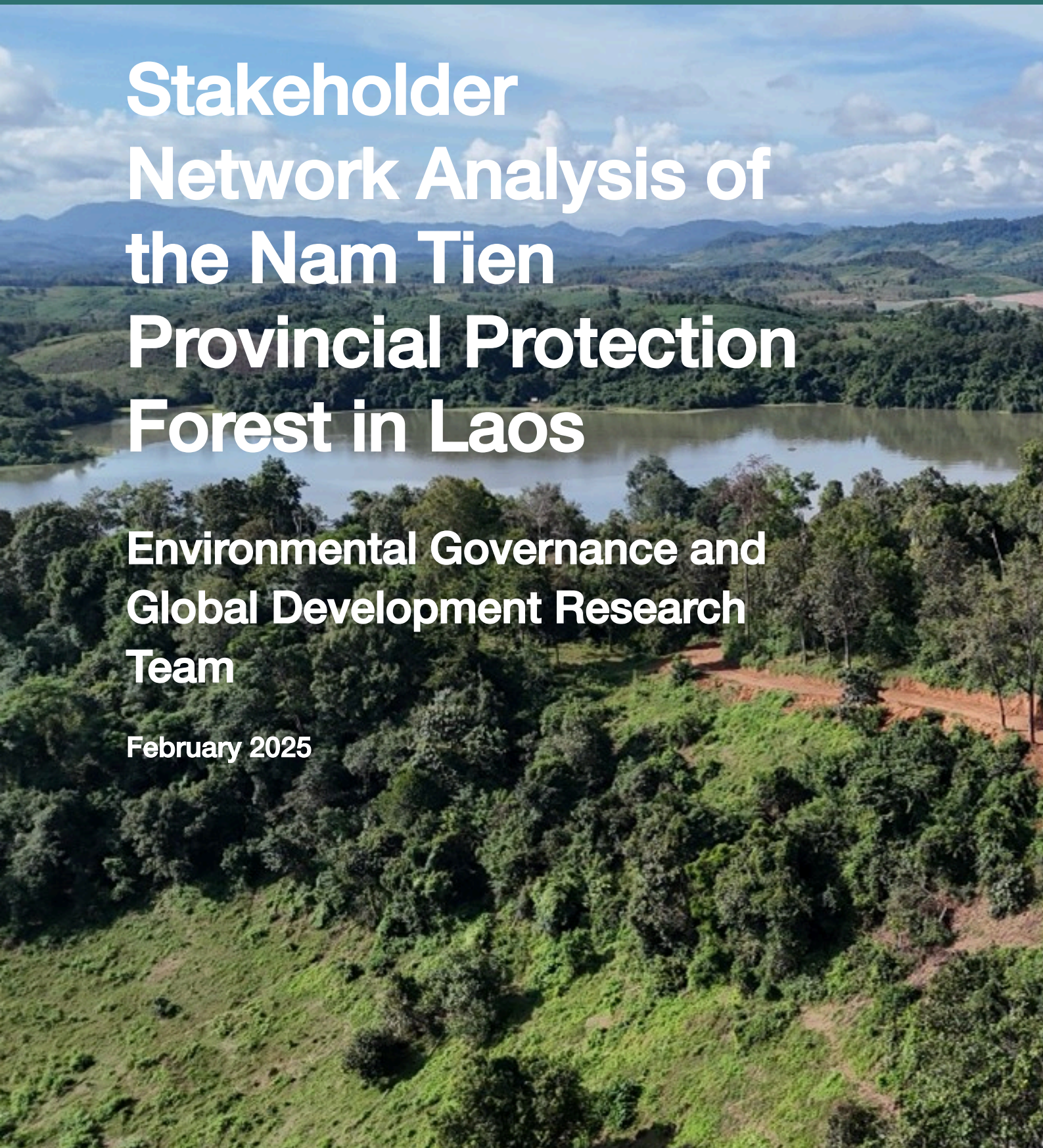
WYSS ACADEMY FOR NATURE



Stakeholder Network Analysis of the Nam Tien Provincial Protection Forest in Laos

Environmental Governance and Global Development Research Team

February 2025

Publisher

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

Citation

Kommadam S., Michel R., Nguyen Q., Pravalprukskul P., Sposito H., and Weyerhäuser H. 2025. Stakeholder Network Analysis of the Nam Tien Provincial Protection Forest in Laos. Wyss Academy for Nature, Bern, Switzerland.

Authors

Souliyaphon Kommadam[3], Ramona Michel[1], Quynh Nguyen[1], Pin Pravalprukskul[2], Henrique Sposito[1], and Horst Weyerhäuser[2]

Authors contribution: All authors who contributed to the research design, data collection, and the writing of the report are listed in alphabetic order.

Affiliations

1. Wyss Academy for Nature at the University of Bern, University of Bern, Bern, Switzerland
2. Wyss Academy for Nature at the University of Bern, Hub Southeast Asia, Bangkok, Thailand
3. National University of Laos, Vientiane, Laos

Acknowledgements

We would like to thank the team of researchers from the National University of Laos who helped with the data collection.

Cover photo: © Andreas Heinimann

DOI: https://boris-portal.unibe.ch/handle/20.500.12422/205636

Table of Contents

Executive Summary

This report describes the stakeholder network analysis (SNA) related to the Nam Tien Provincial Protection Forest (NTPPF) in the Sayaboury province in Laos. The research team on Environmental Governance and Global Development at the Wyss Academy for Nature (WA), in collaboration with the WA's Southeast Asia Hub, led this study on the stakeholders involved in the management of the NTPPF.

The study aims to provide a baseline understanding of the relationships between stakeholders in the NTPPF network and identify potential entry points for governance interventions to improve stakeholder engagement and project outcomes. We identified 24 relevant stakeholder groups in the NTPPF network and conducted 50 semi-structured interviews with representatives of these groups. Our descriptive and inferential findings suggest that:

- The District Agriculture and Forestry Office (DAFO) is the most connected stakeholder in the NTPPF network; the Lusheng Import and Export company is closest, on average, to other stakeholders; the Information, Culture, and Tourism Office (ICTO) is a gatekeeper between different groups of stakeholders; and the Provincial Agriculture and Forestry Office (PAFO) is the most influential stakeholder.
- Similar groups of stakeholders are more likely to connect with, and create clusters around, one another.
- PAFO and DAFO are likely more central stakeholders in the NTPPF network than the data collected suggests.

