Eco Adapt

Adaptación al cambio climático
para el desarrollo local

Deliverable N° 2.4

"Socio-Institutional Context Analysis"

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Executive Summary

As global warming continues many Latin American countries face critical water scarcity issues. In particular, rural communities in the region are highly vulnerable because they rely on limited freshwater resources for their main livelihoods. However, future vulnerability of water resources in the region is not determined by climate change alone. In addition to changes in weather and climate, important drivers of increased vulnerability are environmental degradation, demographic pressure, political dynamics, migration patterns, unplanned urban growth, increased economic inequality, low investment in infrastructure and services, and poor inter-sectorial cooperation.

To cope with possible future impacts caused by the combination of these drivers, some countries have made efforts in developing adaptation strategies, particularly through conservation of key ecosystems at the landscape-level. However, evidence thus far shows that little progress in implementing adaptation strategies has been made both at national and sub-national levels. Slow progress relates to, amongst other things, initiatives motivated by external sources, which adopt a top-down approach and face difficulties in designing context-tailored strategies that are able to reduce possible long-term impacts.

To address the above challenge, EcoAdapt adopts a different approach. We consider adaptation planning for water resources as a bottom-up process that requires ways to share and co-generate knowledge between scientists and multiple stakeholders operating across different scales and policy areas through an iterative process of learning. In this regard, we assume that water resources adaptation planning for local development needs to be embedded in a multi-scale and multi-sector environment working with and expanding existing networks that link different spatial scales and knowledge domains. To achieve this, we are working with three civil society organizations that represent multi-stakeholder platforms called Model Forests (MFs). The three MFs engaged in EcoAdapt are located in Bolivia (Model Forest Chiquitano), Argentina (Model Forest Jujuy), and Chile (Model Forest Araucarias de Alto Malleco).

Adopting a bottom-up approach for water planning to design context-tailored adaptation strategies through science-society engagement requires building on the basis of a good understanding of the socio-institutional context. This report is a comprehensive synthesis of the socio-institutional context analysis generated during the first phase of the project (May 2012 to May 2013). It includes a transversal analysis of the three Model Forests in EcoAdapt.

The methodology used for the socio-institutional context analysis is co-constructed with the Model Forests. By doing this, we recognize the importance of integrating their knowledge in this analysis and building a legitimate socio-institutional analysis of water resources management in the landscapes while maintaining credibility of science through the use of scientific methods for water governance analysis.

The methodology we used includes several methods, which were adapted to the context of each Model Forest (MF). The methods involve semi-structured interviews, social network mapping, workshops to validate results, participant observation and the identification of strengths and barriers to water resources adaptation planning in each Model Forest. Results are analysed together with the Model Forest teams, who play a key role in contextualising the findings. Preliminary results of this analysis were presented and discussed in synthesis workshops conducted in each territory in April 2013. These synthesis workshops provided a space for reflection and helped further complement the analysis presented here.

Overall, the process of co-constructing the methodology and co-generating the analysis is iterative and requires time, commitment and trust building. We believe that a more in-depth understanding of the socio-institutional context could only be gained if traditional social science methods are co-managed and strategic alliances are co-created with partners who are embedded in their territory. This interaction promoted exchange of information and knowledge, empowered local actors to design and plan adaptation strategies, and facilitated learning and a shared understanding, which builds relevant capacities and the basis for joint forthcoming action in the landscapes.

The present socio-institutional context analysis is the foundation of future activities in the project, which aim at facilitating bottom-up processes to develop long-lasting, context-tailored adaptation strategies in the landscapes. Firstly, this document integrates local knowledge and differing perspectives from stakeholders within the MFs about the current situation regarding water resources, including different interests and observed trends, which may lead to conflicts in the future. Secondly, the analysis identifies key actors and network relationships that are key to consider in the adaptation planning process. By mapping water governance networks in a participatory way, we identify key actors that play a central role due to either the number of connections to other actors in the network, their influential role in the decision making process around water resources, or because they are important bridges between spatial scales or actor types with differing interests. Based on this analysis and discussions at validation workshops we also identify ‘agents of change’, who are considered allies of the project because they represent attributes that help influence key actors in the governance networks and generate the desired change in the landscapes that the project would like to promote.

