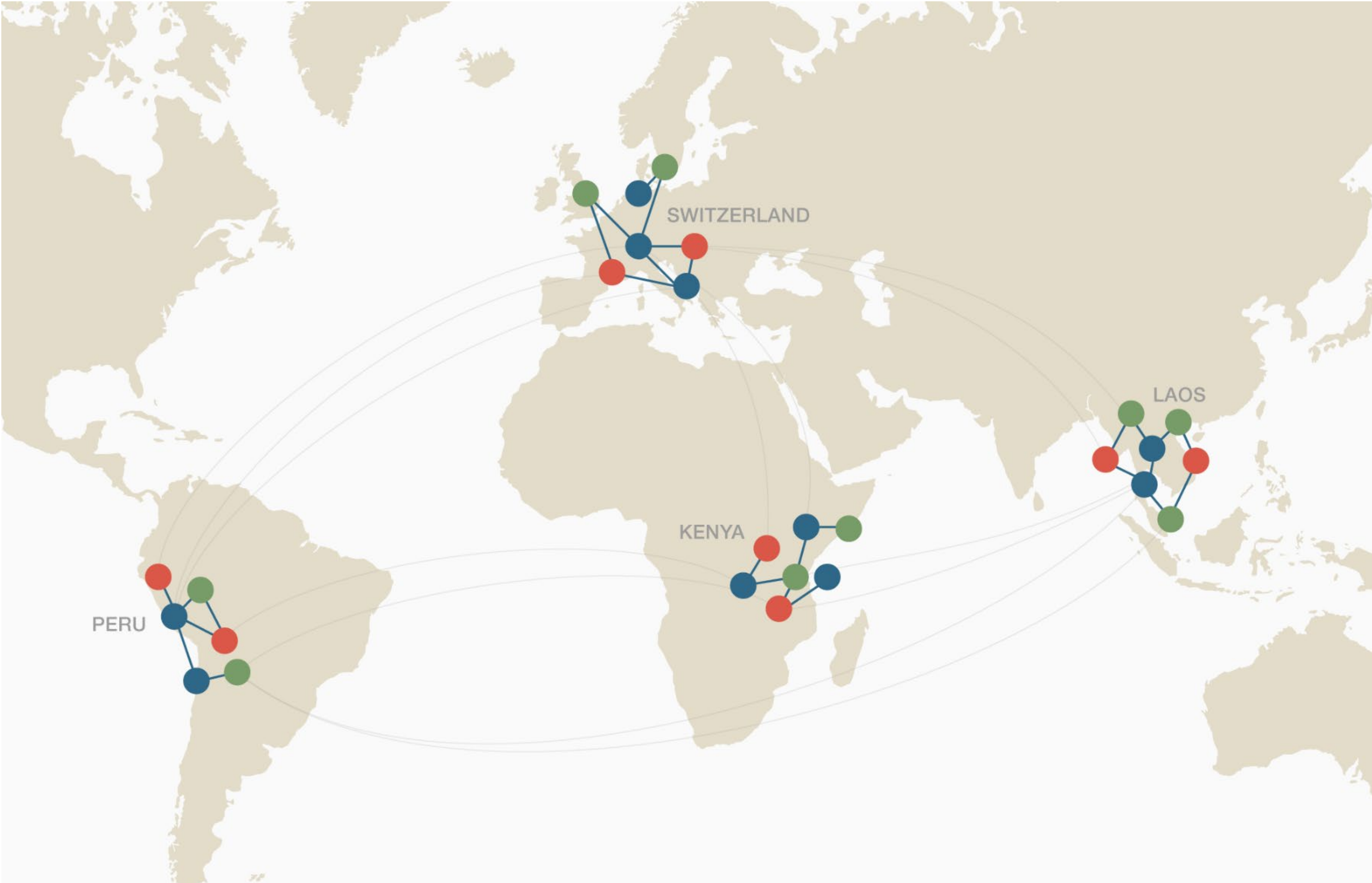
WYSS ACADEMY FOR NATURE



USING SOCIAL NETWORK ANALYSIS TO INVESTIGATE LOCAL STAKEHOLDER DYNAMICS

A Practical Handbook with Case Studies from Laos, Peru, Switzerland, and Kenya

Version 1

Publisher

Wyss Academy for Nature at the University of Bern, Kochergasse 4, 3011 Bern, Switzerland.

Citation

Michel R., Sposito H., and Nguyen Q. 2026. Using Social Network Analysis to Investigate Local Stakeholder Dynamics: A Practical Handbook with Case Studies from Laos, Peru, Switzerland, and Kenya. Version 1. Wyss Academy for Nature, Bern, Switzerland.

Authors

Ramona Michel, Henrique Sposito, and Quynh Nguyen

Corresponding author: Ramona Michel (ramona.michel@wyssacademy.org)

Acknowledgements

We would like to thank Hub SEA in Laos, Hub SAM in Peru, and Hub EAF in Kenya for their on-site support, the team of local research managers and enumerators who supported the data collection, and all the local stakeholders who kindly accepted to participate in the studies.

DOI: 10.48620/96206

List of Abbreviations

Hub EAF - Hub East Africa
Hub SAM - Hub South America
Hub SEA - Hub Southeast Asia
SNA - Social Network Analysis
WA - Wyss Academy for Nature

Table of Contents

Introduction

The Wyss Academy for Nature (WA), a mission-driven organization founded in 2020 at the University of Bern, is committed to bridging science and action to tackle interconnected global challenges such as climate change, biodiversity loss, and unsustainable land use. With offices in Switzerland and regional Hubs in East Africa, South America, and Southeast Asia, the WA operates as a foundation funded by the Wyss Foundation, the Canton of Bern, and the University of Bern. Its approach emphasizes transdisciplinary collaboration, bringing together academia, policymakers, businesses and communities to design and test innovative solutions for systemic transformation that mutually benefit people and nature.

Environmental governance, the system of rules, practices, institutions and policies that shape how humans interact with the environment, is the core of WA's work. Effective environmental governance requires coordinated action across sectors, institutions, and levels of decision-making. However, existing governance systems often lack the relational structures needed to support such cross-sectoral collaboration. Instead, environmental stakeholders operate in fragmented networks where information, resources and influence are unevenly distributed.

Understanding how networks of environment-related stakeholders are configured, who participates, how they interact, and where gaps or bottlenecks emerge, is essential for designing effective and equitable interventions that can drive systemic change. Yet despite this importance, local-level stakeholder dynamics remain insufficiently mapped and poorly understood in a systemic and comparative manner. This gap limits the potential for transformative changes in environmental governance.

The Environmental Governance and Global Development research team at the WA, in collaboration with the regional Hubs, has conducted an interdisciplinary research project that maps and analyzes existing governance relationships using Social Network Analysis (SNA). This approach provides a robust methodological framework for visualizing and measuring relationships among stakeholders, helping to reveal formal and informal connections, influential stakeholders, and marginalized groups. The project aims to (i) identify key stakeholders essential for building effective coalitions for change; (ii) avoid blind spots by including less visible or weakly connected stakeholders; and (iii) support the development of more inclusive, equitable, and adaptive governance systems.

Since 2024, the project has collected, analyzed, and reported on social networks across the WA's Solutionscapes[1] in Laos, Peru, Switzerland and Kenya. Social network data was collected through semi-structured interviews with key stakeholders from a wide range of sectors, including government agencies, traditional authorities, NGOs, local associations, private-sector actors, universities, and international organizations. The data was then visualized and analyzed using both descriptive and inferential SNA methods. Based on this analysis, the project developed strategic governance recommendations to strengthen stakeholder engagement and foster more balanced collaboration. The data collected also serves as a baseline for the long-term monitoring of network dynamics over time.

By providing an evidence base for more coherent and inclusive governance, the project contributes to more effective natural resource management and sustainability transitions, while offering insights applicable to similar contexts globally.

This handbook provides guidance for the preparation, planning, implementation, and analysis of SNA studies.[2] Case studies based on experiences from across the WA Solutionscapes are used throughout to illustrate methodological applications, highlight lessons learned, and explain the rationale behind

[1] The WA uses the Solutionscape approach, which comprises five elements: a coalition for change, a shared vision and strategy, a shared understanding of system dynamics, learning, monitoring and evaluation, and incubators for system transformation. For more information, see the explanatory Video.
[2] If the study is conducted outside the WA context, the term "Hub" can be replaced with "local partners" and "Solutionscape" with "project region".

the approaches presented here. The next chapter outlines the theoretical background of SNA and introduces the case studies. This is followed by a step-by-step guide on how to plan and implement an SNA study. The subsequent chapter presents approaches for data analysis and visualization and defines key network terminology. The final section provides practical tips and insights from previous applications. Throughout the publication, you will find links to a shared folder containing additional information and supporting materials.

Theoretical Background

Environmental challenges such as climate change, biodiversity loss, and unsustainable land use are inherently complex and interconnected. Addressing them requires collaboration across disciplines and sectors (DeFries and Nagendra 2017), as well as careful attention to the relational dynamics that shape environmental outcomes and to systemic perspectives that integrate both social and ecological dimensions (Janssen et al. 2006; Sayles et al. 2019).

