

# Social Network Analysis of Stakeholders in the Grosses Moos region in Switzerland

Environmental Governance and  
Global Development Research  
Team

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Cover photo: © Photo taken on 7 May 2015 from Mont-Vully to the east by P. Trachsel, Soil Department Canton of Bern.

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# Executive Summary

This report presents a social network analysis of stakeholders in the Grosses Moos region in Switzerland, conducted by the Environmental Governance and Global Development Research Team at the Wyss Academy for Nature (WA), in collaboration with the WA Hub Bern. The analysis aims to improve our understanding of relationships among diverse stakeholders in order to identify entry points for more effective and inclusive governance that generates co-benefits for both nature and people.

The analysis draws on data from 49 semi-structured interviews conducted between March and July 2025 with representatives of 17 distinct stakeholder groups, including farmers, NGOs, governmental bodies, and other service providers. The data was analyzed using descriptive and inferential techniques, such as social network modeling and unsupervised text analysis approaches. The findings reveal several important patterns in the network:

- The Grosses Moos social network is relatively dense, with many connections between diverse stakeholder groups;
- Farmers and governmental bodies are central stakeholder groups in the network and can be the drivers of systemic transformations;
- Many stakeholders have more than one role in the network;
- Different stakeholders mention similar concerns about soil health, production pricing, water quality, and long-term planning in the region;

The findings indicate that the Grosses Moos social network is relatively closed, with many stakeholders holding multiple roles, and cohesive, with many stakeholder groups interconnected and similar topics circulating across the network. This suggests interventions may initially face barriers to entry into the network in practice but, once they do, “change” in the opinions and behaviors of any stakeholder can have far-reaching consequences. In fact, the “Development of the Grosses Moos Region”, a joint project by the WA Hub Bern and the office of agriculture and nature of the Canton of Bern (LANAT), managed by Ecoplan, has initiated a participatory process supporting local stakeholders to implement actions aimed at introducing positive systemic change. The project provides a promising foundation for strengthening inclusive and sustainable resource governance in the region.

# Introduction

The WA operates in Switzerland to advance systemic and innovative changes that promote the well-being of both people and nature. In Bern, the WA Hub Bern collaborates with the Canton of Bern and local partners to facilitate participatory, cross-sector initiatives. One of these initiatives is the “Development of the Grosses Moos Region”, a project that brings stakeholders from agriculture and nature conservation to co-develop practical initiatives for tackling the interrelated challenges of maintaining agricultural productivity while strengthening biodiversity and reducing greenhouse gas emissions in the Bernese portion of the Grosses Moos. <sup>1</sup>

The Grosses Moos region is a former wetland, artificially drained over the past two centuries. Its fertile soils are of national importance for vegetable production. However, balancing agricultural use and environmental protection has become increasingly challenging. Today, the landscape faces significant pressures to sustain agricultural productivity while safeguarding water resources, biodiversity, and soil health.

Mapping the different stakeholders in the region and their relationships provides essential insight into the formal and informal structures that shape how natural resources in the landscape are managed. <sup>2</sup> This study seeks to deepen our understanding of stakeholder interactions in the Grosses Moos and identify potential entry points for governance actions that can strengthen stakeholder engagement and improve project outcomes.

This report is divided into three parts. The first part introduces the Grosses Moos region and the methods and data collection process. The second part presents descriptive and inferential patterns on the stakeholder network, drawing on social network and text analysis techniques. Finally, the report concludes with recommendations from this study.

<sup>1</sup>For a detailed overview of the work of Wyss Academy Hub Bern in the Grosses Moos landscape, as well as other projects in Switzerland, please refer to the [Wyss Academy Hub Bern website](#).

<sup>2</sup>Please note that this is a short report, more detailed information about the methods, questionnaires, metrics, and findings can be found in the handbook on “Using Social Network Analysis to Investigate Local Stakeholder Dynamics”. Previous publicly available reports also investigate the network in Peru (see Borasino et al. 2025) and Laos (see Kommadam et al. 2025).

# Study Area, Data, and Methods

## The Grosses Moos region

The Grosses Moos is a vast plain located between Lakes Neuchâtel, Biel, and Morat (Figure 1). <sup>3</sup> Once an extensive wetland, the landscape was artificially drained over the past two centuries. These interventions made it possible to cultivate the region's peat-rich and fertile soil and significantly improved living conditions in the area. Today, the region plays a central role in Swiss vegetable production, accounting for more than 20% of national output. <sup>4</sup>

Figure 1: **The Bernese Grosses Moos.** The figure highlights the 99 square kilometers of the Grosses Moos located within the boundaries of the Canton of Bern (Source: Fonds Landschaft Schweiz).

<sup>3</sup>For more geographical information about the Grosses Moos landscape, please refer to the ["Plaine du Grosses Moos"](#) base study conducted by the Canton of Fribourg in 2022.

<sup>4</sup>For more information on the vegetable production in the Grosses Moos, please refer to Egli et al. (2021).



The region faces significant and interconnected economic and ecological challenges, particularly balancing agricultural production with environmental protection. Although the landscape remains a hotspot for endangered species, overall biodiversity has declined as a result of long-term land-use change and intensive farming practices. These changes have also led to soil compaction, the loss of organic matter, and the gradual thinning of the topsoil. Consequently, the region has become more vulnerable to local flooding and increasingly reliant on fertilizers to maintain agricultural productivity.

<sup>5</sup> Ensuring the long-term viability of agricultural production while safeguarding water resources and biodiversity constitutes a pressing challenge for the landscape.

Climate change is expected to amplify pressures on water availability and ecosystem resilience in the Grosses Moos. This calls for innovative solutions to restore critical areas and secure a sustainable future for both people and nature. Therefore, measures to preserve soil fertility, protect biodiversity, and improve water management, while respecting the well-being of local communities, are urgently needed.

