., 2012. Building ties: social capital network analysis of a forest community in a biosphere reserve in Chiapas, Mexico. *Ecol. Soc.* 17 (3).
- Schaltegger, S., 2002. A framework for ecopreneurship leading bioneers and environmental managers to ecopreneurship. *Greener Manag. Int.* 38, 45–58.
- Schaltegger, S., Wagner, M., 2011. Sustainable entrepreneurship and sustainability innovation: categories and interactions. *Bus. Strateg. Environ.* 20 (4), 222–237.
- Schermer, M., 2015. From “Food from Nowhere” to “Food from Here:” changing producer–consumer relations in Austria. *Agric. Hum. Val.* 32 (1), 121–132.
- Schliep, R., Stoll-Kleemann, S., 2010. Assessing governance of biosphere reserves in Central Europe. *Land Use Pol.* 27 (3), 917–927.
- Semrau, T., Werner, A., 2014. How exactly do network relationships pay off? The effects of network size and relationship quality on access to start-up resources. *Entrep. Theory Pract.* 38 (3), 501–525.
- Shafer, C.L., 2015. Cautionary thoughts on IUCN protected area management categories V–VI. *Global Ecology and Conservation* 3 (Suppl. C), 331–348.
- Shove, E., Pantzar, M., Watson, M., 2012. *The Dynamics of Social Practice: Everyday Life and How it Changes*. SAGE, Los Angeles.
- Snijders, T.A.B., 2016. The multiple flavours of multilevel issues for networks. In: Lazega, E., Snijders, T.A.B. (Eds.), *Methodos Series. Multilevel Network Analysis for the Social Sciences: Theory, Methods and Applications*, pp. 15–46.
- Sørensen, F., 2007. The geographies of social networks and innovation in tourism. *Tourism Geogr.* 9 (1), 22–48.
- Routledge studies in sustainability transitions. In: Spaargaren, G., Oosterveer, P., Loeber, A. (Eds.), *Food Practices in Transition: Changing Food Consumption, Retail and Production in the Age of Reflexive Modernity* (1. Publ.). Routledge, New York, NY [u.a.].
- Speelman, E.N., García-Barrios, L.E., Groot, J.C.J., Tittone, P., 2014. Gaming for smallholder participation in the design of more sustainable agricultural landscapes. *Agric. Syst.* 126, 62–75.
- Statistik Vorarlberg, 2017. *Gemeindefolder 2017*. Retrieved from. https://www.vorarlberg.at/vorarlberg/geschichte_statistik/statistik/landesstatistik/weitereinformationen/gemeindefolder.htm.
- Sullivan Mort, G., Weerawardena, J., 2006. Networking capability and international entrepreneurship. *Int. Market. Rev.* 23 (5), 549–572.
- Tunzelmann, N. von, Acha, V., 2011. Innovation in “Low-Tech” industries. In: Fagerberg, J., Mowery, D.C., Nelson, R.R. (Eds.), *The Oxford Handbook of Innovation*. Oxford Univ. Press, Oxford, pp. 407–432.
- UNESCO, 1996. *Biosphere Reserves: the Seville Strategy and the Statutory Framework of the World Network*, Paris.
- UNESCO, 2008. *Madrid Action Plan for Biosphere Reserves (2008 - 2013)*. Paris.
- UNESCO, M.A.B., 2017. *MAB Strategy (2015-2025) Lima Action Plan (2016-2025) Lima Declaration Network of Biosphere Reserves (2016-2025): A New Roadmap for the Man and the Biosphere (MAB) Programme and its World Network of Biosphere Reserves*.
- Uzzi, B., 1997. Social structure and competition in interfirm networks: the paradox of embeddedness. *Adm. Sci. Q.* 42 (1), 35–67.
- van Cuong, C., Dart, P., Hockings, M., 2017. Biosphere reserves: attributes for success. *J. Environ. Manag.* 188, 9–17.
- van der Ploeg, J.D., 2008. *The New Peasantries: Struggles for Autonomy and Sustainability in an Era of Empire and Globalization*. Earthscan, London.
- van der Valk, T., Gijssbers, G., 2014. The use of social network analysis in innovation studies: mapping actors and technologies. *Innovation* 12 (1), 5–17.
- van Tulder, R., Seitanidi, M.M., Crane, A., Brammer, S., 2016. Enhancing the impact of cross-sector partnerships. *J. Bus. Ethics* 135 (1), 1–17. <https://doi.org/10.1007/s10551-015-2756-4>.
- Wallner, A. (Ed.), 2005. *Biosphärenreservate aus der Sicht der Lokalbevölkerung: Schweiz und Ukraine im Vergleich* [Zugl.: Zürich, Univ., Diss., 2004]. Birmensdorf, Bibliothek WSL.
- Wasserman, S., Faust, K., 1994. *Social Network Analysis: Methods and Applications. Structural Analysis in the Social Sciences*, vol. 8 Cambridge University Press, Cambridge, New York.
- Woods, M., 2011. Rural geography III: rural futures and the future of rural geography. *Prog. Hum. Geogr.* 36 (1), 125–134.
- Zinsli, P., 2002. *Walsert Volkstum in der Schweiz*. In: Vorarlberg, Liechtenstein und Italien: *Erbe, Dasein, Wesen ; mit 1 Farbtafel* (7., erg. Aufl.). Chur: Verl. Bündner Monatsbl.