In response, SNA has emerged as a powerful methodological tool for understanding the structure and function of environmental governance systems. SNA enables researchers and practitioners to map and quantify the relationships among stakeholders, thereby revealing patterns of communication, influence, and coordination (Bodin and Crona 2009, Crona and Bodin 2006). Studies have shown that well-connected networks can facilitate knowledge exchange, mobilize resources, build trust, and ultimately foster more resilient and adaptive governance (Hahn et al. 2006; Isaac et al. 2007; Newman and Dale 2007; Pretty and Ward 2001; Scholz and Wang 2006).

Despite this, the use of SNA remains relatively limited in applied, transformation-oriented research, especially in the Global South, where diverse and unequal stakeholder constellations often play a decisive role in shaping governance outcomes. Applying SNA in these contexts allows for a better understanding of existing dynamics and offers an evidence base to design more inclusive and equitable interventions (Bodin and Crona 2009). Recent reviews highlight how SNA is increasingly recognized as an essential tool in the field of environmental governance, particularly for identifying critical stakeholders, power asymmetries, and network gaps (Sayles et al. 2019; Salpeteur et al. 2017; Vance-Borland and Holley 2011).

Case Study Laos - Nam Tien Provincial Protected Forest

The Nam Tien Provincial Protected Forest in Laos covers more than 6,000 hectares of forest and an irrigation reservoir. Forests in Laos provide critical ecosystem services and serve as sources of food, timber, medicine and income for local communities. Economic liberalization and the shift to market-oriented agriculture, however, has increased pressure on natural resources. Expanding cash crop cultivation, such as maize, cassava, bananas and rubber, has led to deforestation, biodiversity loss, soil degradation, and water pollution. Smallholder farmers have become more dependent on commodity markets, while foreign investors, particularly from China, have established large-scale plantations even within protected areas. Weak governance and limited conservation resources have further worsened the challenges (Göpel et al. 2025).

The WA collaborates in Laos with local communities, authorities, universities and private stakeholders to safeguard ecosystems while simultaneously fostering sustainable income opportunities. One of the WA's projects, for example, focuses on developing more comprehensive value chains to strengthen agroforestry practices. Together with diverse partners, the project establishes pilot sites and provides tailored agroforestry training programs for local officials and community members.

Case Study Peru – Tambopata Province in Madre de Dios

Madre de Dios, in the Peruvian Amazon, is a region of high biodiversity and cultural richness. It covers 8.53 million hectares, about 91.6% of which remains rainforest. However, deforestation is accelerating. In 2022 alone, 24,485 hectares of forest were lost (INEI 2022). Pressures include agricultural expansion, logging, mining, and infrastructure development such as the Interoceanic Highway. These activities cause habitat loss, cultural disruption, and risks to local livelihoods.

The WA collaborates with local partners in Peru to counter these trends by integrating conservation with community needs. Its pilot projects combine scientific and local knowledge to test new development models. Focus areas include innovative territorial governance, transformative knowledge dialogues, and active networks for change, aiming to provide viable alternatives to extractive development and to strengthen the resilience of both ecosystems and communities (Torre-Marin Rando et al. 2021).

Case Study Switzerland - Grosses Moos Region in Bern

The Grosses Moos is part of the Seeland and the Three-Lakes Region. Following the Jura water corrections in the 19th and 20th centuries, the former peatland was drained and has since become one of Switzerland's most important agricultural zones, particularly for vegetable production. Covering approximately 6,250 hectares, it plays a key role in national food security. However, the intensive cultivation on drained peat soils is increasingly reaching its limits, as soil degradation leads to growing production challenges (Röösli and Egli 2024; HLS 2010). In addition to soil loss, the region faces other pressing issues, including biodiversity decline, water management problems, and the impacts of climate change (BirdLife et al. 2025).

Foundational work, such as updated soil maps and stakeholder studies, has already been undertaken by regional organizations. Building on these efforts, the Hub Bern, in collaboration with the Office for Agriculture and Nature, leads a participatory initiative that brings together farmers, authorities and civil society to co-develop innovative solutions that balance agricultural productivity, biodiversity conservation, and climate resilience.

Case Study Kenya - Oldonyiro and Naibunga Landscape

The Oldonyiro and Naibunga landscape in northern Kenya spans roughly 1,600 km^2 of semi-arid rangelands that are increasingly affected by prolonged droughts and shifting rainfall patterns. Water scarcity and heavy grazing have led to severe vegetation degradation in this dryland region, which is unsuitable for crop agriculture. Wildlife, including elephants, are directly affected, as the area forms an important migration corridor between the lowlands of Isiolo and the highlands of Laikipia. Local pastoralist communities face shrinking grazing land and increasing pressure on their livelihoods, while competition over scarce resources has intensified tensions between groups and contributed to rising human-wildlife conflict (Regional Pastoralists Peace Link and Wyss Academy for Nature 2023).

The WA collaborates with two community conservancies, government, civil society and private partners to support rangeland restoration and strengthen ecosystem resilience. Together with local communities, the WA works to integrate scientific and Indigenous knowledge to test new approaches for sustainable rangeland management and to develop alternative income opportunities that reduce dependence on livestock. The aim is to secure vital wildlife migration corridors and to provide evidence for policies that balance conservation needs with community wellbeing.

Fieldwork

Initial Preparations and Timeline

To ensure effective data collection and analysis, careful planning is essential, particularly when working with multiple partners and stakeholder groups. The timetable presented in Table 1 provides an overview of the recommended preparation and timeline, informed by our experience with the case studies presented in this handbook. Each of the steps listed in the timeline is detailed below.

Step	Month	Tasks
1	1 - 2	• Coordinate with the Hub: Clarify existing knowledge, review the history of previous SNAs, expectations, and available resources. • Define roles and responsibilities among the Hub, the research team, the local research manager, and the enumerators. • Appoint or recruit a local research manager.
2	2 - 3	• Develop a preliminary stakeholder list with input from the Hub and the local research manager. • Validate the stakeholder list jointly with the Hub and other experts.
3	3 - 5	• Adapt and translate the interview guide and supporting materials. • Submit all documents for ethical review and, if required, field approval. • Await approval before initiating field activities.
4	6 - 7	• Recruit enumerators in collaboration with the Hub or the local research manager. • Select interview sample and compile a list of contacts. • Prepare logistics, including invitation letters, transport arrangements and accommodation if necessary. • Organize enumerator training and conduct a pilot test of the questionnaire. • Refine instruments and procedures based on pilot feedback (e.g. tablets/paper form, contact list, questions, and response categories) • Contact stakeholders and schedule interviews.
5	7 - 9	• Conduct fieldwork with daily check-ins, ongoing quality control, and adaptive adjustments. • Transcribe and translate interviews. • Clean and verify the data.

Table 1: Overview of tasks and suggested timeline for SNA studies based on previous experience.

Step 1: Hiring

The first step in conducting an SNA is to collaborate with the Hub to clarify the existing knowledge, needs and expectations, as well as the Hub's time availability and role distribution. Based on this assessment, a suitable local research manager should be identified, along with four to six enumerators.

The local research manager plays a central role in coordinating fieldwork and ensuring that data collection adheres to the agreed procedures and timelines. For this reason, the position should be filled as early as possible, either by an internal staff member or by an externally recruited person. They contribute essential knowledge of the local context and language(s), oversee the work of the enumerators, and prepare a final field report based on the data collection process. The local research manager should be fluent in both English and the target language(s) and possess a sound understanding of survey methodology to prevent misinterpretations or distortions of meaning. An overview of the skill requirement for the position and the tasks is provided in Table 2. A sample job description and contract for the local research manager can be found under Terms of Reference: Research Manager.

To ensure efficient and reliable data collection, it is recommended to recruit four to six enumerators, ideally through local educational institutions. Enumerators should be onboarded once ethical approvals and fieldwork permissions have been granted and the final stakeholder list is available. They are essential for launching the fieldwork, and depending on the context, enumerator recruitment may need to begin earlier. Enumerators are responsible for conducting the interviews under the supervision of the local research manager. They must have prior experience in conducting interviews and must adhere strictly to ethical standards. Detailed requirements for the job posting and a sample contract are provided under Terms of Reference: Enumerators.

Role	Nr.	Responsibility
Local research manager	1	• Finalize the stakeholder list • Translate the questionnaire if necessary • Compile contact information • Contact stakeholders and schedule interviews • Assist in the enumerator training workshop • Coordinate the enumerator team • Supervise interviews and make quality controls • Report back on data collection or any issues
Enumerators	4-6	• Participate in the training workshop • Conduct and transcribe interviews • Participate in regular check-ins • Adhere to ethical standards

Table 2: Suggested staff needs and respective tasks for SNA study

Step 2: Stakeholder Assessment

To conduct an SNA, the first step is to define the social network under investigation – in this case, the Solutionscapes of interest for the Hubs. Next, a clearly defined and measurable group of relevant stakeholders must be identified. It is equally important to define the types of relationships to be studied and to clarify how these relationships relate to the overarching research and governance questions. In this study, both formal and informal interactions between stakeholder groups were considered.