<sup>5</sup>For more information about the historical changes in the Grosses Moos landscape please refer to Roeoesli and Egli (2024).

## Social network analysis and environmental governance

Social network analysis examines the relationships between social units, representing various types of connections between them. Examples of such connections include friendships or the exchange of knowledge. These connections can have distinct characteristics, such as being directed (i.e., having a clear origin and target) or undirected, and take different values reflecting the strength, intensity, or frequency of interactions between social units. In network terminology, social units are commonly referred to as “nodes” and connections are called “edges”. Nodes are graphically represented by points and edges by lines. The structure of social networks varies depending on the nature of the nodes and the characteristics of the edges between them. <sup>6</sup>

Environmental governance requires collaboration among various stakeholders. <sup>7</sup> Stakeholders are embedded in and interact with the ecological systems they rely on or manage. <sup>8</sup> Examining how they connect to each other and to the ecological systems in place provides a better understanding of their role in local governance of natural resources (Table 1). <sup>9</sup> Various network attributes, such as the strength of the edges connecting nodes, the characteristics of the nodes themselves, and their position within the network, influence local environmental governance processes and decision-making. Insights derived from social network analysis can therefore inform interventions aimed at mitigating resource conflicts, reducing the marginalization of stakeholders, and

<sup>6</sup>For an introduction to social network analysis and an overview of various perspectives, methods, and applications, please refer to Scott and Carrington (2011).

<sup>7</sup>For more information on the resilience of social-ecological networks, please refer to Janssen et al. (2006). For more information on how social-ecological systems are formed, change, and persist, see Folke et al. (2010).

<sup>8</sup>For more information on social networks in the context of natural resource governance, please refer to Bodin (2009).

<sup>9</sup>For more information on how network structures can foster collaboration on environmental governance, please refer to Bodin (2017).

ensuring that local governance dynamics reflect diverse interests. <sup>10</sup> While stronger connections, for example, can be beneficial for addressing complex tasks, they may also hinder innovation within networks. In contrast, weak ties may be less effective in building trust but play an important role in connecting otherwise disconnected groups.

Table 1: **Network concepts relevant for natural resource management** (adapted from Prell, Hubacek, and Reed 2016).

Network concept	Positive effects	Negative effects
Strong edges	May facilitate work with complex information	May hold redundant information
	May sustain trust between actors	May reduce exposure to new (innovative) ideas
	May influence thoughts, views, and behaviors	May constrain actors
	May create norms and maintain reciprocity	
Weak edges	May bridge diverse actors and groups	May be less effective for complex tasks
	May connect otherwise disconnected segments of the network	May provide lower levels of trust
	May facilitate simple tasks May spread new information	May break more easily
Homophily (i.e., similar nodes may be more likely to attach to one another than dissimilar ones)	May share norms, reduce conflicts, and increase coordination	May share similar sources of knowledge and increase resistance to change
Degree centrality (i.e., nodes with more connections to others in the network)	May motivate change and increase the speed of information exchange	May not bring together diverse segments of the network
	May provide a target for interventions and to diffuse information	May hold many weak edges that do not translate into influence
Betweenness centrality (i.e., how often a node is part of the shortest path connecting different nodes in the network)	May link disconnected segments of the network	May be torn between two (or more) positions
	May mobilize and diffuse information through the network	
Centralization (i.e., network structure revolves around a few central actors)	May reduce coordination costs of network interventions	May not be the optimal structure for resilience or problem-solving

<sup>10</sup>For more on this please refer to Prell, Hubacek, and Reed (2016).

## Data collection

The data collection process for networks can be complex and time-consuming, but ensuring that the network is representative of the stakeholders and their relationships is essential. Careful planning and testing help ensure that the data collected is reliable and provides valuable insights into the stakeholder network and its interactions in the study area. The data collection underlying this report took place in three steps.

- Step 1: Stakeholder selection

We relied on project partners involved in the “Development of the Grosses Moos Region”, such as LANAT and Ecoplan, to obtain an initial list of stakeholders in the Grosses Moos. The list was then used to identify 17 stakeholder groups of interest. Specific representatives from each stakeholder group were then pre-selected, taking into account the heterogeneity of the groups, to form the interview sample. This means that representatives of diverse stakeholder groups with a large presence in the region (e.g., farmers) are more strongly represented in the pre-selected sample than representatives of more homogeneous groups (e.g., a specific government institution).

- Step 2: Questionnaire development

Social network data was collected through an in-person, semi-structured survey. The questionnaire included network-related questions (e.g., common contacts and frequency of interactions), as well as open-ended questions related to their additional activities, perceptions of the environment, and the management of the region. <sup>11</sup>

- Step 3: Interview logistics and training

Enumerators were recruited internally from the WA staff pool due to the proximity to the research area and the availability of qualified personnel. The enumerators were supervised by the field manager, who coordinated and oversaw the data collection process. Enumerators underwent a comprehensive training covering how to build trust with respondents, accurately formulate questions, and record responses. The training also included an overview of the methods and relevant ethical guidelines.

<sup>11</sup>The questionnaire was approved by the ethics committee of the University of Bern.

Fieldwork took place between March and July 2025. On average, each interview lasted approximately one hour. Table 2 provides an overview of the stakeholder groups, their composition, and the number of interview respondents per group. In total, 49 interviews were conducted. The data collected were subsequently transcribed and cleaned. <sup>12</sup>

Table 2: List of stakeholders interviewed.