Thirdly, the present socio-institutional context analysis highlights conditions that may facilitate or hinder water resources adaptation planning in the landscapes, as well as entry points that build on existing strengths. These entry points could be considered first steps or guiding points towards actions that could support bottom-up processes for water resource adaptation in the MFs. These entry points serve as inputs to Work Packages 3 and 4, where they could be further explored in the formulation of future scenarios, and the identification and evaluation of water-related adaptation strategies in collaboration with a range of actors in the landscapes.

Disclaimer

The current document is a comprehensive synthesis of three reports produced in Spanish analysing the socio-institutional context in the Model Forest Chiquitano, Model Forest Jujuy, and Model Forest Araucarias de Alto Malleco. The versions in Spanish are more extensive and detailed, and present more figures than this synthesis report, which for the purpose of comparison and synthesis could not use all the information available in the individual reports.

1. Introduction

Warming of the climate system is unequivocal and many of the observed changes since the 1950s are unprecedented over decades to millennia (IPCC 5AR 2013). As temperatures continue to rise, many Latin American countries may face critical water scarcity issues. This is compounded by the fact that many rural communities in the region are already relying on limited freshwater resources and using water-harvesting methods, which are very vulnerable to drought (IDB 2004).

Future vulnerability around water resources in Latin America is not only determined by climate change. In addition to weather and climate changes, important drivers of increased vulnerability are demographic pressure (by 2050, population in the region is expected to be 50% larger than in 2000), unplanned urban growth and rapid rural migration, increased economic inequality, low investment in infrastructure and services, and poor inter-sectorial coordination (Magrin et al. 2007). These drivers interact synergistically with other current threats such as over-exploitation and contamination of natural resources, intensification of land-use change, deforestation and other processes of land degradation, and loss of critical species and habitats further increasing the social and ecological vulnerability in the region (UNEP 2003). Poorly understood interactions and feedbacks between these processes add to the complexity and uncertainty of future impacts.

To cope with possible future impacts, some countries in Latin America have made efforts to develop adaptation strategies particularly through conservation of key ecosystems at the landscape-level, including agricultural systems, implementation of early warning systems, flood, drought and coastal risk management and disease surveillance systems (Magrin et al. 2007). However, evidence thus far shows that little progress in implementing adaptation plans has been made both at national and sub-national levels due to one or a combination of factors such as low awareness of changing climate and its potential impacts; lack of basic information, observation and monitoring systems; lack of capacities and commitment; absence of appropriate political, institutional and technological frameworks; marginalisation of many societal sectors, and poor integration of local knowledge and visions into adaptation planning (San Martin 2002, Solanes and Jouravlev 2006).

In this context, initiatives motivated by external sources and adopting a top-down approach face difficulties to design context-tailored strategies to cope with or reduce the possible impacts of combined pressures. Such is the case of watershed management initiatives in the region who have a science to society focus (i.e. top-down approach) often without considering socio-institutional contexts or considering it through a rapid appraisal with little inclusion of local knowledge, differing perspectives and experiences of the conditions that may enable or obstruct the access and management of water resources.

To address the above challenges, in EcoAdapt we adopt a different approach. First, we consider adaptation planning for water resources as a bottom-up process that requires ways to share and co-generate knowledge between scientists and multiple stakeholders operating across different scales and policy areas through a process of two-way learning. Secondly, given the complexity inherent to the interplay between hydro meteorological cycles, land use and development policy decisions we strive for an explicit consideration of different climatic and non-climatic stresses through the use of complementary quantitative and qualitative information. Finally, we consider that a prerequisite for the first two points is the building of trust among scientists and local stakeholders from civil society organizations and the empowerment of the latter to participate in the adaptation decision-making process.