When developing the initial stakeholder list, it is advisable to be overly inclusive rather than too restrictive, as the relevance of individual stakeholders can later be validated through discussions with local experts and triangulated with

Step 1

Case Study Laos

The local research manager recruited and hired the enumerators, requiring only a single contract from the research team. All enumerators were members of the National University of Laos.

Case Study Peru

A short-term, part-time consultant with prior experience working with Hub SAM was contracted to support the stakeholder assessment (Step 2 below). For the remaining steps, another internal staff member from the Hub supported the process. While the external consultant was helpful, the ideal setup would have involved a dedicated local research manager, external to the Hub, with sufficient local knowledge and time availability to oversee the entire fieldwork process. For data collection, master's students from the National Amazonian University of Madre de Dios with prior experience conducting structured interviews were recruited as enumerators.

Case Study Switzerland

Since the research was conducted near the WA's main office in Bern, a research team member coordinated the fieldwork and served as an enumerator. An internal staff member was hired to support data collection. Additionally, a staff member from Hub Bern helped with data collection when needed.

additional sources. The list of typical Stakeholder Groups provides guidance on what is expected from this step. Creating this list can be challenging, as the relevance of different stakeholders varies by context. For this reason, the identification process typically draws on multiple data sources:

- **Existing stakeholder lists**: The Hub and/or local partners often maintain a list of stakeholders working within the Solutionscape. Where available, this can serve as the starting point. Where not available, the research team and the local research manager should use their local knowledge and the literature to develop an initial overview of key stakeholders.
- **Expert input:** Local experts can help identify stakeholders missing from the initial list and assist in categorizing them according to their relevance for local governance dynamics.

Once initial stakeholders are identified, they can be grouped into stakeholder categories. The final list of stakeholders should represent a broad and diverse spectrum of stakeholders involved in the social network under investigation and clearly indicate their respective groups. This list forms the basis for defining the interview sample. When selecting interviewees, it is important to include multiple representatives per stakeholder group to account for potential dropouts. The aim is to interview at least two representatives per group, and more if the group is large and internally diverse. If this is not possible, it is preferable to secure a wide variety of perspectives across many groups rather than multiple interviews from only a few.

After finalizing the stakeholder list, the local research manager should compile all contact details. Depending on the context, it may be useful to pre-contact some of the selected stakeholders to confirm their willingness and availability to participate in the study.

During the interviews, respondents will be asked to share their perspectives on which stakeholder groups they consider influential within the Solutionscape. They will also have the opportunity to identify additional stakeholder groups not yet included in the list. This information can then be used to expand the existing stakeholder list.

Step 3: Research Design

Various methods can be used to collect social network data. In this study, an in-person, semi-structured survey design was employed and is provided in the shared folder as an example and template for replicating similar studies. The questionnaire can be administered in either paper-based or digital format. Whenever feasible, digital data collection (e.g. using tablets) is strongly recommended, as it enhances efficiency, accuracy, and overall data quality. Importantly, collecting social network data can differ from standard survey procedures. Applying the questionnaire therefore requires clear and practical guidance for enumerators to ensure interviews are conducted correctly and consistently, especially when done on paper.

Paper-based format: The questionnaire should be compiled into a bound booklet to prevent the loss of loose pages. All questions and pages must be clearly numbered, with sufficient space provided for notes and responses. The

Step 2

Case Study Laos

The initial identification of stakeholders in Laos relied on colleagues' knowledge of relevant Solutionscape stakeholders and on interviews and focus groups by the Centre for Development and Environment (CDE). Individuals were categorized into private sector, public sector, and international development. Within each category, both individuals and stakeholder groups were included. The list was reviewed and revised several times before being finalized.

Case Study Switzerland

Implementation partners, coordinated by the Hub Bern, had already developed a stakeholder list at the outset of the project. Together with the project's core team, they refined the list. The local research manager prepared an initial proposal which was reviewed and improved by Hub Bern and the core team. Stakeholders were assigned to groups during the co-design phase, with missing stakeholders and contact details added as needed. An additional "prioritization" column assessed relative importance.

Case Study Kenya

The initial identification of stakeholders in Kenya was based on an existing list of more than 200 stakeholders. With support from the Hub, this list was prioritized. The local research manager then organized the stakeholders into categories, further reduced the list, and identified contact details. During data collection, stakeholders who were unavailable were replaced with suitable alternatives, always in consultation with the Hub.

design should prioritize clarity and ease of use in the field and include instructions or annotations to guide enumerators through the process.

Tablet-based format: Digital questionnaires offer several advantages, as they can automatically guide enumerators through the interview and reduce input errors. We recommend using Qualtrics, as it allows flexible questionnaire design, offline survey functionality, and easy adaptation to local needs. Even when tablets are used, it is recommended to have a paper backup available in the field in case of technical issues or battery failure.

The questionnaire consists of several core components: an introduction, an informed consent form, general interview information, the core questions for the stakeholder network, an optional context-specific section, and an enumerator debrief. These components are illustrated in detail in the Complete Interview Guide. The full questionnaires for the case studies are provided separately in Laos, Peru, Bern, and Kenya.

The core questions for the stakeholder network must be adapted to the local contexts. They are suitable for use alongside other surveys or in combination with additional modules. To ensure comparability across sites, the core questions should remain as consistent as possible with the original version, with adaptations limited to necessary contextual or linguistic adjustments.

Before finalizing the adaptation of the questionnaire, the Hub and the local research manager should review it to ensure that it accurately reflects the local context and terminology. If necessary, the questionnaire should be translated into the relevant local language(s). Once the questionnaire has been adapted and translated, it must be submitted to the appropriate ethics committee for approval. Depending on the committee, the review process can take considerable time, so it is important to plan sufficient time for this step. The Hub can be consulted for further guidance on the submission process.

Finally, the questionnaire should be pre-tested and refined based on feedback. This step takes place both before and during the enumerator training workshop. The whole fieldwork team should additionally conduct 5–10 pilot interviews, both among the enumerators during training and with individuals who share similar backgrounds to the target respondents. The objective of this pre-test is to ensure that the questions are clear, the response categories are appropriate, and the interview duration and flow are manageable. This step also helps ensure that the collected data is valid and reliable, providing valuable insights into the social networks and interactions of stakeholders in the study area.

Step 4: Last Preparations

Before contacting participants, all enumerators must complete a comprehensive training workshop. This training is essential to ensure accurate delivery of the questionnaire and precise recording of responses. The quality of data collection depends heavily on both the careful selection and thorough preparation of enumerators. Ideally, the enumerator training workshop should take place one to two weeks before the start of fieldwork and be co-facilitated by a member of the research team and the local research manager. Depending on the local

Step 3

Case Study Laos

The questionnaire included several demographic questions such as gender, age, residence, education, ethnicity, occupation and income. These variables were not used in the SNA analysis and were therefore omitted in the subsequent surveys. Ethical approval was obtained from the University of Bern Ethics Committee and took around two weeks. The questionnaire was translated by the local research manager.

Case Study Peru

An additional section on human-ecosystem relationships was included, arising from a parallel collaboration between Hub SAM and a research project on social-ecological systems. Ethical approval had to be obtained from the ethics committee of the local university, following its specific structure and formal requirements. This also included an online ethics training course. Together, these preparatory steps required over one week, while the review process took two months, making early planning essential. The questionnaire was translated by the Hub.

Case Study Kenya

Additional Hub-specific interview questions were developed in collaboration with Hub EAF. These included open-ended questions exploring regional challenges and potential solutions. The review process and permit applications were done through the National Commission for Science, Technology and Innovation. The process took a few weeks.

context and the enumerators' experience, the training should last between one and two full days.

The training program should include:

- an overview of the WA, the project, and its objectives.
- core ethical principles for conducting research.
- practical guidance on interview techniques.
- a comprehensive understanding of the questionnaire and the purpose of each question.
- clear procedures for data management, including detailed instructions for recording and processing responses.
- a feedback session to refine questions and response categories.
- a pilot phase to test and optimize the overall process.

Training logistics, including finding a suitable venue, arranging catering, and planning compensation for enumerators during both the training and pilot phase, should be organized in advance. The detailed agenda and accompanying materials are available in the shared folder under Workshop.

Questionnaire testing consists of practice interviews with participants who resemble the actual target group. This allows enumerators to familiarize themselves with the questionnaire, clarify ambiguities, and identify potential additions to the stakeholder list. It also provides an opportunity to make final adjustments to the questionnaire before full deployment.

After the training, the whole fieldwork team should reserve at least one full day to incorporate any necessary adjustments to the questionnaire. Once these steps are completed, the local research manager schedules the in-person interviews. The local research manager conducts all initial outreach and provides enumerators with an interview schedule while coordinating logistics such as interview locations and transportation. This process may be adapted depending on the context and enumerators' experience. In some cases, enumerators may be able to manage scheduling and logistics themselves.