<b>Stakeholder groups</b>	<b>Stakeholders</b>	<b>Nr. of respondents</b>
Agricultural organizations	Agricultural organizations or institutions, and flurgenossenschaften	6
Civil construction	Civil construction or consulting companies	1
Contracting companies	Contracting companies	2
Farm shops	Farm shops	1
Farmers	Vegetable, livestock, arable, fruit, other crops or animals farming	5
Governmental bodies	BAFU, BLW, AGR, LANAT, AWA, Hunting and Fishery authorities	9
Gravel pit	Gravel pit owners	1
Machinery cooperatives	Machinery or ring cooperatives	1
Markets	Wholesale, marketing, producer or retail organizations	4
NGOs	Environmental-related non-government organizations	6
Politicians	Municipal council, municipality or canton parliament, national party, or board members of political parties	1
Private experts	Private expert offices	2
Processing industries	Processing industry	1
Regional conferences	Regional conferences and other similar bodies	2
Research	Research institutions	3
Transportation	Transport and storage providers	2
Utility providers	Electricity, gas or water suppliers	2

<sup>12</sup>The “flurgenossenschaft” was usually referred as an agricultural organization by interviewees, for this reason it is placed under “agricultural organizations”.

## Analysis

The subsequent analysis focuses on stakeholder groups (e.g., governmental bodies) instead of individual actors. <sup>13</sup> Since this aggregation could introduce unforeseen biases, we normalize attribute values, such as frequency of contact, and analyze the number of edges received by groups rather than those sent. <sup>14</sup> The analysis relies on descriptive measures, such as different types of centrality and is therefore exploratory and not causal.

Stakeholders in the Grosses Moos can hold multiple roles and belong to multiple groups. Stakeholders were allocated to groups based on the sampling design which was defined before the interviews took place (see data collection). Our aim was to ensure representation of all groups, while maximizing variation, in the interview sample. However, stakeholders were also asked about other roles they fulfill within the network. Those roles are included in the analysis below.

The data collected is not exhaustive and likely misses stakeholders and relations in the network. It captures a picture of the network at a single point in time. Although the network aggregation by groups makes the results less sensitive to the number of stakeholders interviewed per group, it limits, for example, what can be said about how changes in the network composition (e.g., the entry or exit of specific stakeholders) influence network dynamics. <sup>15</sup>

<sup>13</sup>The aggregation by stakeholder group also facilitates the visualization and descriptive analysis of the network. This does not assume these groups are monolithic, rather that they are a partial and abstract representation of the relations of a certain stakeholder group at a point in time.

<sup>14</sup>We normalize values by keeping the average value for their attributes (e.g., frequency of contact) multiplied by half of the number of edges recorded (i.e., dependent on interview number). This means we aggregate edges and their values by stakeholder groups to facilitate visualization. If, for example, edges are duplicated (i.e., multiple stakeholders within a stakeholder group share the same edge with another group), we keep the average value for their attributes (e.g., frequency of contact) multiplied by half of the number of edges recorded.

We employ exponential random graph models (ERGM) to systematically investigate the structure of the Grosses Moos social network. <sup>16</sup> ERGM is a flexible network modeling technique for cross-sectional network data (i.e., data collected at one point in time) that assumes that the observed network structure can be explained by a set of sufficient statistics. The dependent variable in ERGMs is the network structure (e.g., the presence or absence of edges between nodes), while the independent variables are the node or edge covariates (exogenous) and network effects refer to the (endogenous) structures that influence the formation of edges.

In addition, structural topic modelling (STM) is used to analyze qualitative data from the open-ended interview responses. STM is a probabilistic text analysis approach that identifies latent thematic patterns across documents. It assumes that each document consists of a mixture of topics, which may co-occur without being inherently related. By incorporating metadata such as stakeholder groups, the model improves topic estimation and allows for systematic comparisons across actor categories. This approach enables the identification of latent themes and their association with specific stakeholder groups. <sup>17</sup>

<sup>15</sup>Answering questions related to how edges may change over time for specific stakeholders might require a different research design, data collection, and hypotheses. Future studies should move beyond the initial overview presented in this report and provide more specific insights into how changes in the composition of stakeholders and changes in their connections influence local governance dynamics.

<sup>16</sup>There are different ways to model networks; for more information please refer to Block et al. (2019).

<sup>17</sup>For more information about how STM works and has been implemented, please refer to Roberts, Stewart, and Tingley (2019).