This report makes two recommendations:

- Whereas helping to connect PAFO and DAFO to other peripheral stakeholders could make the NTPPF network more "predictable" for future interventions, better connecting peripheral stakeholders among themselves could help diffuse power by "flattening" the network.
- Interventions attempting to change perceptions or behavior in the NTPPF network should consider stakeholders such as the District Office for Natural Resources and Environment (DONRE) and the Provincial Office for Natural Resources and Environment (PONRE). Interventions meant to diffuse information through the network should consider stakeholders such as the Elephant Conservation Center (ECC), the District Planning and Investment Office (DPI), and the village heads of Donengern and Donemai, since they connect diverse stakeholders.

Introduction

Mapping different stakeholders and their relationships as they manage the resources of a landscape helps to understand the formal and informal structures of the network and the social links between actors. The Research and Innovation team on Environmental Governance and Global Development at the Wyss Academy for Nature (WA), in collaboration with the WA's Southeast Asia Hub, led this study on the stakeholders involved in the management of the NTPPF.

The goals of this study are twofold:

- Provide a baseline understanding of the relationships between stakeholders in the NTPPF that allows to better grasp the impact of future interventions on the network.
- Identify potential entry points for governance interventions to improve stakeholder engagement and project outcomes in the NTPPF.

The central challenge for the WA in Laos relates to protecting and restoring forest landscapes to safeguard local ecosystems, enhance the services of intact ecosystems, increase biodiversity, and create viable, sustainable, and attractive income opportunities for local communities. Together with various stakeholders, including government authorities, communities, schools, universities, and the private sector, the WA conducts activities to create a shared vision for the sustainable management of the NTPPF and develop new opportunities for mutual benefits for nature and people.

This report is divided into four parts. The first part describes the NTPPF background. Next, we discuss the social network methods and the data collection. We, then, conduct a descriptive and inferential analysis. The report concludes with the lessons and recommendations gathered from the study. [1]

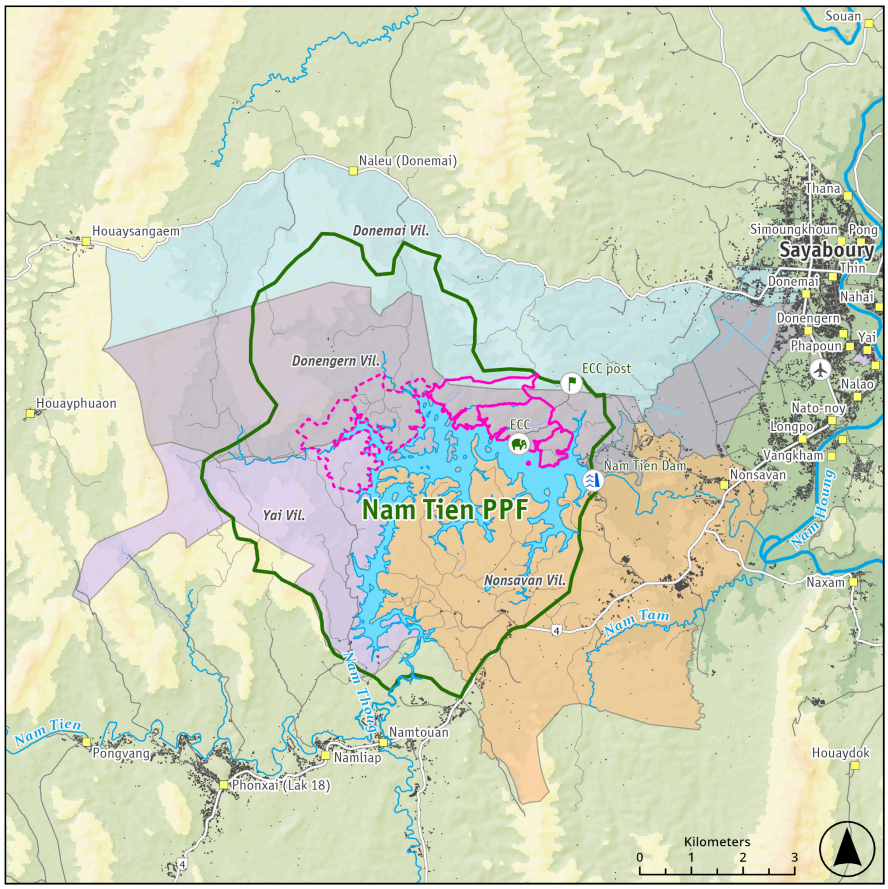
Background

The Nam Tien Provincial Protection Forest in Laos

Laos has one of the highest rates of forest coverage in Southeast Asia, with over 200 protected areas covering 27% of the country. Local communities use the forests as vital sources of food, timber, medicine, and income. The NTPPF is located in the Sayaboury Province and encompasses more than 6,000 hectares of land, including an irrigation reservoir and surrounding forests (Figure 1).

Laos' economic opening and transition to a market-oriented economy accelerated growth and drove the exploitation of natural resources. Rapid urbanization and the expansion of agricultural crops grown for export markets such as maize, cassava, bananas, and watermelons, have led to the degradation of forest landscapes. This resulted in biodiversity loss, soil degradation, and the pollution of water resources. Local smallholder farmers have become more exposed to price fluctuations of commodities in international market. Foreign investors, especially those from China, lead the transition to large-scale agricultural production of these crops in the NTPPF region.

Managing the NTPPF involves a diverse range of stakeholders, including government organizations, private companies, and community representatives. Using SNA, the interactions and engagement of these stakeholders can be comprehensively studied. This helps understand the distribution of power and influence within the network, explain social bonds and network dynamics, and identify possible coalitions for change. The WA, and its partners, can derive successful governance or other interventions from these insights and support the creation of coalitions of change.



Nam Tien Provincial Protection Forest | Sayaboury Province - Lao PDR

Legend

- Nam Tien Provincial Protection Forest

ECC concession areas
- managed
- unmanaged

Village area boundaries
- Donemai Village
- Donengern Village
- Nonsavan Village
- Yai Village
- Settlements
- Buildings

Roads
- Major road
- Minor road
- Track

Elevation (in m)
- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 800

Map scale: 1:100,000
Projection: UTM47N, WGS1984

Data sources: geospatial data from Sayaboury provincial government, the Centre for Development and Environment (CDE), the Elephant Conservation Center (ECC), German International Cooperation Society (GIZ), Google Open Buiildings and NASA JPL, were used to produce the map.

This map has been prepared by the CDE Laos for operational purposes. The CDE Laos does not make any claims about the accuracy or completeness of the map. The boundaries or names shown do not imply any opinions or endorsements by the CDE Laos. For more information about the map or permissions to reproduce it, please contact Patrick Oswald (patrick.oswald@cde-regions.net).