Before fieldwork begins, all logistical arrangements – including the preparation of official letters, organization of travel, and booking of accommodation for the field team – must be finalized. Where appropriate, small symbolic gifts (e.g. chocolate) may be offered to respondents as a token of appreciation for their time and participation.

Step 5: Data Collection

The data collection is conducted under the supervision of the local research manager, supported by a team of enumerators. A predefined sample of key individuals from each identified stakeholder group is interviewed using the interview guide (see Step 3: Research Design). During the data collection, the following tasks are relevant:

- **Gather interview documents:**
    - At the start of each interview, participants are asked to give their consent.

Step 4

Case Study Peru

The enumerator training workshop was conducted by the research team with support from Hub SAM, particularly for Spanish translation. As the process progressed, it became evident that a follow-up half or full-day workshop after the first round of interviews would be highly beneficial to address questions and uncertainties that arose once enumerators began fieldwork.

The enumerators were responsible for organizing the interviews themselves, due to the limited availability of the local research manager and Hub staff. To facilitate participation from public-sector stakeholders, the research team sent out an official letter signed by the Hub to secure their engagement. For all other stakeholder groups, enumerators conducted the outreach using a general invitation letter.

However, this approach proved less effective, as the enumerators faced challenges in independently managing contacts and scheduling interviews. In similar contexts, it is therefore recommended that the local research manager takes the lead in coordinating and scheduling the interviews to ensure smoother field implementation.

Case Study Switzerland

The enumerators were responsible for managing invitations, scheduling, conducting interviews, and preparing transcripts. An invitation letter prepared by the research manager was available and could be adapted as needed to suit different stakeholder groups. In the Swiss context, this decentralized approach proved effective,

- During the interview, enumerators carefully note responses and, when possible, record them. After each interview, they immediately review their notes to ensure legibility, accuracy, and completeness, adding any missing detail. Where available, audio from interviews should be collected and safely stored.

- **Supervision:** Daily quality checks are conducted by the research team and the local research manager to maintain data integrity during data collection. These include:
  - Random checks of selected interviews.
  - Review of recorded data for completeness (e.g. interview numbers, locations, plausibility and consistency checks. Survey software can support this step).
  - Regular debriefs with the enumerators, ideally at the end of each fieldwork day.
- **Reporting and communication:**
  - The local research manager provides short fieldwork updates to the research team every two to three days.
  - Any urgent issues or challenges encountered in the field are reported immediately.
  - Enumerators inform the local research manager if new relevant stakeholder groups are identified. The research manager decides whether these stakeholders should be included in the sample.
  - Throughout the fieldwork, the local research manager remains available to support enumerators with questions or logistical problems.
- **Final deliverables:** At the end of the data collection phase, the local research manager delivers documentation to ensure transparency, facilitates data validation, and provides a comprehensive basis for subsequent analysis.
  - A brief interim report summarizing key observations (via email).
  - A complete dataset including all collected variables.
  - Full English transcriptions of all interviews.
  - A final detailed report covering the sampling strategy and respondent recruitment process, fieldwork timeline and interview procedures, data quality assurance measures and monitoring activities, and any issues encountered during fieldwork.

Respondents should be given the opportunity to indicate their preferred interview location. In many cases, this may be their office or home. However, where feasible, it is recommended to conduct interviews in a single central location, such as the WA office, and to cover respondents' transportation costs. This arrangement enables the local research manager to supervise fieldwork more effectively and to conduct regular quality checks. It also reduces the need for enumerators to travel between multiple sites and simplifies the provision of refreshments for participants. Moreover, conducting interviews in a quiet, professional environment helps create a more formal and focused atmosphere. In cases where several respondents are unable to travel or live too far from the interview location, interviews can be clustered by location. The research team can then travel together as a team or in smaller groups to conduct interviews on site.

demonstrating that interview invitations do not necessarily need to be coordinated by a single core team member.

Case Study Kenya

A full-day enumerator training workshop was conducted with the research team member and the local research manager. Test interviews were carried out among the enumerators, observed by the core team member to ensure consistency and quality. An additional half-day training session focused on practicing the survey using tablets. After completing these sessions, the enumerators were ready for fieldwork. The local research manager was responsible for coordinating and scheduling all interviews and assigned them directly to the enumerators.

Step 5

Case Study Laos

In total, 50 interviews were conducted with representatives from 25 stakeholder groups, held within a government facility. The team of one local research manager and three enumerators completed the work within seven days.

Challenges included unavailable stakeholder groups due to the conclusion of a previous project and the absence of relevant stakeholders in the region. This highlights the value of extending the research team's on-site availability. Interview sessions also took longer than expected, as many participants were unfamiliar with the methods, underlining the importance of clear pre-interview communication. Furthermore, some questions in the interview guide proved difficult for participants to understand, limiting the quality of responses. Future guides should therefore be written in clear and concise language, tailored to both participants and enumerators.

Additional difficulties arose during the translation and transcription of the collected data. Errors in the raw data could not always be corrected due to readability issues, emphasizing the need for timely processing of interviews so that clarification can still be sought from those responsible. Despite these challenges, the fieldwork also revealed new and relevant stakeholder groups, and the team promptly included them in the survey.

Case Study Peru

A total of 49 interviews were conducted with 18 stakeholder groups, mostly at respondents' workplaces or in the field. Enumerators traveled independently by motorbike, and no accommodation was required due to short distances.

In the first phase, the research team acted as the local research manager, supported by the Hub and three enumerators. Coordination was maintained through weekly in-person check-ins and daily WhatsApp communication, and a shared Google Sheet tracking contacts and progress.

Fieldwork challenges included the absence of a dedicated local research manager, and the enumerators' limited experience with scheduling and conducting outreach. In addition, some respondents were unavailable or declined to participate. As a result, data collection was delayed and took longer than originally planned. To address these issues, a local research manager was assigned to complete the remaining interviews.

Future studies should involve a local research manager with strong contextual knowledge to oversee stakeholder outreach, scheduling, and enumerator coordination. Efficiency and quality could be improved by organizing shared accommodation for the field team, conducting interviews in quiet central locations, and holding daily in-person check-ins. Attention should also be given to stakeholder fatigue in regions with overlapping projects. Enumerators should be formally introduced through badges, business cards, or introduction letters, and hospitality could be enhanced with quality refreshments. A clear and flexible transportation reimbursement system should be established, including predefined rules for short motorbike trips and centralized organization of longer travel.

Case Study Switzerland

The proximity to the research site, combined with the core team's familiarity with ongoing projects, greatly facilitated a smooth and efficient fieldwork process. In total, 49 interviews from 17 stakeholder groups were conducted. Interview locations were typically selected by the respondents themselves, often taking place in their homes or offices. This arrangement required substantial travel on the part of the enumerators but was necessary to ensure the inclusion of stakeholders living in rural areas. Whenever possible, public transportation was used; however, in some cases, traveling by car proved to be more practical.

If a stakeholder could not be reached or declined to participate, this was promptly communicated to the Hub Bern, which then suggested alternative participants. In several cases, secondary contacts had already been identified in anticipation of such situations. Regular check-ins between the local research manager and enumerators were held throughout the fieldwork phase. These meetings helped to resolve emerging uncertainties and allowed for minor adjustments to the questionnaire where necessary.

However, since only two (main) enumerators were involved and many respondents had limited availability, the overall data collection period was longer than usual, with between two and ten interviews conducted per week. To shorten the overall duration, it would be advisable to engage more enumerators and to send invitations some weeks in advance to secure respondents' availability.

Case Study Kenya

In total, 54 interviews were conducted with representatives from 17 stakeholder groups. Respondents were free to choose the interview location. Many interviews took place at the WA office, while others were held in town or in more remote areas around Nanyuki. For interviews within town, enumerators traveled independently. For longer distances, transport was organized jointly by the local research manager and the Hub. Whenever possible, interviews were clustered geographically to ensure efficient use of time and resources.

No gifts were provided to respondents, and no formal introduction of enumerators was required. After each interview day, the enumerators, the local research manager, and the research team met either online or in person for check-ins to discuss challenges and any necessary adjustments. This ensured that all enumerators consistently received the same information. Enumerators were paid every fifth day of fieldwork, once the research team had reviewed the data for completeness and quality.

After roughly two-thirds of the interviews were completed, a review meeting was held between the local research manager, the research team, and the Hub to replace unavailable stakeholders and confirm that all relevant stakeholders were still included. Thanks to the flexibility and commitment of the local research manager, most interviews were completed within three weeks. The final interviews were conducted by a single enumerator to reduce costs.