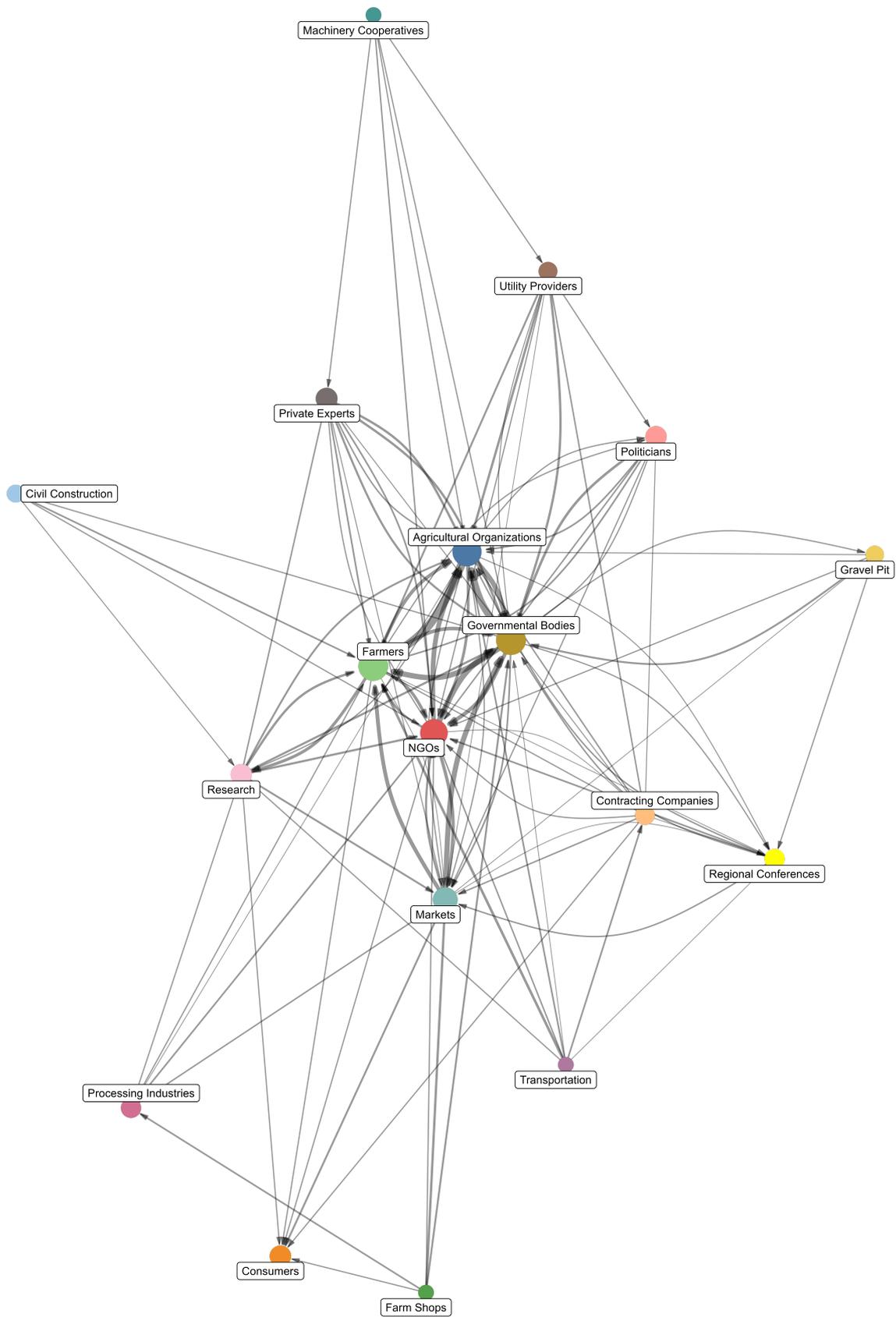
# Findings

## The Grosses Moos social network

The Grosses Moos social network is relatively dense (i.e., the ratio of edges in relation to all possible edges), with many connections between different stakeholder groups in the network (Figure 2). <sup>18</sup> Some stakeholder groups, such as farmers, governmental bodies, and NGOs, receive more ties than others.

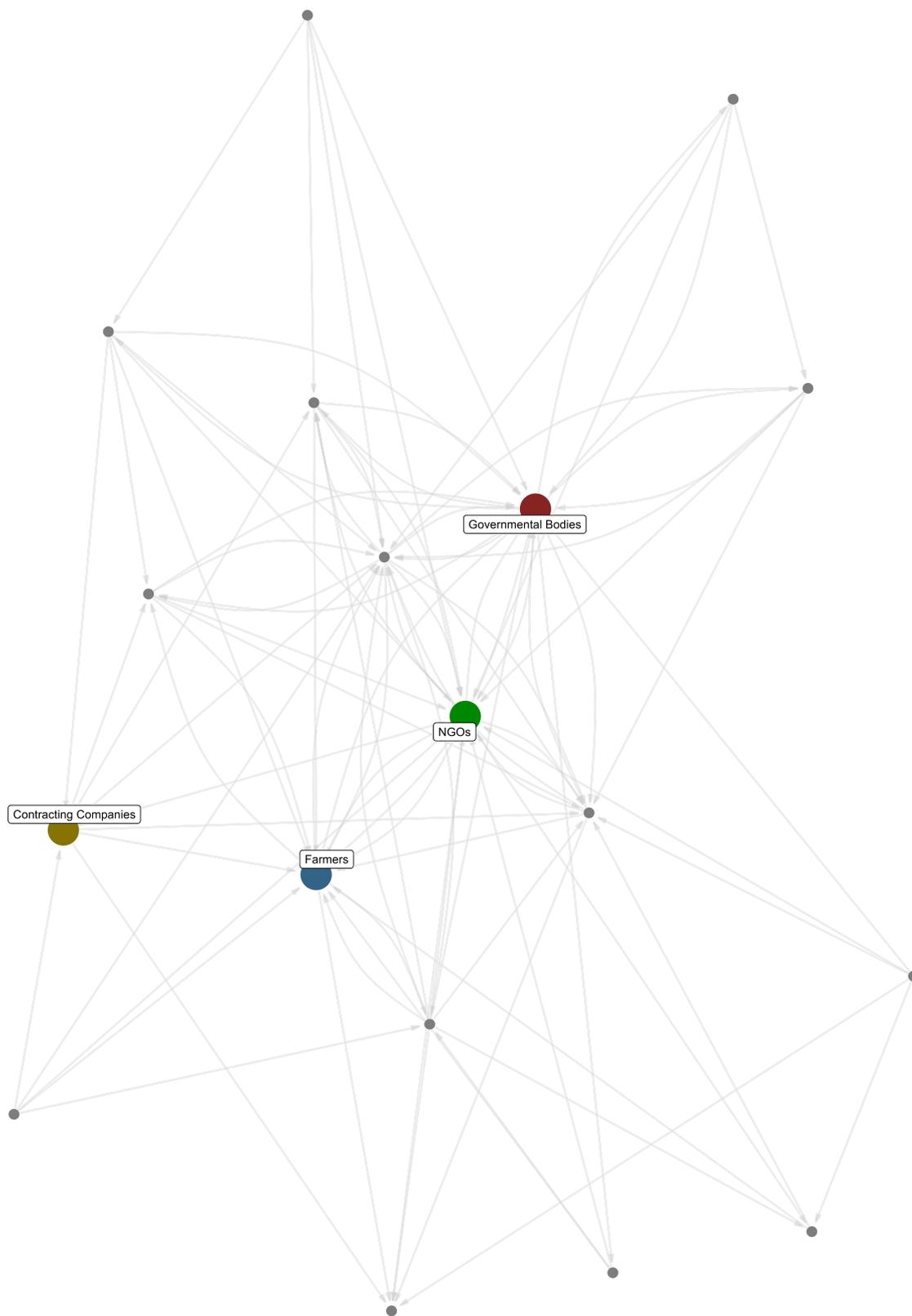
Figure 2: **The Grosses Moos network by stakeholder group.** Node colors represent stakeholder groups. Nodes are sized by number of edges received. Edges are sized according to the (normalized) frequency of interactions. Arrows indicate the source and target of edges.