In order to adopt the strategic approach just described, we assume that water resources adaptation planning for local development needs to be embedded within a multi-scale and multi-sector perspective working with and expanding existing networks that link different spatial scales and knowledge domains. To achieve this, we are working with three civil society organizations that represent multi-stakeholder landscape-level platforms called Model forests (MFs). These platforms are linked to multiple actors within the country in which they operate and are linked to each other through an Ibero-American and International Network. Model Forests operate at the landscape-level and have been built through a bottom-up process institutionalizing previous multi-actor initiatives on sustainable development. The three MFs engaged in EcoAdapt are located in Bolivia (Model Forest Chiquitano, MFC), Argentina (Model Forest Jujuy, MFJ), and Chile (Model Forest Araucarias de Alto Malleco, MFAAM).

Furthermore, we acknowledge that in many instances turning research findings into long-lasting practices has failed due to cultural, social, economic and institutional constraints. These include i) limited understanding of local capacity to integrate or foster sustainable innovations through their institutions, ii) a gap between stakeholders' perceptions, terminology and 'worldview' and scientists' ability to communicate their findings, and iii) state policy failures in supporting sustainable innovations. On this premise, the project adopts a constructive role of science in decision-making processes by i) opening up the constrained view of the science-management interface, ii) going beyond the merely technical fix approaches to water in ecosystem management; and finally, iii) by promoting innovative tools to evaluate scientific quality with focus not only on 'doing the thing right' but also on 'doing the right thing' (Falkenmark and Folke 2002).

Adopting a bottom-up approach for water planning to design context-tailored adaptation strategies through science-society engagement requires building on the basis of a good understanding of the socio-institutional context and engaging multiple actors in the process. This type of science can be viewed as a process of collaborative learning and co-construction of knowledge that builds on a diversity of worldviews and objectives (such as in watershed management initiatives) and strives to identify alternatives that capture a broad suite of system behaviours.

This report is a comprehensive synthesis of the socio-institutional context analysis generated during the first phase of the project, and includes a cross-site analysis of the three Model Forests. This analysis is the foundation of future activities in the project, as successful implementation of long-lasting adaptation strategies in the MFs will largely depend on the understanding of the socio-institutional context we are working in, the factors that may enable or constrain water adaptation strategies, and actors that may influence the future use and management of water resources in the landscapes. More specifically, the objectives of this socio-institutional context analysis are to:

1. Generate a shared understanding around the current situation of water resources in the landscapes based on different local perspectives in the MFs about current drivers and dynamics affecting water resources, different interests around the use and management of water resources, and observed trends in the landscape that could lead to possible problems around water resources in the future;
2. Study and identify actors, influences and inter-actor relationships in information and governance networks around water resources planning and management, which are key to consider in the adaptation planning processes;
3. Identify potential 'agents of change' that can be considered project allies, which can reach key actors in the networks, integrate or bridge different worldviews and interests, influence decision-making, and create more feedback channels or links for collaboration;
4. Identify and map factors that may facilitate or constrain processes for water resources adaptation planning in the landscapes;
5. Explore and identify possible entry points that can be considered first steps to start working on adaptation strategies in the MFs building on existing strengths to overcome some of the current barriers to the water resources adaptation process.

This document is structured in eight parts. This first section provides the background and rationale behind the EcoAdapt project in general and the socio-institutional context analysis in particular. The second section describes the focus of analysis in this report, namely the Model Forest landscapes in Bolivia, Argentina and Chile. The third section presents the methodology, as well as some of its limitations. The following section is a synthesis about the current situation of water resource management in the landscapes and possible future challenges. The fifth section focuses on the socio-institutional networks for water governance in the MFs and key actors that should be considered in water resources adaptation planning. The next section provides a synthesis of strengths and barriers to water resources planning and management in the landscapes, comparing commonalities and differences between the MFs. The discussion section identifies possible entry points that can be considered in the next steps of the project when adaptation strategies are developed together with local actors in the landscapes. It also includes remarks on lessons learned throughout the process of co-construction of methods, information gathering and exchange, validation with local actors, and co-generation of knowledge, which contribute to collective learning, collaboration and we hope, ultimately desired change in the landscapes. The final section concludes with a brief summary of the objectives achieved with this analysis and the next steps in the project.