Data Visualization and Analysis

This handbook provides an introductory overview of data visualization and analysis for SNA. It is not intended as a comprehensive methodological guide, but rather as a practical starting point that introduces commonly used tools, data structures, and analytical workflows. A variety of open-source tools can be used for network visualization and analysis. This section focuses primarily on R, a programming language and software available free of charge, and one of the most powerful and versatile options for working with network data. R contains numerous resources specifically designed for SNA, enabling users to learn how to load, clean, and visualize network data in practice. The book "*Statistical Analysis of Network Data with R*" (Kolaczyk and Csárdi 2020) is freely available and provides an excellent introduction to network concepts, statistical methods of network analysis, and their implementation in R. Other tools, such as Gephi, are also well suited for network visualization and analysis (see SNA with Gephi).

Data Preparation

Once the data has been collected, it must be cleaned and systematically entered into an Excel file. While programming environments such as R offer more flexibility in data structure, most other network analysis tools require the data to be organized into two specific formats: a node list and an edge list. The node list resembles a standard dataset from interviews, where each row represents one respondent and each column corresponds to a variable or attribute. The edge list, by contrast, captures the relationships mentioned in the interviews. Each row in the edge file represents a single connection between two stakeholders. Table 3 below outlines the required structure of these files.

Node List				
Interview ID	**Stakeholder Group**	**Other Characteristics of the Interview**	**Other Questions Outside of the SNA Study**	**Debrief**
ID of the interview.	Stakeholder group number of the respondent.	Additional interview details (e.g., location, time).	Questions included in the questionnaire that are unrelated to the SNA component.	Important notes, observations, or challenges encountered during data collection.
Edge List				
Interview ID	**Source**	**Target**	**Priority**	**Additional Information**
ID of the interview.	Stakeholder group number of the respondent.	Stakeholder group number of the mentioned Connection.	Priority score (e.g., one to five).	Description of the relationship (e.g., type of collaboration or information exchange).

Table 3: Explanation of the node and edge list. Please note that in the edge list, multiple rows may share the same Interview ID and Source, as a single interview can include several distinct connections.

Data Analysis (with R)

There are many open-source resources available for using R and conducting SNA. If you are new to R, we highly recommend looking at the freely available resources below.

- Douglas, Ross, Mancini, Couto and Lusseau (2022). An Introduction to R.

- Venables, Smith and R Development Core Team (2022). An introduction to R.
- Wickham and Grolemund (2017). R for data science: import, tidy, transform, visualize, and model data.

The following overview provides practical guidance and useful references for getting started with network data in R.

Install R and RStudio: Both R and RStudio are required, as they work together. Numerous online tutorials guide users through installation and first steps.

Use R Markdown for analysis and reporting: R Markdown is an R extension and allows text, code, and outputs to be combined in a single document. It supports flexible and reproducible workflows and is commonly used for generating reports and presentations.

Importing data: Excel files can be imported into R using the readxl package, which reads spreadsheet data directly without the need for file conversion.

Data wrangling: After importing, datasets often need cleaning or restructuring, as variables might need to be renamed, merged, or removed. The dplyr and tidyr packages provide all the tools needed for these tasks. Both packages offer concise cheat sheets summarizing their key functions (see the dplyr and tidyr cheat sheets online).

Network analysis packages: The igraph package serves as the primary tool for conducting SNA in R. It includes all the functions to explore diverse network aspects such as centrality, communities, and other metrics. The package also provides helpful guides to get you started with network data. Other packages, such as tidygraph, offer an alternative syntax that integrates seamlessly with the packages mentioned above. There are also helpful tutorials available to get started on working with tidygraph. Additionally, packages such as manynet and autograph also help simplify both analysis and visualization by facilitating the usage of different network packages together.

Visualizing networks: R offers powerful visualization capabilities. The ggplot2 package provides a general framework for producing a variety of plots, while other packages such as ggraph adapt the framework to provide more specific visual tools for network data.

Modeling network data: The ergm package enables statistical modeling of network structures. Comprehensive resources are available that introduce the principles of network modeling and demonstrate their implementation in R.

Instead of describing the use of each package and function in detail, a sample R Markdown document and a sample data sheet are provided under SNA with R Markdown. The document is meant to facilitate getting started with your social network analysis in practice. It illustrates how to load data formatted as described earlier, prepare and wrangle variables, conduct basic analyses and modeling, and produce clear, reproducible reports directly in R. Although the document contains a basic introduction to the markdown markup language and R programming, it requires that users have R installed and some basic knowledge about the software (e.g. how to load data and run simple codes).

Network Dictionary

It is essential to have a clear understanding of the type of data collected and the network concepts used in the analysis. Relationships between stakeholders can vary widely in type and characteristics. For example, they may involve friendship, but also the exchange of knowledge, money, or material goods. Relationships can be directed or undirected. A direct relationship between two social units has an origin and a target, meaning it has a clear direction. For instance, sending a letter is a directed relationship. An undirected relationship, by contrast, has no inherent direction, such as friendship. Another key distinction is dichotomous versus valued relationships. Dichotomous relationships are either present or absent for each pair of social units, for example, whether one country sends an ambassador to another or not. Valued relationships, on the other hand, can take a range of values indicating the strength, intensity, or frequency of the relationship between social units (Faust and Wasserman 1994; Grandjean 2021).

In SNA, the fundamental components of a network are nodes (representing social units such as individuals or organizations) and edges (representing the relationships between them). Graphically, nodes are depicted as points and edges as lines, as shown in Figure 1. Table 4 provides an example of how the network's connections would be structured in the data file.

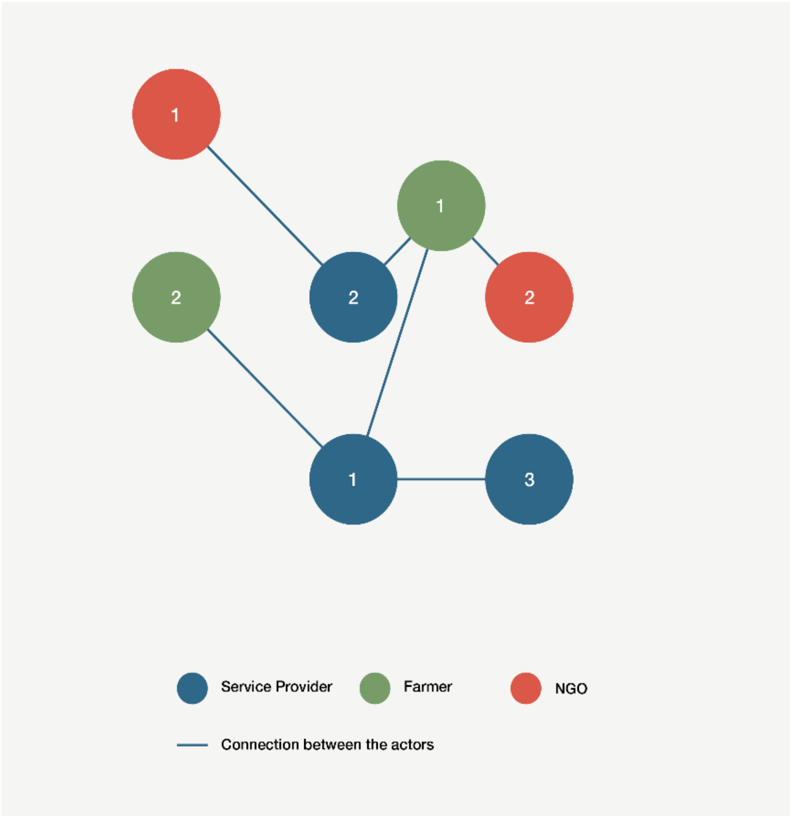


Figure 1: Example of a one-mode network (in which all stakeholders belong to the same set). The circles represent individual organizations or people (nodes) within each sector; the lines represent relationships (edges). Graphic: Daria Vuistiner, Wyss Academy for Nature, 2025

Interview ID	Source	Target
1	NGO 1	Service Provider 2
2	Farmer 1	Service Provider 1
2	Farmer 1	Service Provider 2
2	Farmer 1	NGO 2
3	Service Provider 1	Farmer 2
3	Service Provider 1	Service Provider 3

Table 4: This table lists the reported connections represented in Figure 1 in one direction only. In this example, the network has seven nodes and six edges.

This handbook focuses on one-mode networks, in which all stakeholders belong to the same set and can, in principle, be connected to each other. The structural characteristics of networks determine their overall shape and properties and can be calculated with tools such as R or Gephi, as described above.

To support the analysis, this chapter provides an overview dictionary of key network concepts used in SNA. Drawing on established literature (Crona and Bodin 2006, Newman and Dale 2007, Grandjean 2021, Faust and Wasserman 1994, and Schneider et al. 2003), the dictionary is not intended to be exhaustive but to serve as a practical reference for both applying and interpreting network metrics. Importantly, these metrics should always be interpreted in relation to the size, structure, and data collection approach of the specific network under study. In this process, local partners and others involved in data collection can provide essential contextual knowledge that supports meaningful interpretation of the results.

Quantitative Network Metrics

This section explains in detail the quantitative network metrics. A summary of the most important metrics, how and when to use them, and how to interpret them can be found under SNA Metrics Overview.