<sup>18</sup>The network density of the Grosses Moos network is of 0.343 while the network transitivity is of 0.715. As well, community detection algorithms identify 4 broad communities (i.e., densely connected sets of nodes) in the network. Please note that network density could be a feature of how the data was collected or other types of sampling bias. We account for this by focusing the analysis on the broader groups and weighting the edges by both the number of interviews per group and average frequency of contact.



Stakeholders can influence network dynamics based on their structural position (e.g. centrality) within the Grosses Moos network (Figure 3). Degree centrality indicates which groups maintain the most connections with others. Closeness centrality reflects which groups are, on average, closest to all other stakeholders. Betweenness centrality identifies stakeholder groups that act as gatekeepers by connecting otherwise separate parts of the network. Finally, eigenvector centrality captures influence derived from being connected to other highly central stakeholders.

Figure 3: **Central stakeholder groups in the Grosses Moos network.** Node colors represent different types of network centrality. Central nodes are labelled and displayed at a larger size to facilitate visualization.



● Most influential ● Most connected ● Gatekeeper ● Closest (on average) to others

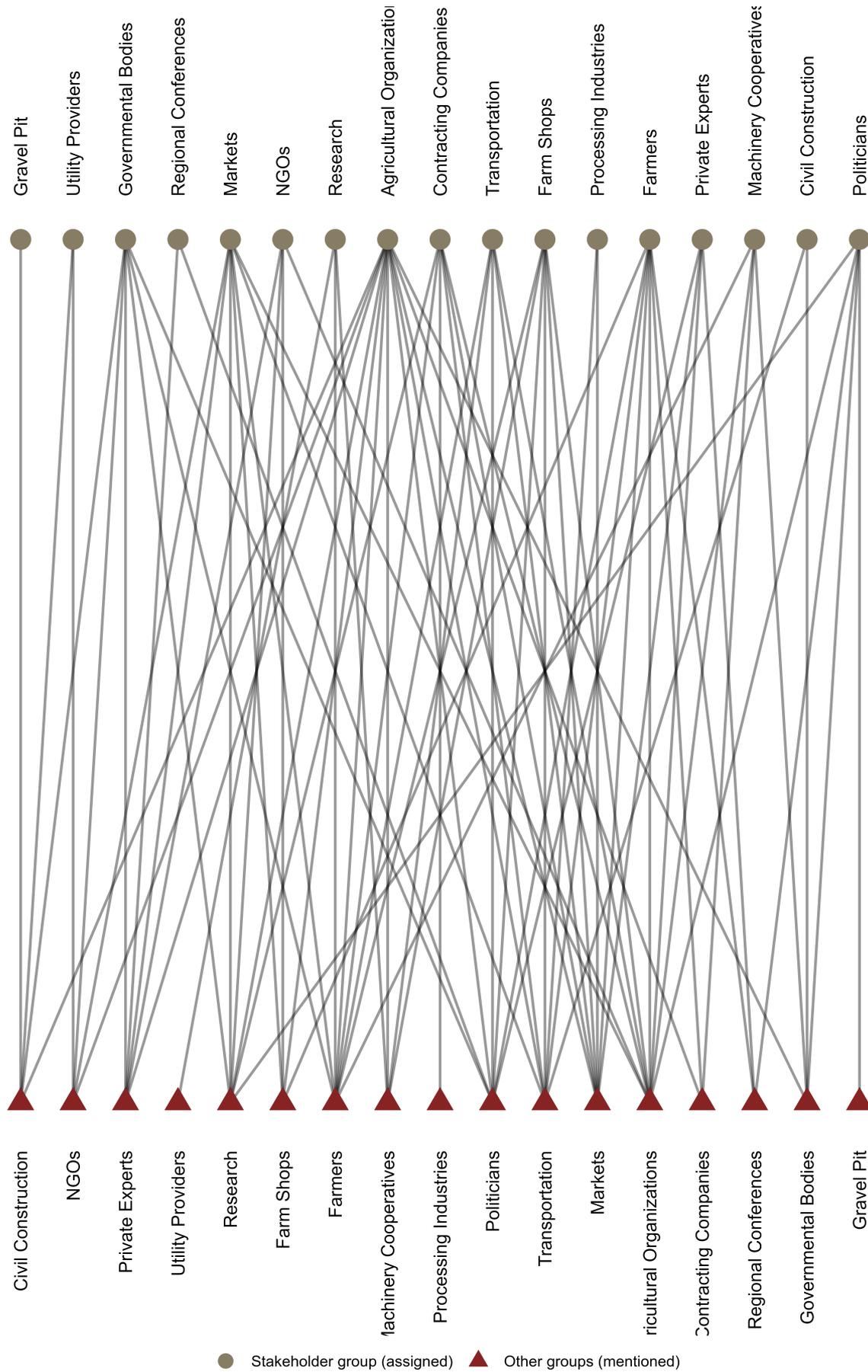
Governmental bodies are the most connected stakeholder group in the network. These institutions are deeply embedded in the day-to-day governance of the landscape. For example, construction work requires authorization from relevant authorities. Farmers emerge as the most influential stakeholder group, as they connect with many other influential groups. Farmers have been active in the region for a long time and are well organized through their associations, often engaging in local governance processes. NGOs connect otherwise distinct stakeholder groups and may play a key role in facilitating information flows across the network. This reflects their diverse interests and memberships, which enable them to engage with a broad range of stakeholders. Contracting companies are closest (on average) to all other stakeholders in the network and can reach other groups more quickly than others. While this may appear surprising, it relates to their function in providing infrastructure-related services across the region.