2. Site Description: Model Forests

Model forests (MFs) represent multi-stakeholder platforms linked to multiple actors in the landscape they operate. Three Model Forests are engaged in EcoAdapt, namely the Model Forest Jujuy in Argentina, the Model Forest Chiquitano in Bolivia, and the Model Forest Araucarias de Alto Malleco in Chile. These MFs were selected at a consultation process held in 2010 with Latin American Model Forests to design the EcoAdapt project. The three MFs have been working for years in their landscapes on issues related to income generating activities and community empowerment to participate in local decision making for natural resources management (Chile), social-ecological assessments for land use planning and ecosystem management (Bolivia), and assessment of watershed services and ecosystem management (Argentina). This section provides a brief description of each Model Forest.

2.1 Model Forest Jujuy - Argentina

The Model Forest Jujuy covers the water basin area of Los Pericos-Manantiales in the Jujuy Province, in the north of Argentina. In this territory, the Association Model Forest Jujuy (MFJ) implements project activities with the overarching goal to contribute to an integrated management of the watershed. The basin Los Pericos - Manantiales is a sub-basin of the Rio Grande. The basin (see Figure 2-1) has great economic, as well as social and productive importance in the country. It encompasses an area of 1,300 km^2 and has about 100,000 inhabitants, of which 80% are located in urban settlements.

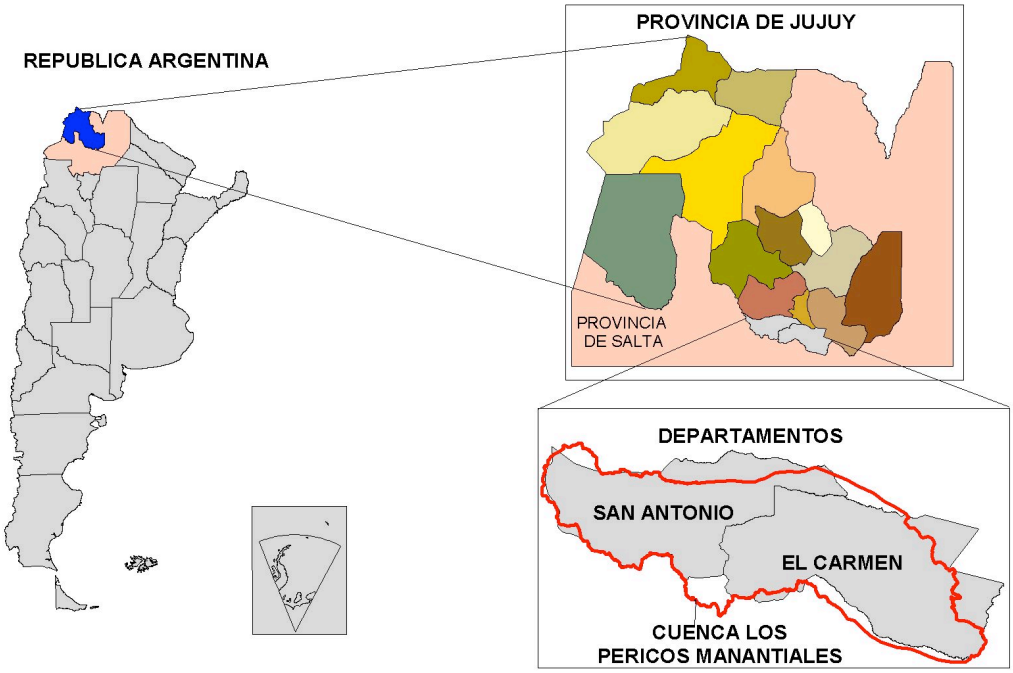


Figure 2-1: Los Pericos-Manantiales basin
EcoAdpt project site and territory covered by the Model Forest Jujuy
Source: TCP/ARG/2802, Google Earth 2012, MFJ 2013

The basin can be divided into upper, middle and lower basin. The socio-institutional context analysis focuses on the upper and middle basin, locally known as the "Area of the Diques and Perilagos", which means the area around the water dams (ADP, see Figure 2-2). The upper basin is characterised by steep slopes and periglacial environments with grasslands and native forests. About 40% of the upper basin belongs to a single landowner and scattered farmers in this area live in somewhat marginal conditions; they depend on livestock (i.e. beef and goat) as main livelihood. The middle basin is highly populated and is characterised by its agricultural production and a small area of natural vegetation. Upwelling, forest cover and agricultural production typify the lower basin.