Graph Size - Nodes and Edges

The *graph order* is the number of nodes in the network, while the *graph size* refers to the number of edges. In some cases, such as interview-based data collection, the number of nodes is known from the outset. Estimating the total number of edges, however, becomes more difficult as the network grows and the diagram becomes too dense to interpret visually. The distribution of edges and their weights also affect visual estimates. Although basic, these two measures provide valuable context when comparing networks. Graph order is particularly useful when assessing size, density, and complexity, while graph size indicates the total level of connectivity. However, they are rarely interpreted in isolation. In the example shown in Figure 1, the network has a graph order of seven and graph size of six.

Density

Density measures the proportion of actual connections in the network relative to the maximum possible number of connections. It is a central metric for comparing networks of different sizes, provided they are constructed in comparable ways. Density can also be interpreted as an indicator of network complexity or completeness. For undirected networks, the maximum possible number of edges is calculated as $n(n-1)/2$, where n is the number of nodes. In the example from Figure 1, with seven nodes, there are $7\times6/2=21$ possible connections. Dividing the actual number of edges (6) by this maximum gives a density of 0.29.

Shortest Path

The shortest path between two nodes is the minimum number of steps needed to connect them. This measure is useful for assessing the efficiency of information flow and can be compared to intuitive notions of distance in the network.

Diameter

The diameter of a network represents the longest “shortest path” between any two nodes. This metric is only meaningful in connected graphs, where all nodes are reachable from one another. A small diameter indicates that even the most distant nodes are only a few steps apart, typical of dense or “small world” networks. Large diameters are more common in geographically distributed or sparse networks. The diameter shown in Figure 2 is four.

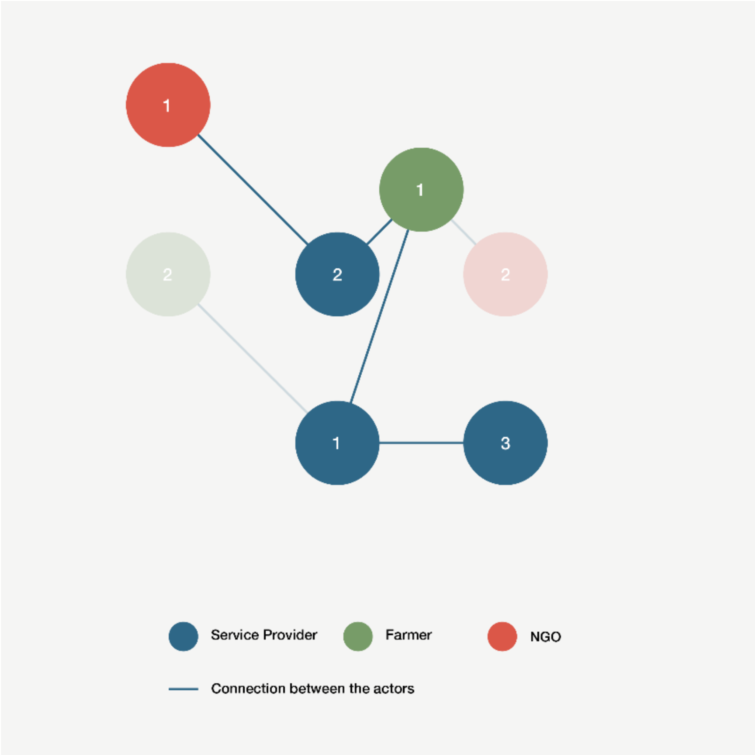


Figure 2: Example of a network with a diameter of four. Given that the network contains only seven nodes, this represents a relatively large diameter. Graphic: Daria Vuistiner, Wyss Academy for Nature, 2025

Connectedness

Connectedness measures whether all nodes belong to the same connected component. A fully connected network has a single component and no isolated groups. The measure decreases as the number of separate components increases, meaning that networks with many disconnected groups are considered less connected. The network in Figure 1 has a connectedness of one, meaning all nodes are part of the same component.

Centrality Measures

Centrality metrics capture different aspects of a node's importance or influence within the network.

Degree centrality counts the number of direct connections a node has, distinguishing between weighted and unweighted degrees, and, in directed networks, between *in-degree* (incoming connections) and *out-degree* (outgoing connections). In-degree often reflects authority or popularity, while out-degree can indicate activity or influence in dissemination.

Betweenness centrality measures the extent to which a node lies on the shortest paths between other nodes. High-betweenness nodes act as bridges, linking otherwise separate parts of the network. These bridges can be critical for information flow but also represent points of vulnerability: their removal may fragment the network (see Figure 3).

Closeness centrality reflects how close a node is, on average, to all others, based on the length of the shortest paths. Nodes with high closeness can reach others quickly, while low-closeness nodes are more peripheral.

Eigenvector centrality extends the idea of degree centrality by weighing connections according to the centrality of the connected nodes. This identifies nodes connected to other influential nodes.

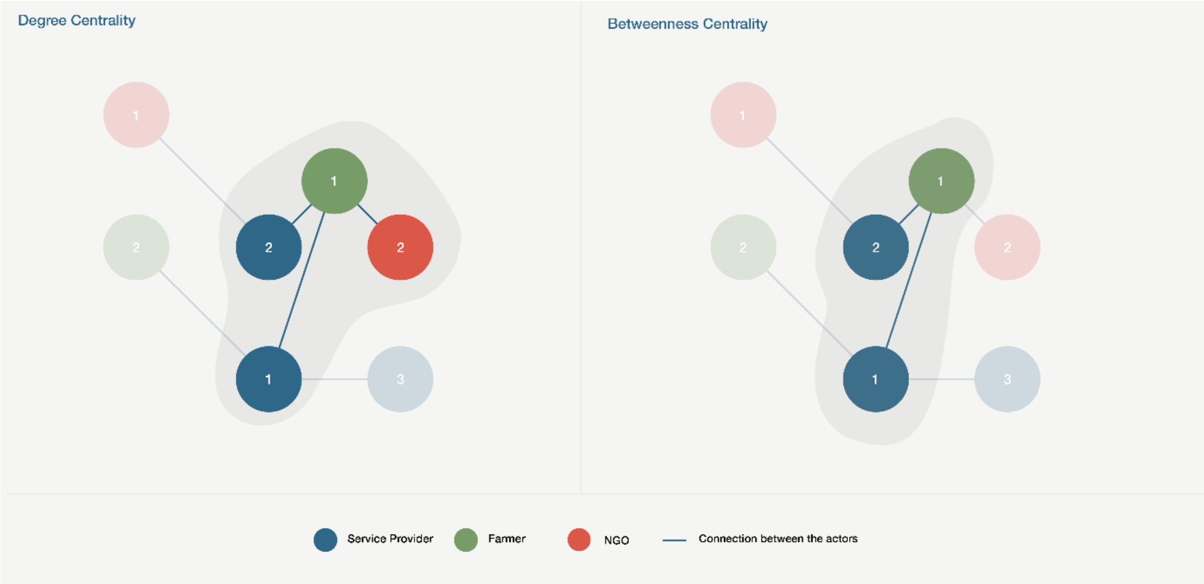


Figure 3: *Left*: The connectivity (degree centrality) of Farmer 1 is three, as the node is directly connected to three other nodes. (The same applies to Service Provider 1). *Right*: All highlighted nodes act as bridges; removing one or more of them would fragment the network into separate components. Graphic: Daria Vuistiner, Wyss Academy for Nature, 2025

Clustering

The **average clustering coefficient** is a global measure of the tendency of a network to form tightly connected groups. It is the average of the local clustering coefficient values for all nodes.

The **local clustering coefficient** considers only the immediate neighborhood of a node, measuring how interconnected its neighbors are (see Figure 4). High local clustering can indicate group membership and redundancy of ties, while low values suggest isolation.

Modularity and Community Structure

Modularity assesses the degree to which a network is divided into groups or communities. High modularity indicates well-defined subgroups with dense internal connections and sparse external ones, while low modularity suggests a more cohesive overall structure (see Figure 5). In governance contexts, an optimal balance between cohesion and subgroup integration is often sought.

Cliques are a specific form of subgroup in which all possible edges exist between members (density = one). While rare in real networks, cliques are useful for evaluating connectivity and completeness.

More advanced methods, such as **statistical inference**, can reveal subtle or hidden community structures not captured by modularity analysis alone.