## Multiple roles in the Grosses Moos network

Many stakeholders in the Grosses Moos assume more than one role and may belong to different groups (Figure 4). This overlap in group membership and roles contributes to a cohesive network and has implications for local governance dynamics.<sup>19</sup> On the one hand, it facilitates outreach and coordination, as stakeholders who operate across sectors can connect different groups and accelerate the diffusion of information. On the other hand, it may increase resistance to change. Diverse stakeholders who share similar sources of knowledge may reinforce existing perspectives and practices while limiting openness to alternative approaches.

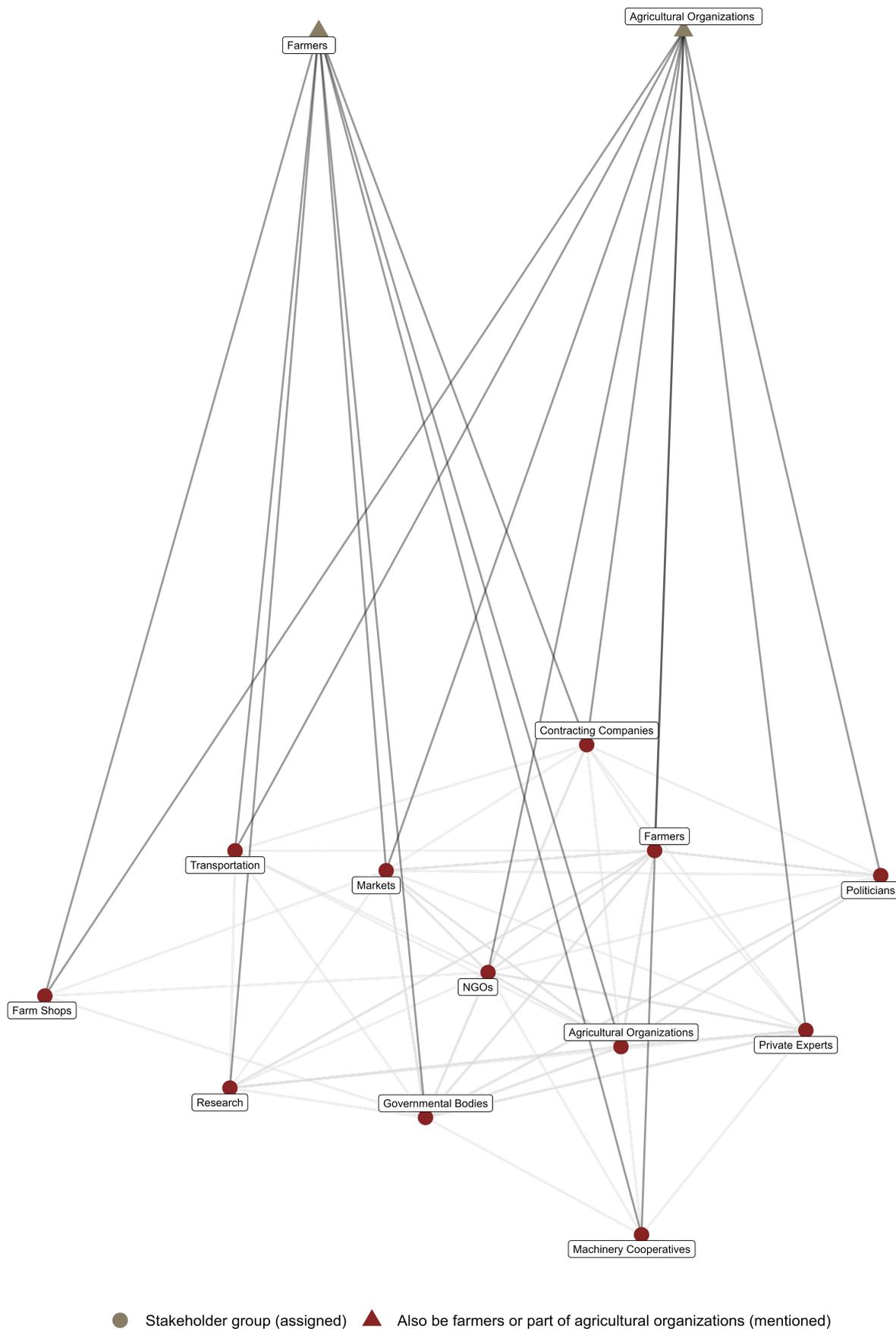
Figure 4: **Multiple roles in the Grosses Moos network represented as a bipartite network.** Node colors and shapes represent assigned stakeholder groups (during sampling) and other groups mentioned (during interview process). Edges represent connections between assigned and mentioned stakeholder groups.

<sup>19</sup>A substantial share of the Swiss population engages in different volunteering activities locally over the course of their lives. Voluntary engagement fosters social interaction, mutual understanding, and cooperation, contributing to trust, shared values, and social cohesion. In the context of the Grosses Moos, this is one possible explanation for the degree of role overlap. For more on how volunteering helps to build cohesion in Switzerland, please refer to the Swiss Society for Public Welfare report by Fischer et al. (2025).



How these dynamics operate in practice is complex and multifaceted. Figure 5 illustrates the overlap in roles among those who report also being farmers or members of an agricultural organizations, the two most frequently mentioned groups. Beyond confirming that both farmers and agricultural organizations have substantial potential to influence others and shape network dynamics, the diversity of stakeholders holding overlapping memberships in these two groups limits what can be said descriptively on how role overlap shapes stakeholder behavior and network dynamics.