Figure 1: Map of the NTPPF (Source: CDE Laos 2023)

Data and Methods

Social (stakeholder) network analysis

Social network data encompasses measurements of relationships between social units, representing various types of connections between them. Examples of such connections include friendships, or the exchange of knowledge, money, or material goods. Relationships can also have distinct characteristics, such as being directed (e.g., a relationship with a clear origin and target, like sending a letter) or undirected (e.g., a reciprocal relationship, like friendship). Additionally, these relationships may take on different values, reflecting the strength, intensity, or frequency of interactions between social units. Figure 2, below, illustrates common stakeholders and relationships involved in the management of the environment.[2]

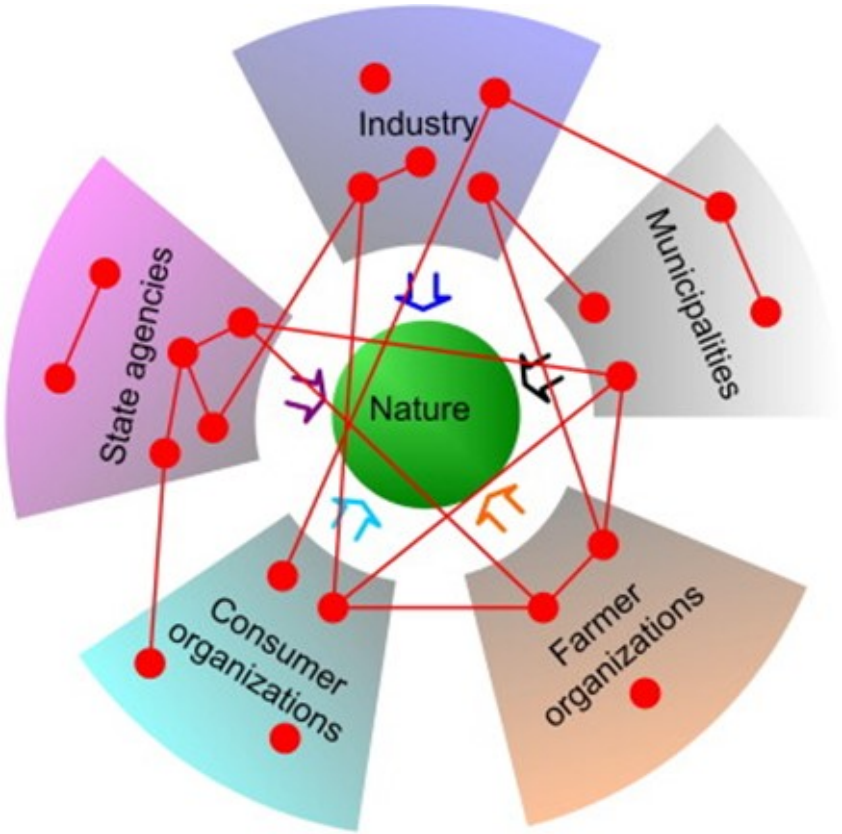


Figure 2: Example of stakeholders managing the environement (Source: Bodin and Crona 2009)

In network terminology, actors are commonly referred to as “nodes” and relationships are called “edges”. Nodes are graphically represented by points and edges by lines. There are many different types of social networks, depending on the nature of the nodes and the characteristics of the edges between them. Even though network data is often collected at different levels (e.g., individuals and organizations), in practice, networks are usually simplified so that both descriptive and inferential findings can be highlighted.

Semi-structured interviews

The data collection process for networks can be complex and time consuming, but assuring that the network is representative of the actors and their relations is essential. Careful planning and testing ensures that the data collected is reliable and can provide valuable insights into the stakeholder network and their interactions in the studied area. The data collection in the NTPPF underlying this report took place in 4 steps:

- Step 1: Initial stakeholder screening

We first identified stakeholders groups that belonged to broad categories of actors in the network. To do so, we consulted colleagues in the Southeast Asia Hub to produce a preliminary list of stakeholders. The list was then complemented with secondary sources (e.g., academic literature, media reports, and administrative data). A total of 24 different stakeholder groups were identified.

- Step 2: Actor assessment

Specific actors from each stakeholder group were pre-selected considering the heterogeneity of their groups, the size of the overall network, and the availability of resources. We pre-selected between 1 and 4 representatives for each of the 24 stakeholder groups mapped to make up the interview sample.

- Step 3: Preparation of questionnaire

Among the various available methods for collecting social network data, we choose to collect data via an in-person semi-structured survey. The survey questionnaire includes demographic questions (e.g., age, education, and location), network-related questions (e.g., common contacts and frequency of their contacts), and questions related to perceptions about the environment. [3]

- Step 4: Interview logistics and training

We recruited four enumerators, headed by a field manager from the National University of Laos. The field manager facilitated and oversaw the data collection process. Enumerators underwent a comprehensive survey training on how to build trust with respondents, accurately formulate questions, and capture responses. The training included an overview of the project and ethical guidelines. The fieldwork took place between February and March 2024. On average, each interview took 45 minutes to

complete. Table 1 details the broad actor categories, the specific stakeholder groups, and the number of interview respondents per group. A total of 50 interviews were conducted.

Table 1: List of stakeholders

Category	Stakeholder group	Nr. of respondents
Smallholders and other local actors	Smallholders (i.e. subsistence and commercial agriculture)	4
	Local hospitality and entertainment business (e.g. restaurants, karaoke, golf course)	2
	Land agents (i.e. individuals or local government officials with connections to Chinese Investors)	2
Foreign investment, commerce, and trade	Traders (i.e. individual or business that retail commodities to other locations or processing factories)	1
	Processing factories (e.g. Chinese owned cassava processing factories)	2
	Chinese investors (e.g. for large-scale cash crop plantations)	1
Elephant related actors	Elephant Conservation Center (ECC)	3
	Mahouts (i.e. individuals who capture, train, and raise elephants)	2
Provincial agencies	Provincial Agriculture and Forestry Office (PAFO)	3
	Provincial Office for Natural Resources and Environment (PONRE)	2
	Provincial Office for Planning and Investment (PPI)	4
	Information, Culture and Tourism Office (ICTO)	2
	Governor of Sayaboury Province Office	1
District agencies	District Agriculture and Forestry Office (DAFO)	3
	District Office for Natural Resources and Environment (DONRE)	2
	District Planning and Investment Office (DPI)	2
Military	National military	2
	Provincial military	2
	District military	1
Village administration	Village Head Donemai	2
	Village Head Donengern	2
	Village Head Yai	2
	Village Head Nonsavan	2
International organizations	German International Cooperation Society (GIZ)	1

Limitations

The data collected is not exhaustive and likely misses stakeholders and relations in the network. First, the data collected captures a “picture” of the network at a single point in time. This means we overlook network changes that occurred before (or after) data collection as, for example, how the addition (or removal) of relevant stakeholders change the structures of the network.