Figure 2-2: Area of the Diques and Perilagos (ADP), area surrounding the water dams in the MFJ
Source: Google Earth 2012

Furthermore, the middle basin has an important irrigation system in place, covering about 25,000 ha of the area. Water comes from the upper basin and from Rio Grande through a water channel. This is an important area for tobacco production, which dominates the irrigated agricultural land and constitutes an important source of economic revenue equivalent to 35% of the GDP in the territory.

The ADP in Figure 2-2 is located in the middle basin and is considered a tourist attraction. Urban housing, forests and farms border the water dams in this area. Diverse leisure activities take place in the ADP, including recreational fishing and nautical activities, among others. There are also restaurants and different clubs in the area, which offer different recreational activities to local visitors and international tourists alike. Water in the water dams ('*diques*' in Spanish) is also used for irrigation of the surrounding agricultural fields. The *Consorcio de Riego del Valle de los Pericos* (CRVP) is a public-private institution, which manages the water distribution and irrigation system under the *Direccion Provincial de Recursos Hidricos* (DPRH).

2.2 Model Forest Araucarias de Alto Malleco - Chile

The Model Forest Araucarias de Alto Malleco (MFAAM) covers the communes of Lonquimay and Curacautin in the Malleco Province, IX Region of the Araucania, in the south of Chile (see Figure 2-3). The MFAAM implements project activities across these two communes. The territory includes pre-Andean and Andean landscapes, comprising an area of 560,000 ha.

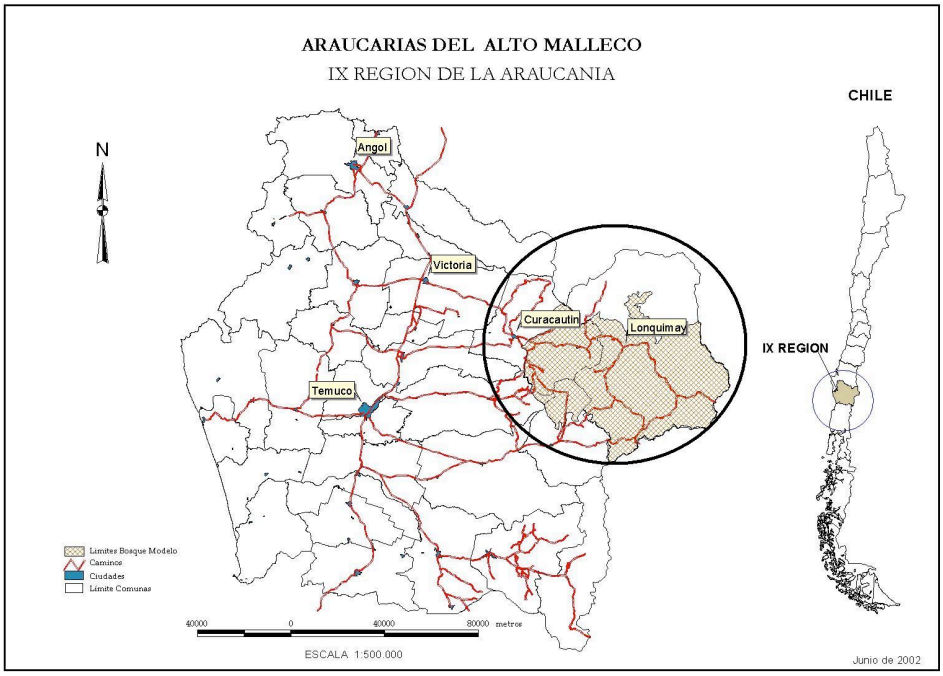


Figure 2-3: Lonquimay and Caracautin communes in the IX Region of the Araucania
Source: MFAAM 2013

Two important river basins cross the territory of the MFAAM. One is the Bio Bío river basin with an area of 24,264 Km^2 and the other one is the Cautín river basin with a surface area of 12,763 km^2 (see Figure 2-4).