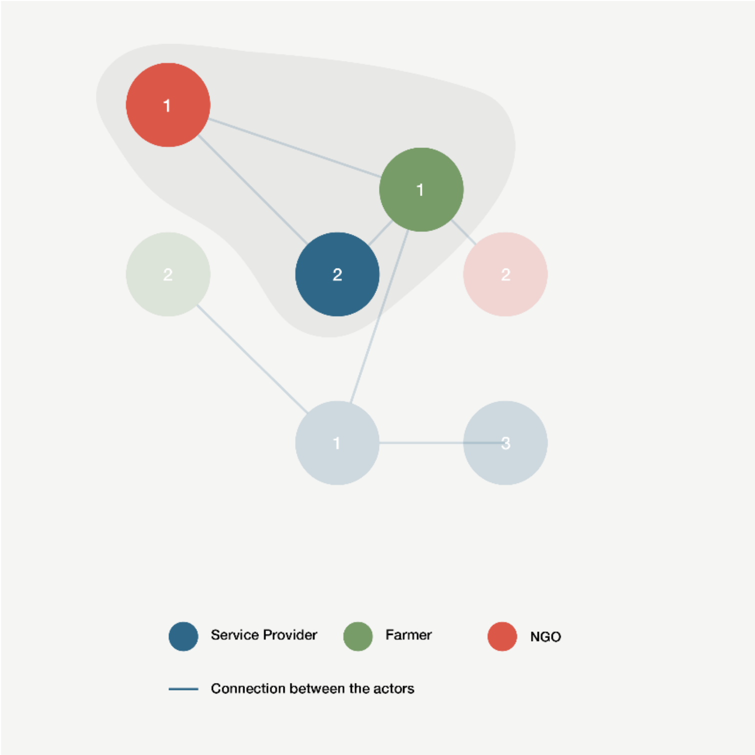


Figure 4: In the original network, no clusters are present. Here, the clustering coefficient of Service Provider 2 and NGO 1 would be the highest, as their direct neighbors would also be connected to each other. Graphic: Daria Vuistiner, Wyss Academy for Nature, 2025

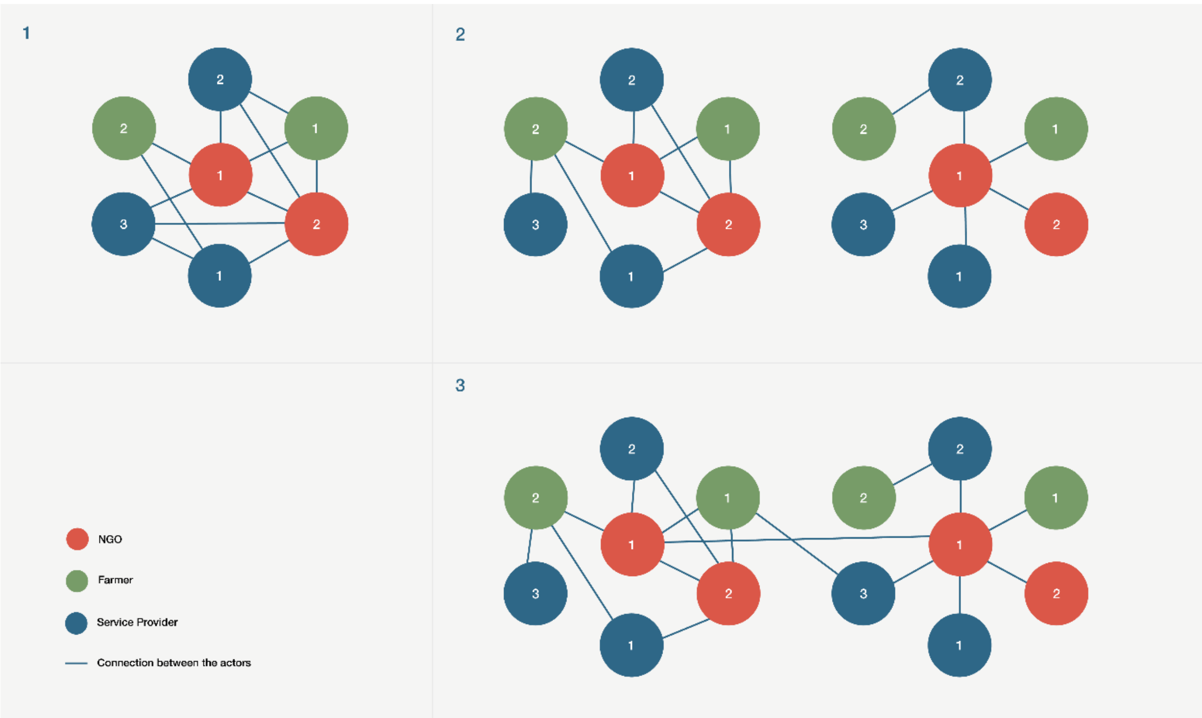


Figure 5: Examples of networks with different modularity levels. (1) A network without distinguishable subgroups: high overall cohesion, low modularity. (2) A network with two isolated subgroups: low cohesion, high modularity. (3) A network with two distinguishable but connected subgroups: moderate cohesion and modularity. Graphic: Daria Vuistiner, Wyss Academy for Nature, 2025

Network Core and Periphery

The core-periphery structure is a way of describing how stakeholders are positioned within a network. The core consists of stakeholders who are densely connected to each other. They often play central roles in the flow of information, resources, or influence. Core members typically hold more power, visibility, or control within the network. The periphery includes stakeholders who are less connected and often linked mainly to the core rather than to one another. They may have limited influence but can provide access to new ideas, resources, or external contacts. This distinction highlights how networks are unevenly structured: a small, well-connected group forms the backbone of the network, while many others remain more loosely connected on the margins. Understanding this structure helps identify both key stakeholders for coordination and entry points to involve those at the periphery.

Network Robustness Analysis

Network robustness analysis examines the impact of removing key nodes – often those with high degree, betweenness, or eigenvector centrality – on network integrity. If removal leads to significant increases in modularity, diameter, or average path length, the affected nodes can be considered structural vulnerabilities.

Interpreting Network Measures in a Governance Context

SNA metrics and measures are interpreted in relation to the social and contextual dynamics of the landscape. Network concepts can help explain how structural patterns shape communication, trust, innovation, and collective action in natural resource management. Table 5 illustrates how some of the concepts highlighted above can be interpreted in relation to local governance dynamics. It is important to note that the Hub has a key role in contextualizing the results of the analysis, assessing their implications, and determining whether additional steps, such as a stakeholder workshop, are needed once the report is finalized to refine the interpretation of results and identify more concrete action points.

Network Concept	Effect on resource management
Strong ties	+ Good for communicating about and working with complex information + Hold and maintain trust between stakeholders + Stakeholders are more likely to influence one another's thoughts, views, and behaviors + Encourage creation and maintenance of norms of trust and reciprocity – Increase the likelihood that stakeholders sharing strong ties hold redundant information – Stakeholders are less likely to be exposed to new ideas and thus may be less innovative
Weak ties	+ Tend to bridge across diverse stakeholders and groups + Connect otherwise disconnected segments of the network together + Good for communicating about and working with simple tasks + New information tends to flow through these ties – Not ideal for complex tasks/information – Stakeholders sharing weak ties are less likely to trust one another – Can break more easily
Homophily	+ Shared attributes among social stakeholders reduce conflict and provide the basis for the transfer of tacit, complex information – Can also result in redundant information, i.e. stakeholders have similar backgrounds and therefore similar sources of knowledge

Degree Centrality	+ Stakeholders with contacts to many others can be targeted for motivating the network and diffusing information quickly through the network, i.e. these are the focal stakeholders in a centralized network – These stakeholders do not necessarily bring together diverse segments of the network – Because of their many ties to others, these ties are often weak, thus decreasing influence over others
Betweenness Centrality	+ Stakeholders that link across disconnected segments of the network have the most holistic view of the problem + As with degree centrality, they can mobilize and diffuse information to the larger network – They can feel constrained or torn between two (or more) positions
Centralization	+ As only a few stakeholders hold the majority of ties linking the network together, one only needs to reach these well-connected few to reach the entire network – Reliance on only a few is not the optimal structure in terms of resilience and long-term problem-solving

Table 5: Network concepts and trade-offs relevant for natural resource management (Prell et al. 2009).

Network Modeling: ERGMs

Exponential Random Graph Models (ERGMs) are a statistical tool for the systematic analysis of network structures and patterns. They help to understand why certain connections between stakeholders emerge while others do not, addressing the central question of which properties of a network make specific relationships more likely. The underlying assumption of these models is that the observed network structure can be explained by a combination of sufficient statistics. ERGMs do not model the entire network as a single probability but rather the probability of individual ties given the rest of the structure. Different characteristics can be incorporated into the models, such as the overall density of ties, the tendency of nodes to share partners (transitivity, where the likelihood of forming a triangle increases with the number of shared partners), or the probability that stakeholders with similar attributes such as roles, opinions, or categories will be connected. This makes it possible to test hypotheses, for example whether stakeholders of the same category are more likely to connect (homophily), whether networks tend to form clusters through shared contacts (transitivity), or whether the network as a whole is dense or sparse. Unlike purely descriptive approaches, ERGMs compare the observed network with many possible random networks and reveal whether the structure is shaped by chance or by underlying social processes.

Lessons Learned

Across the different applications of SNA presented in this handbook, several overarching lessons emerged. A smooth data collection process requires clear roles and responsibilities within the team, including the Hub, the research team, the local research manager, and the enumerators. The effectiveness of data collection depends strongly on the skills, local network, and engagement of the local research manager, making this position particularly important to select carefully. Early planning also proved essential, especially because ethical approvals often require substantial lead time and must be tailored to different national or institutional systems. Starting early with stakeholder identification and engagement is equally important, as building and validating stakeholder lists can take longer than expected, particularly when key stakeholders such as government representatives have limited availability.