Second, social network analysis is helpful to examine certain types of relational power. These sources of power are often different from commonly used measures such as financial or geopolitical power. Node centrality, for example, can be helpful to illustrate how certain stakeholders are relevant for network dynamics based on their position. Although these sources of relational power might implicitly account for formal institutions (e.g., laws and agreements) that shape, regulate, or precede network connections, we refrain from specifically discussing each of these institutions in this report. We welcome future research that explores how laws, agreements, and other sociopolitical aspects help explain the NTPPF network.

Third, certain stakeholder groups were interviewed more frequently than others (e.g., provincial and district agencies). Since we were aware that this could lead to biased estimation of their role in the network, we also asked respondents' about their perceptions of powerful actors in the NTPPF region as an additional robustness check. Perceptions of network power often align with various network measures of centrality detailed in Figures 4 and 6 in the analysis section below.

Findings

Descriptive analysis - Visualizing the NTPPF network

With data collected and cleaned, we can start to visually analyze the structure and patterns in the NTPPF network. For example, we can visualize the NTPPF network by stakeholder category (Figure 3). We see that certain stakeholder categories appear close to each other and to hold relatively similar structural positions in the network (e.g., provincial and district agencies) while other categories appear more spread across the network, but consistently at the periphery in the network (e.g., smallholders and other local actors).

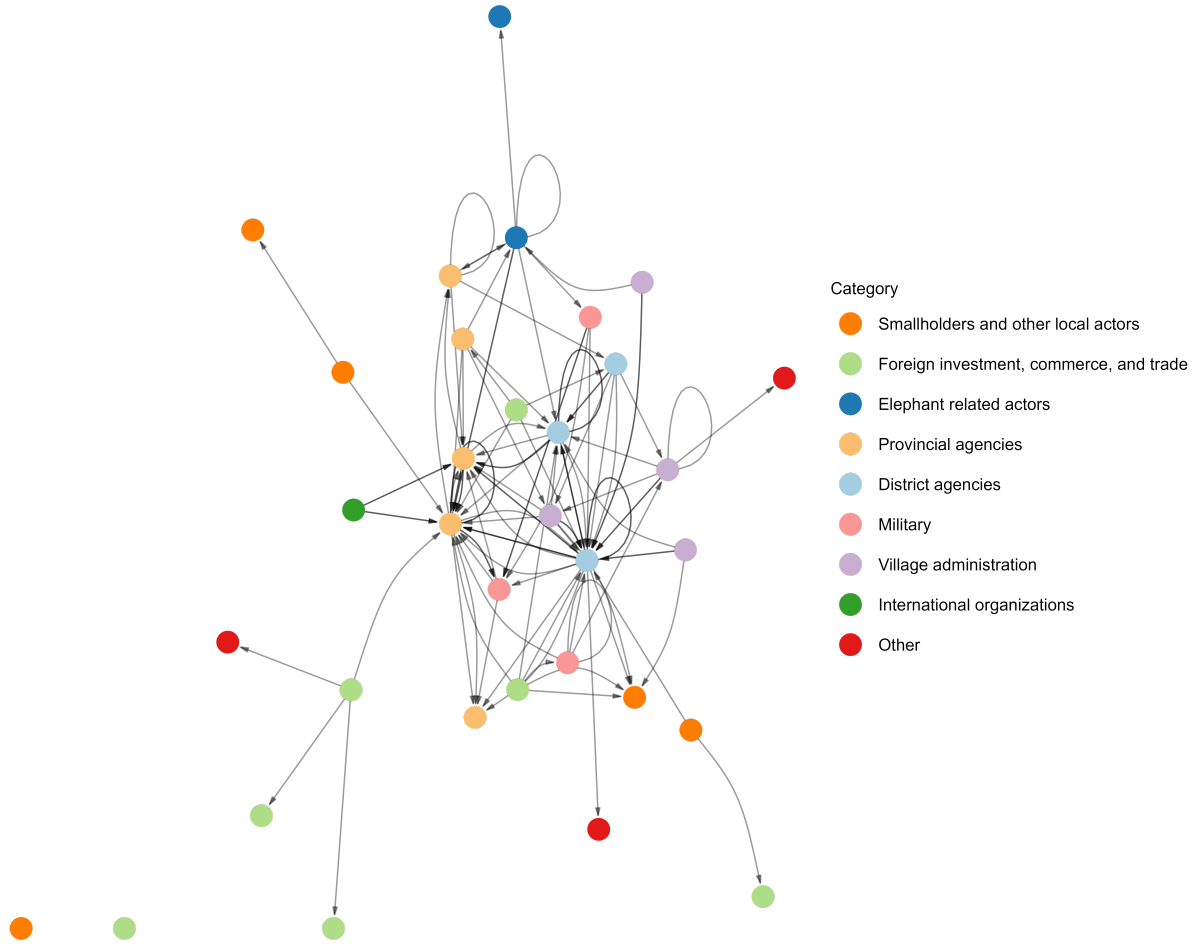


Figure 3: The NTPPF network by stakeholder category

We can also visualize which stakeholders are perceived as the most important in managing the NTPPF network. Figure 4 shows that provincial agencies such as PAFO, PONRE, and the Governor's office are perceived to be important stakeholders in the network. This is also the case for certain district organisations such as DAFO. Some non-governmental stakeholders, including the ECC and smallholder farmers, are also perceived to be important in the NTPPF management.