Figure 5: **Role overlap for farmers and members of agricultural organizations represented as a multilevel network.** Node colors and shapes represent assigned stakeholder groups (during sampling) and other groups mentioned (during interview process). Edges represent connections between stakeholder groups and other mentioned groups. Only edges involving stakeholder groups that are also farmers or members of agricultural organizations are retained to facilitate visualization.



## Common topics in the Grosses Moos

Different stakeholder groups share similar views, beliefs, and concerns regarding the landscape and the future of the Grosses Moos. We analyze the text from the open-ended interview questions where stakeholders were asked to reflect on the main challenges associated with the management of the region, what successful development of the landscape would look like in their view, and how they would initiate change if they were able to do so. <sup>20</sup> We rely on unsupervised text analysis techniques to examine patterns in stakeholders' responses. <sup>21</sup> Figure 6 presents the seven main topics identified through STM, the main words associated with each topic, and the proportion in which these topics appear in the interviews. <sup>22</sup> Topics related to soil, pricing, and water are frequently mentioned. <sup>23</sup> These topics are broad and can include different types of discussions. For example, the topic "soil" includes terms related to land use and soil health; "pricing" includes terms associated with production competitiveness and cooperation; and "water" covers terms related to water quality and other forms of pollution. While the analysis does not imply that stakeholders discuss these topics in identical ways and multiple topics can be mentioned in the same interview, it enables a systematic comparison of how often these topics emerge.

Figure 6: **Unsupervised topics generated from the interviews conducted with Grosses Moos stakeholders.** Top words per topic based on semantic coherence and exclusivity (i.e., FREX) scores. Words are lemmatized; topic labels were assigned based on these lemmas. Percentages indicate the proportion in which topics appear in the interviews.

<sup>20</sup>Some of the multiple choice questions also allowed respondents to provide their opinion, however, these are not included in the analysis.

<sup>21</sup>A more in-depth analysis of the qualitative data is also planned to provide a more comprehensive overview of the problems and solutions articulated by stakeholders in the Grosses Moos.

<sup>22</sup>Lemmatization is a pre-processing technique used to reduce word variants to a common root form to improve word matching.

<sup>23</sup>STM relies on a mathematical algorithm to find "bags of words" that make a topic based on different text metrics (e.g., where words appear on text). We chose the topic labels based these "bag of words" of each topic.



Topic percentage

Table 3 illustrates a few examples of passages extracted from interviews that the STM classified as predominantly associated with each topic. This overview is illustrative rather than exhaustive, as discussions within each topic are diverse and context-dependent. The table also includes the stakeholder groups most associated with each topic. <sup>24</sup> Topics such as pricing and water are associated with different stakeholder groups, suggesting that concerns over how and where products are sold for how much and concerns about groundwater contamination and the sustainability of current agricultural practices are widespread. Other topics, such as production, appear associated with researchers, likely due to more technical discussions of production processes in the region.

Table 3: Topic, description, quote, and stakeholder groups associated based on STM classification.

Topic	Description	Quote	Stakeholder group
Soil	Includes discussions about land use and soil health, among other things.	The soils are being used very intensively and unsustainably. Nevertheless, we have many vegetable producers in the region, the know-how is there, as well as the processing industry. We really have to be able to offer farmers on site a perspective on how to deal with organic soils so that they see a future for themselves and their farms. (Interview 22)	Governmental bodies, private experts, regional conferences
Pricing	Includes discussions about competitiveness of production and cooperation, among other things.	Do we invest, produce expensively, and sell expensively? Or do we go to the competitor, where we can buy more cheaply and who is fully equipped? That brings us back to politics: What do you want now to strengthen or to do it yourself? In my opinion, support each other. Because we are definitely too small here in Switzerland. And ultimately it is also the struggle against the big two or three in retail, in order to be able to survive there. (Interview 44)	Agricultural organizations, civil construction, markets, processing industries, transportation
Water	Includes discussions about water quality and other pollution issues, among other things.	To my knowledge, there is not a single groundwater well in the Grosses Moos that can be used for drinking water. So in that respect it is a complete derailment. We are allowed to supply water into the Grosses Moos, because so many drinking water wells there had to be given up. And most of them because of high nitrate levels. If one were to measure now, there would certainly also be significant pesticide pollution. But because these wells were already closed due to high nitrate levels or other usage conflicts, it is practically no longer an issue in the Grosses Moos. (Interview 45)	NGOs, regional conferences, research, utility providers

<sup>24</sup>To determine which stakeholders are associated to each topic, first, we select the highest topic score per interview. That is, we assign each interview to the topic that is coded as the most mentioned. Second, we remove any interviews for which the topic scores are lower than 0.7. We do so to ensure the interviews have a clear topic assignment. Finally, we average these scores based on the stakeholder group assigned to interviewee.

Planning	Includes discussions about planning and future compromises in the region, among other things.	But here politics would have to become more flexible with all the different interest groups, so that land, the necessary land, could be reorganized or allocated more broadly, more variably, more flexibly. Or at least the different stakeholders should perhaps become more equal in a way, so that one becomes more flexible. (Interview 46)	Farmers, governmental bodies, utility providers
Conservation	Includes discussions about sustainability and the struggles to reconcile agricultural production and nature conservation, among other things.	Yes, I think the biggest challenge is to bridge the gap between agriculture, and by agriculture I mean, said a bit harshly, serious agriculture, i.e. producing agriculture, and nature conservation. (Interview 37)	Markets, NGOs, transportation
Tradition	Includes discussions about history and traditions, local knowledge, and other societal perceptions, among other things.	One hundred years ago, everyone still produced part of their own food. Then industrialization started, and people began to specialize. Back then people still had those connections and knew that you had to treat a plant with something if you wanted to harvest it. Many people no longer know this. They know the products from the store. They are as nice and convenient as they are, but why they are that way, people no longer know. They then simply perceive the negative things from their perspective and criticize them. A lot of educational work is needed there, that is how it is. (Interview 10)	Agricultural organizations, farmers, markets
Production	Includes discussions about production and economic incentives in the region, among other things.	Of course, quality has to be right, that is undisputed. But the requirements are extreme. And on the other side, we are increasingly reaching the limits in crop protection. There is less and less available to achieve the required quality. It is a vicious circle: Retail demands only the most beautiful and best goods, and at the same time fewer pesticides are allowed to be used. (Interview 48)	Research