Proper training, regular check-ins, and systematic quality control help ensure that the data collection is clear and robust, which ultimately determines the depth and reliability of the SNA findings. Clearly defined network boundaries, consistent naming conventions, and precise relationship definitions are necessary to avoid misinterpretation. Interview guides may also need to be written in simpler, more accessible language to match participants' understanding. Depending on the context, formal introductions of the study, such as invitation letters from the Hub or identification badges for enumerators, can be crucial for building trust.

During data collection, coordination methods such as shared accommodation, joint field trips, central interview locations, and regular in-person check-ins greatly simplify supervision and improve consistency. Daily communication between the research team, the local research manager, and the enumerators enables quick troubleshooting, while tools such as WhatsApp groups and shared Google Sheets support effective coordination. Providing refreshments and creating a respectful interview setting enhance respondent comfort and improve interview quality. Inevitably, some stakeholders will be unavailable. Allowing flexibility to add new stakeholders during fieldwork improves coverage but can lead to delays, making it important to agree on a clear management plan with the local research manager. Mixed interview modes, such as phone or online conversations, can increase participation where in-person availability is limited, though these require adequate training. Immediate data processing helps ensure that information remains accurate and complete while interviewers' memories are still fresh.

In the analysis phase, SNA metrics gain meaning only when interpreted in context. A given metric value can imply very different dynamics depending on network size, purpose, and socio-geographic setting. Combining multiple metrics provides a more nuanced understanding than relying on any single indicator. Visualizations are valuable tools for communicating patterns, clusters, and key stakeholders, but they should complement rather than replace careful quantitative interpretation and must be accompanied by clear explanations to avoid oversimplification. The process of conducting SNA itself can strengthen networks – sharing preliminary findings with participants, discussing interpretations collaboratively, and collectively identifying strategies for improvement can build trust, foster new connections, and support joint action. Sufficient resources should be allocated to ensure this step is carried out thoroughly.

Overall, strong local management is a decisive success factor, early preparation helps prevent delays, consistent training and communication safeguard data quality, and flexibility and adaptability enable teams to respond effectively to unforeseen challenges.

Bibliography

BirdLife, ProNatura, Schweizerischer Fischerei-Verband, Stiftung Landschaftsschutz Schweiz, and WWF. 2025. 'Vision 3-Seen-Land 2050'. https://dreiseenland2050.ch/vision.

Bodin, Örjan, and Beatrice I. Crona. 2009. 'The Role of Social Networks in Natural Resource Governance: What Relational Patterns Make a Difference?' *Global Environmental Change* 19 (3): 366–74. https://doi.org/10.1016/j.gloenvcha.2009.05.002.

Crona, Beatrice, and Örjan Bodin. 2006. 'What You Know Is Who You Know? Communication Patterns Among Resource Users as a Prerequisite for Co-Management'. *Ecology and Society* 11 (2). https://doi.org/10.5751/ES-01793-110207.

DeFries, Ruth, and Harini Nagendra. 2017. 'Ecosystem Management as a Wicked Problem'. *Science* 356 (6335): 265–70. https://doi.org/10.1126/science.aal1950.

Faust, Katherine, and Stanley Wasserman. 1994. 'Social Network Data'. In *Social Network Analysis: Methods and Applications*. Structural Analysis in the Social Sciences. Cambridge University Press. https://doi.org/10.1017/CBO9780511815478.003.

Göpel, Jan, Stefano Jud, Souliyaphon Kommadam, et al. 2025. *Nam Tien Solutionscape Baseline Survey*. Wyss Academy for Nature.

Grandjean, Martin. 2021. 'Introduction to Social Network Analysis: Basics and Historical Specificities'. HNR+ResHist Conference 2021. Zenodo, June 30. https://doi.org/10.5281/zenodo.5083036.

Hahn, Thomas, Per Olsson, Carl Folke, and Kristin Johansson. 2006. 'Trust-Building, Knowledge Generation and Organizational Innovations: The Role of a Bridging Organization for Adaptive Comanagement of a Wetland Landscape around Kristianstad, Sweden'. *Human Ecology* 34 (4): 573–92. https://doi.org/10.1007/s10745-006-9035-z.

HLS. 2010. 'Grosses Moos'. Historisches Lexikon der Schweiz, September 17. https://hls-dhs-dss.ch/articles/010298/2010-09-17/.

INEI. 2022. 'Estadísticas: Medio Ambiente'. PERU Instituto Nacional de Estadística e Informática. https://www.inei.gob.pe/estadisticas/indice-tematico/medio-ambiente/.

Isaac, Marney, Bonnie Erickson, S. Quashie-Sam, and Vic Timmer. 2007. 'Transfer of Knowledge on Agroforestry Management Practices: The Structure of Farmer Advice Networks'. *Ecology and Society* 12 (2). https://doi.org/10.5751/ES-02196-120232.

Janssen, Marco A., Örjan Bodin, John M. Anderies, et al. 2006. 'Toward a Network Perspective of the Study of Resilience in Social-Ecological Systems'. *Ecology and Society* 11 (1). https://www.jstor.org/stable/26267803.

Kolaczyk, Eric D., and Gábor Csárdi. 2020. *Statistical Analysis of Network Data with R*. Use R! Springer International Publishing. https://doi.org/10.1007/978-3-030-44129-6.

Newman, Lenore, and Ann Dale. 2007. 'Homophily and Agency: Creating Effective Sustainable Development Networks'. *Environment, Development and Sustainability* 9 (1): 79–90. https://doi.org/10.1007/s10668-005-9004-5.

Prell, Christina, Klaus Hubacek, and Mark Reed. 2009. 'Stakeholder Analysis and Social Network Analysis in Natural Resource Management'. *Society & Natural Resources* 22 (6): 501–18. https://doi.org/10.1080/08941920802199202.

Pretty, Jules, and Hugh Ward. 2001. 'Social Capital and the Environment'. *World Development* 29 (2): 209–27. https://doi.org/10.1016/S0305-750X(00)00098-X.

Regional Pastoralists Peace Link and Wyss Academy for Nature. 2023. *Assessment of Community Cohesion in Oldonyiro (Isiolo) and Naibunga (Laikipia) Community Conservancies*. Regional Pastoralists Peace Link (RPPL). https://boris-portal.unibe.ch/server/api/core/bitstreams/64c75181-a248-4ab1-8bb9-268ed2e559fe/content.

Röösli, Claudia, and Markus Egli. 2024. 'Using Historical Data to Assess the Surface Subsidence in the Vegetable Belt of the Three Lakes Region, Switzerland'. *Swiss Journal of Geosciences* 117 (1): 9. https://doi.org/10.1186/s00015-024-00452-9.

Salpeteur, Matthieu, Laura Calvet-Mir, Isabel Diaz-Reviriego, and Victoria Reyes-García. 2017. 'Networking the Environment: Social Network Analysis in Environmental Management and Local

Ecological Knowledge Studies'. *Ecology and Society* 22 (1). https://doi.org/10.5751/ES-08790-220141.
Sayles, J. S., M. Mancilla Garcia, M. Hamilton, et al. 2019. 'Social-Ecological Network Analysis for Sustainability Sciences: A Systematic Review and Innovative Research Agenda for the Future'. *Environmental Research Letters* 14 (9): 093003. https://doi.org/10.1088/1748-9326/ab2619.
Schneider, Mark, John Scholz, Mark Lubell, Denisa Mindruta, and Matthew Edwardsen. 2003. 'Building Consensual Institutions: Networks and the National Estuary Program'. *American Journal of Political Science* 47 (1): 143–58. https://doi.org/10.1111/1540-5907.00010.
Scholz, John T., and Cheng-Lung Wang. 2006. 'Cooptation or Transformation? Local Policy Networks and Federal Regulatory Enforcement'. *American Journal of Political Science* 50 (1): 81–97. https://doi.org/10.1111/j.1540-5907.2006.00171.x.
Torre-Marin Rando, Amor, Santos José Gonzalez Rojí, Kaspar Hurni, et al. 2021. *Towards Sustainable Futures for Nature and People. An Appraisal Report for Madre de Dios, Peru*. Wyss Academy for Nature. https://doi.org/10.48350/161385.
Vance-Borland, Ken, and June Holley. 2011. 'Conservation Stakeholder Network Mapping, Analysis, and Weaving'. *Conservation Letters* 4 (4): 278–88. https://doi.org/10.1111/j.1755-263X.2011.00176.x.

Appendix

Throughout the handbook, you will find links to a shared folder containing additional information and supporting materials. An overview of all documents in this folder is provided here:

- Terms of Reference: Research Manager
- Terms of Reference: Enumerators
- Stakeholder Groups
- Complete Interview Guide
- Complete Interview Guide for Laos, Peru, Bern, and Kenya
- Workshop
- SNA with Gephi
- SNA with R Markdown
- SNA Metrics Overview