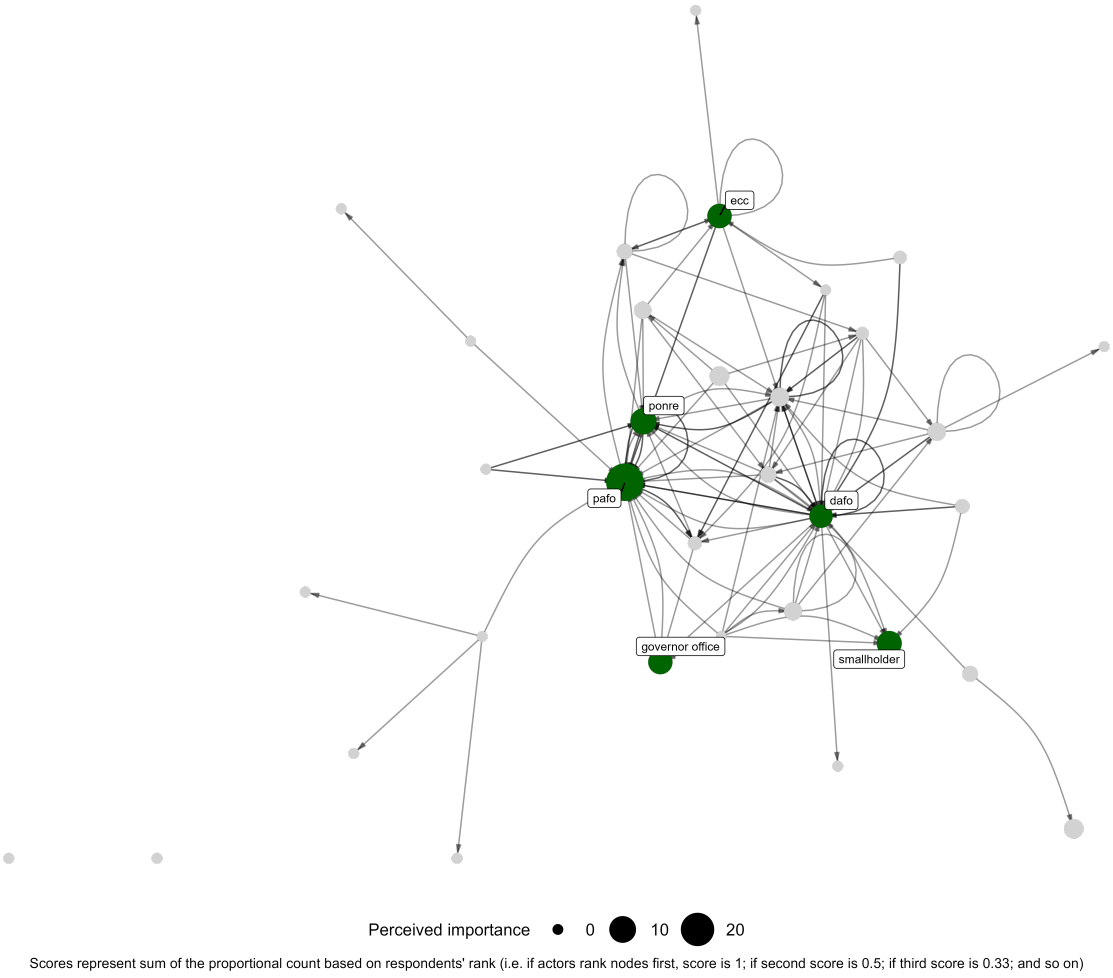


Figure 4: The NTPPF network by perception of importance

Since the network appears to be clustered around district and provincial agencies, looking at the stakeholders that connect the core of the network to the periphery is relevant (Figure 5). We see that diverse stakeholders, from district and provincial agencies to the ECC and the village heads of Donemai and Namtuan, are cut points for bridges that connect stakeholders otherwise unconnected in the network. It illustrates the pathways through which certain peripheral stakeholders, such as smallholders and other local actors, can be reached and which stakeholders could be better integrated in the network.

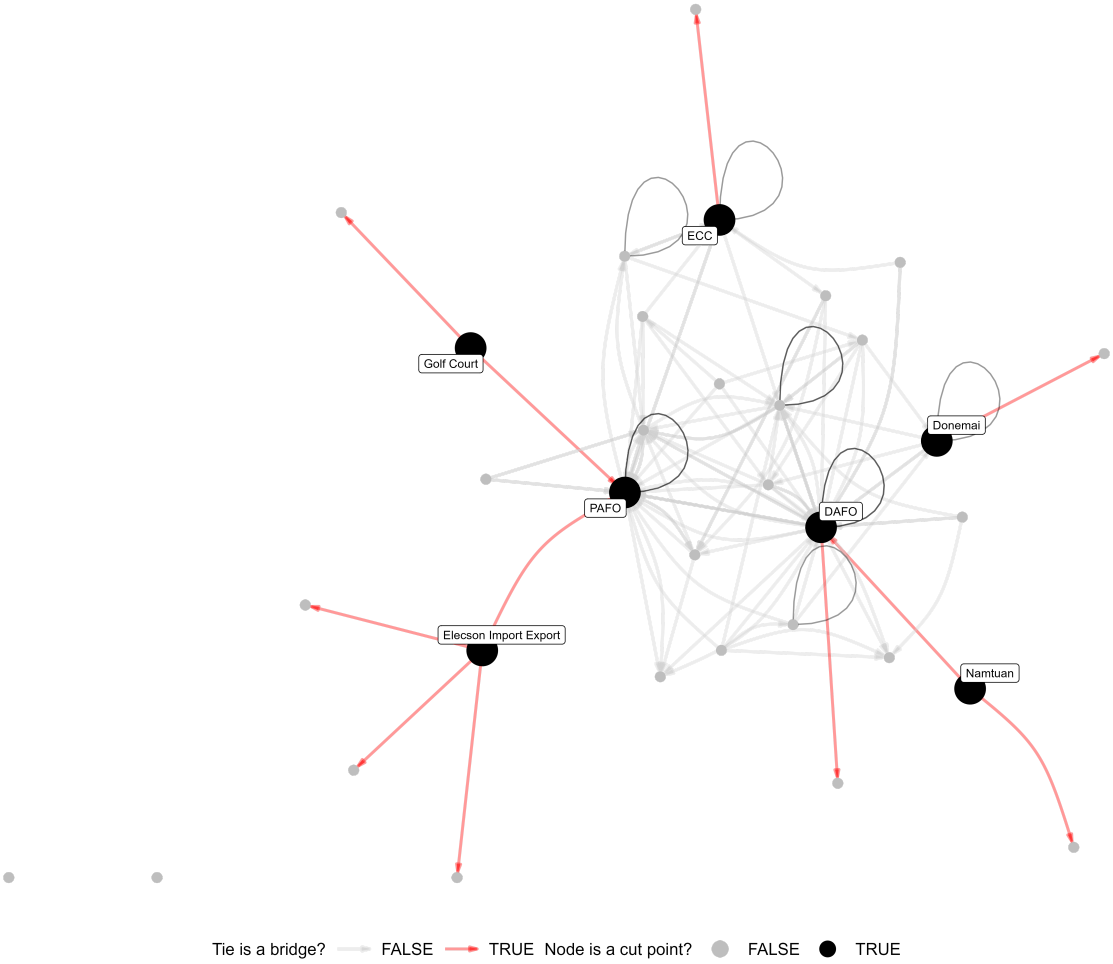


Figure 5: Bridges and cut points in the the NTPPF network

Network analysis is frequently used to identify central nodes in a network (Figure 6). There are different types of centrality in networks. We can, for example, identify which node has more connections to others in the network (i.e., degree centrality). In the NTPPF network, the stakeholder with the highest number of connections to others is DAFO.

Another centrality measure relates to nodes that are closest, on average, to all other nodes in the network (i.e., closeness centrality). Closeness centrality represents the average shortest path from a certain node to others in the network. Interestingly, in the NTPPF network, the Lusheng Import and Export company is closest, on average, to most other stakeholders in the network. This means it can quickly reach or communicate with other stakeholders in the network.