## Modelling the Grosses Moos network

Network modeling techniques are powerful tools to systematically investigate network patterns. Network models allow us to investigate network patterns not visible to the naked eye. <sup>25</sup> Many stakeholders in the Grosses Moos network assume multiple roles and tend to discuss similar topics in their interviews. One possibility is that stakeholders who share similar characteristics may be more likely to connect with one another, behave in similar ways, and exchange information more frequently, a phenomenon commonly referred to as homophily in social network analysis (Table 1). Based on this, we hypothesize that *stakeholders' additional roles and/or the topics they discuss influence edge formation in the network*. In other words, if stakeholder A and stakeholder B share similar additional roles and/or address similar topics in their interviews, they are more likely to be (strongly) connected.

<sup>25</sup>Social network modelling can also help projects understand how their interventions change network configurations. As well, modelling can pinpoint ways to improve project reach and efficiency, or the unintended consequences, of interventions.

We rely on ERGMs to investigate this hypothesis. In Models 1 to 3 in Table 4, we account for (i) the baseline probability of observing the network based solely on the number of edges, (ii) the tendency of nodes to form shared partnerships, captured by the likelihood of triangle-like structures, and (iii) the likelihood that nodes form ties with others who differ in their additional roles or in the topics mentioned during interviews. The results indicate that the Grosses Moos network is not randomly structured, as evidenced by a significant edges effect. Triangle-like formations are more likely to occur between nodes that share multiple partners, as reflected in the positive and significant GWESP term. Moreover, edge formation is less likely between nodes that differ in their additional roles or that discuss different topics, as indicated by negative and significant effects for both variables.

Table 4: Modelling the Grosses Moos network using ERGMs.

	Model 1	Model 2	Model 3
Edges	-0.65 <sup>***</sup> (0.12)	-4.60 <sup>***</sup> (1.01)	-3.08 <sup>**</sup> (0.99)
Shared partners (GWESP)		2.94 <sup>***</sup> (0.85)	2.41 <sup>**</sup> (0.78)
Additional roles			-0.73 <sup>**</sup> (0.27)
Topics			-0.70 <sup>*</sup> (0.30)
AIC	395.57	368.37	358.20
BIC	399.30	375.82	373.09
Log Likelihood	-196.79	-182.18	-175.10

Note: Edges are a network effect that refers to the odds of observing the network based on the number of observed edges. Shared partners (GWESP) are a network effect that refers to the tendency of nodes to share partners based on the number of shared partners (e.g., the probability of triangle-like formations). Additional roles are a node attribute that accounts for the likelihood that nodes will form edges with others that have different additional roles. Topics are a node attribute that accounts for the likelihood that nodes will form edges with others that mention different topics. Each column in the table represents a model. Model 1 includes only edges; model 2 includes edges and shared partners (GWESP); and model 3 includes edges, shared partners (GWESP), additional roles, and topics. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are statistical metrics to compare different models by balancing their goodness-of-fit and complexity. Significance: <sup>\*\*\*</sup>  $p < 0.001$ ; <sup>\*\*</sup>  $p < 0.01$ ; <sup>\*</sup>  $p < 0.05$

These findings suggest that, although topics and additional roles help explain important aspects of the network structure, the models could be improved with additional data and the inclusion of other network effects. <sup>26</sup> The relationships on the ground are likely shaped by a broader range of attributes than those captured in the collected data.

<sup>26</sup> Goodness of fit diagnosis confirm that that the models could be improved.

# Recommendations and Conclusion

The findings indicate that the Grosses Moos social network is relatively closed, with many stakeholders holding multiple roles, and cohesive, with many different stakeholder groups connected and similar topics circulating across the network. This suggests new stakeholders may find it difficult to “break into” the network and that proposed changes might encounter some resistance. However, these changes might have far-reaching consequences if they are successful in changing the beliefs or actions of any stakeholder.

The analysis also highlights critical gaps and opportunities for strengthening local governance and promoting nature–people co-benefits. First, farmers and governmental bodies are the most central and influential stakeholder groups in the network, and have the potential to drive systemic transformations. Promoting structured roundtables that bring these stakeholders into dialogue with others to enhance soil fertility, improve water management, and protect biodiversity can strengthen coalitions of change and support the development and implementation of innovative solutions to these complex and interconnected challenges.

Second, most stakeholders assume more than one role in the Grosses Moos. This can lead to barriers to participation in local decision-making from those at the margins. An opportunity lies in enabling more inclusive and diverse representation for younger generations, for example, at political bodies and agricultural organizations. Such efforts might help bring new ideas to life and spark positive impact that has spillover effects on land-use management. [27](#)

Finally, while diverse stakeholders often raise similar topics related to soil health, production pricing, water quality, and long-term planning for the region, connections are less likely to form between stakeholders with different additional roles or who mention different topics in the interviews. Focusing discussions on these shared salient concerns can help sustain stakeholder engagement, improve information flows, and bridge connections through shared experiences, providing a basis for collective action.

<sup>27</sup>For more information on how networks influence local spillover effects in Switzerland, please refer to Kreft et al. (2023).

The WA Hub Bern, along with the Canton of Bern and local partners, has begun to engage with stakeholders and promote systemic transformations that generate co-benefits for nature and people in the Grosses Moos, as the Development of the Grosses Moos region project exemplifies. The recommendations provided in this report are not only key to advancing co-benefits for nature and people in the Grosses Moos region, but also to improving governance dynamics in other landscapes facing similar environmental and social pressures.

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