Centrality in networks can also be related to gate-keeping. That is, how often a node is the shortest path connecting different nodes in the network (i.e., betweeness centrality). Gatekeepers, as is the case with the Information, Culture, and Tourism Office in the NTPPF network, can share or withhold information from different clusters or types of stakeholders in a network.

Finally, we can calculate which nodes are most influential in the network based on how many connections they share with other central nodes (i.e., eigenvector centrality). In the NTPPF network, PAFO is the most influential stakeholder. The provincial agency is also perceived as the most important stakeholder in managing the NTPPF network (see Figure 4 above).

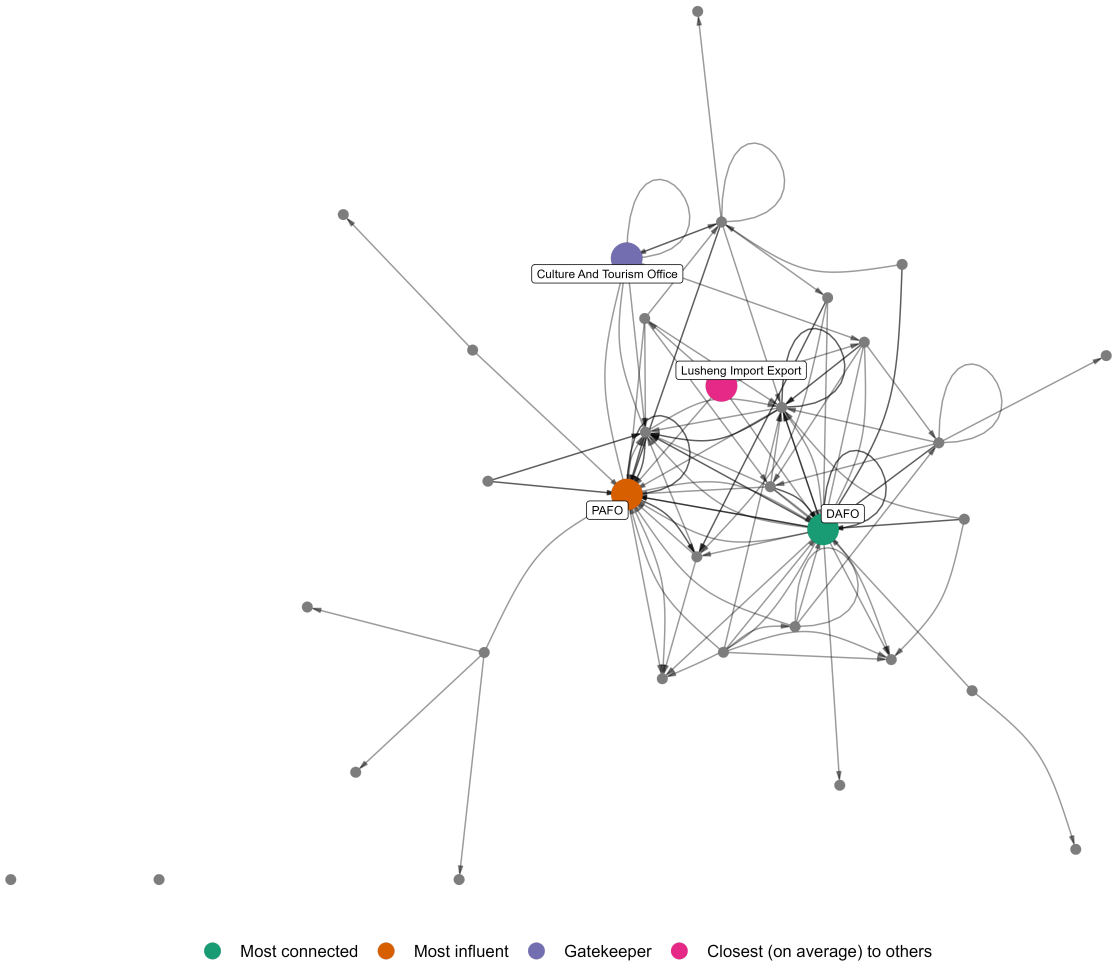


Figure 6: Central nodes in the NTPPF network

Inferential analysis - Modelling the NTPPF network

In this section we explore how certain network structures and node attributes help explain the network as a whole. We hypothesize that *stakeholders of the same category are more likely to share (stronger) edges*. This assumes that similar actors in a network are more likely to connect to one another, behave in similar ways, and exchange information more frequently (i.e., homophily).

To investigate this, we employ exponential random graph models (ERGMs), broadly understood as the conditional probability of a tie given the rest of the network, to systematically analyze the structures and patterns in the network. [4] We chose ERGMs for two reasons. One, model assumptions related to network formation reflect the social processes hypothesized to be present in the NTPPF network. Two, the model is appropriate for cross-sectional network data (i.e., data collected at one point in time), as is the case for the NTPPF data collected. In the models and simulation below, we account for the odds of observing the network based on the number of edges observed, transitiveness (i.e., the tendency of actors to cluster around common connections), and the stakeholder category.

The models (Table 2) illustrate that network edges are not likely to be formed at random (i.e., edge coefficients are consistently negative and statistically significant). Network transitiveness and node category help predict the existence of edges between stakeholders (i.e., positive and statistically significant coefficients for both effects). This means stakeholder category and their common "friendships" connect the network in uneven ways, forming clusters around groups of friends and of stakeholders from similar categories in the network.

Table 2: Modelling the NTPPF network

	Model 1	**Model 2**	**Model 3**
Edges	-2.56***	-3.74***	-3.85***
	(0.12)	(0.19)	(0.20)
Transitiveness		1.58***	1.57***
		(0.18)	(0.19)
Node category			0.80***
			(0.21)
AIC	548.38	485.80	477.58
BIC	553.35	495.73	492.47
Log Likelihood	-273.19	-240.90	-235.79

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

Even though accounting for transitiveness and category can help predict the network structure, the simulation (Figure 7) illustrates how there are additional social dynamics at play in the NTPPF network missed by the models. In practice, the NTPPF network is even more connected and clustered around central stakeholders than the simulation suggests. Altogether, the models and simulation indicate that there are opportunities for interventions aimed to reduce network clustering and to better connect more diverse categories of stakeholders in this network.

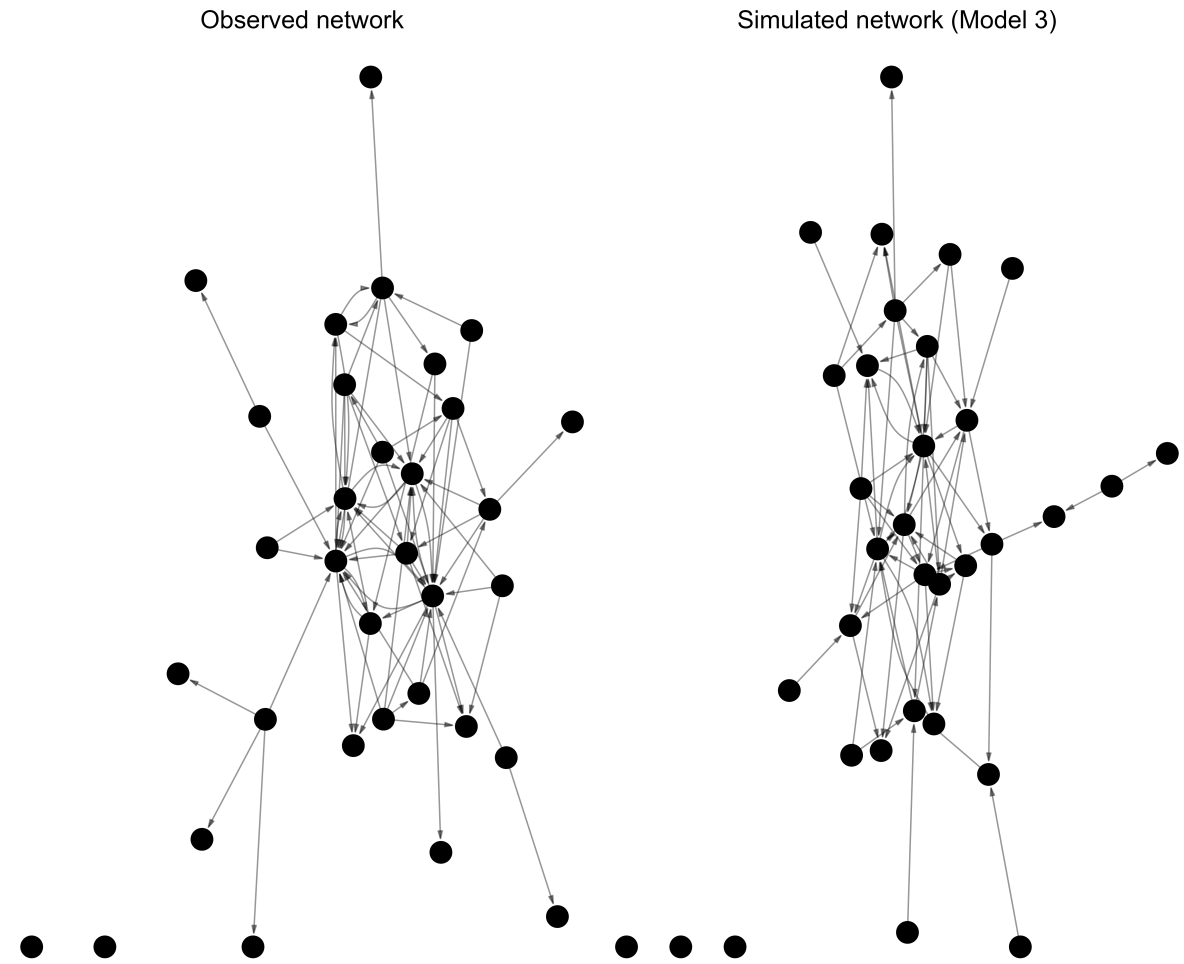


Figure 7: The observed and simulated NTPPF network

Lessons

What connections could be missing in the NTPPF network?

The descriptive and inferential findings suggest that similar groups of stakeholders are more likely to connect and create clusters around one another. Yet, we know that the NTPPF network data collected likely misses edges connecting diverse peripheral stakeholders (i.e., represents a subgraph of the network). [5] We can employ different network modelling techniques to predict the probabilities that certain edges are missing based on the network structure. [6]

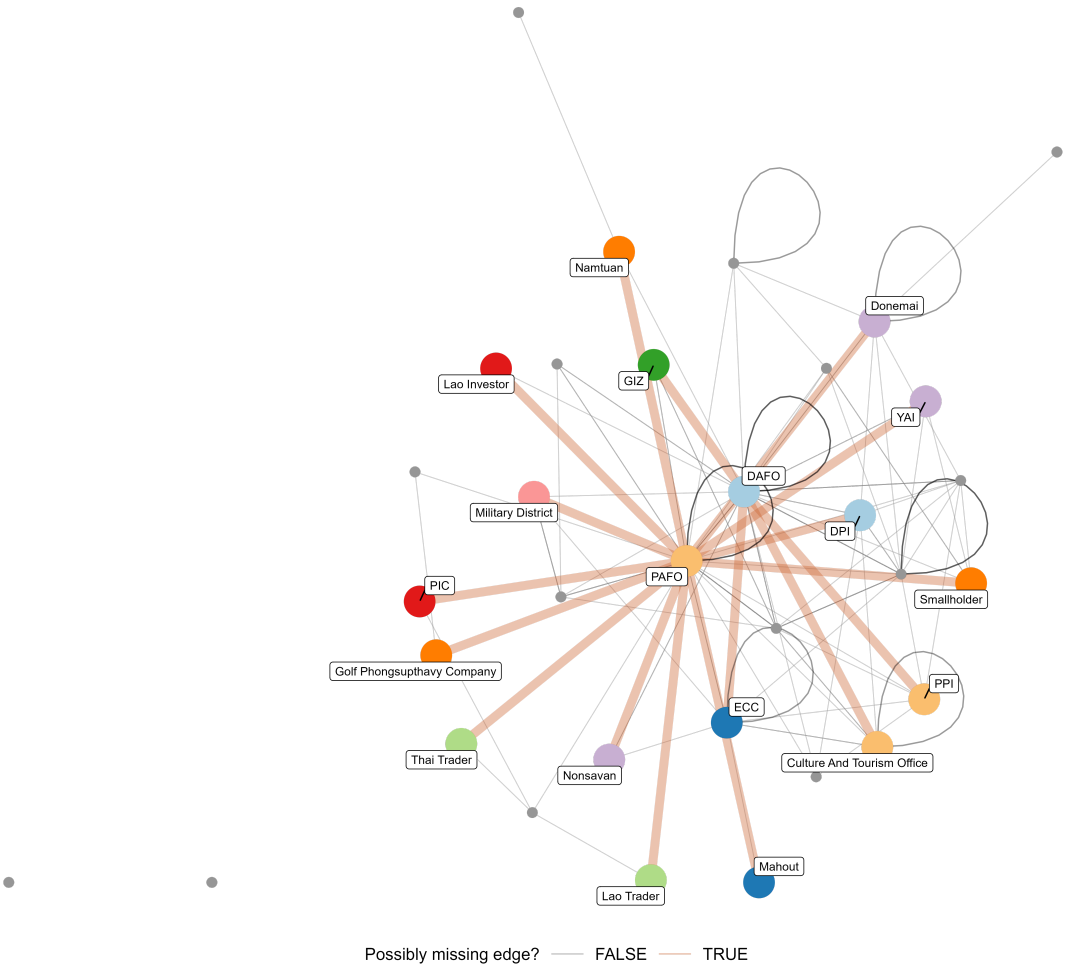


Figure 8: Possibly missing edges in the NTPPF network

Figure 8 illustrates how both PAFO and DAFO are likely more central stakeholders in the NTPPF network than the data collected suggests. This has two main implications. On the one hand, it illustrates how helping to connect PAFO and DAFO to certain peripheral stakeholders in the network - if they are not already - could make the network more "predictable" for future interventions. That is, future interventions could focus on these two stakeholders since they are the most popular and influential ones. On the other hand, it illustrates that the NTPPF is likely more hierarchical as a network than the data collected suggests. This means power is likely to be concentrated within fewer stakeholders such as PAFO and DAFO. Therefore, better connecting peripheral stakeholders among themselves could help diffuse power by "flattening" the network.

Which stakeholders could be more central in the NTPPF network?

Assuming that PAFO and DAFO are likely more central and influential in the NTPPF network than what the data suggests, are there other central stakeholders we missed?

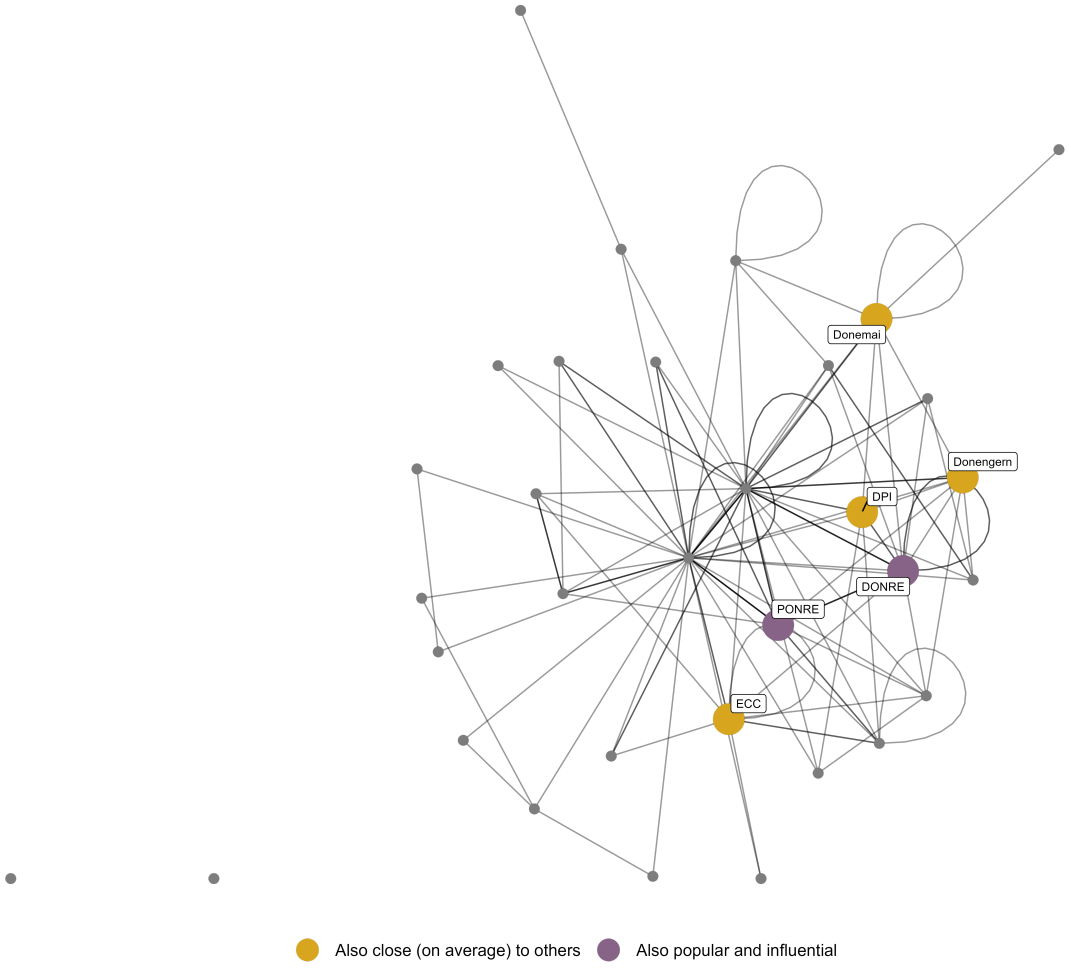


Figure 9: Other central nodes in the NTPPF network

A diverse range of stakeholders also play central roles in the NTPPF network (Figure 9). DONRE and PONRE, for example, are both popular stakeholders (i.e., share many connections to others) and influential in the network (e.g., connected to many other central stakeholders). This means interventions that attempt to change "attributes" (i.e., perceptions or behavior) in the network should also consider these stakeholders. The ECC, DPI, and the villages of Donengern and Donemai are "close" (i.e., average shortest path) to many others stakeholders. This means interventions meant to diffuse information through the network should also consider these since they connect diverse categories of stakeholders.

---

1. Please note that this is a short report, more detailed information about the methods, questionnaires, metrics, and findings can be found in the codebook.↩
2. For more information on social networks in the context of natural resource governance, please refer to Bodin, Örjan, and Beatrice I. Crona. "The role of social networks in natural resource governance: What relational patterns make a difference?." *Global environmental change* 19.3 (2009): 366-374.↩
3. The questionnaire, available in the codebook, was approved by the ethics committee of the University of Bern.↩
4. There are other ways to model networks, for more information please refer to Block, Per, Christoph Stadtfeld, and Tom Snijders. "Forms of dependence: Comparing SAOMs and ERGMs from basic principles." *Sociological Methods & Research* 48.1 (2019): 202-239.↩
5. The data sampling and collection likely makes this a crawled subgraph of the network since it favors connections to stakeholders perceived as relevant to the NTPPF management. For more information on network subgraphs, please refer to Yan, Bowen, and Steve Gregory. "Finding missing edges and communities in incomplete networks." *Journal of Physics A: Mathematical and Theoretical* 44.49 (2011): 495102.↩
6. We rely on hierarchical random graphs to calculate the probability that certain edges are missing, for more information please refer to Clauset, Aaron, Cristopher Moore, and Mark EJ Newman. "Hierarchical structure and the prediction of missing links in networks." *Nature* 453.7191 (2008): 98-101.↩

WYSS ACADEMY FOR NATURE