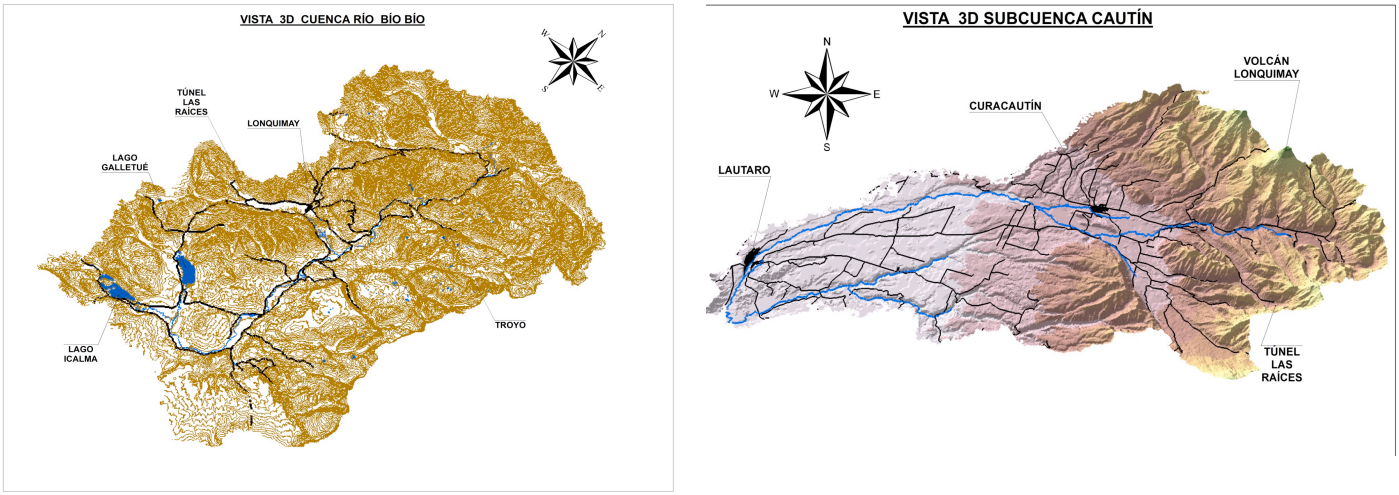


Figure 2-4: Bio Bio river basin (left) and Cautin river basin (right)
Source: MFAAM 2013

In 2002, the population in the MFAAM was 27,207, with 37.6% living in Lonquimay and 62.4% in Curacautin. For 2012, the National Statistics Institute (2002) had estimated a population growth of 12,8% in Lonquimay and a population decrease of 10.5% in Curacautin, with a total population growth of only 0.3%[1] for both communes together, equivalent to 26,736 inhabitants (see Table 2-1). By 2009, more than half of the population in Lonquimay (66.5%) was living in the rural area, while more than half of the population in Curacautin (69.1%) was urban population. In total, 54.2% of the population in the MFAAM territory was urban in 2009 (CASEN survey, National Ministry of Social Development 2009).

Table 2-1: Total population in 2002 and projected population in 2012, Lonquimay and Curacautín.

	Lonquimay		**Curacautín**		**Total**	
	2002	**2012**	**2002**	**2012**	**2002**	**2012**
Men	5,414	6,279	8,310	7,293	13,724	13,572
Women	4,823	5,269	8,660	7,895	13,483	13,164
Total	10,237	11,548	16,970	15,188	27,207	26,736

Source: National Statistics Institute (INE), national census 2002

[1] Calculated based on the following formula: Growth rate = [P2/P1) ^(1/t) -1]*100

[2] http://netmap.wordpress.com/about/

An important feature of the MFAAM is the presence of Mapuche-Pehuenche indigenous communities. According to the 2002 national census, these communities accounted for the 45% of the population in Lonquimay and only 6% in Curacautín. The total indigenous land covers 141,929.76 ha, which represents 37% of the total area of the Model Forest. Overall, the territory is covered by annual crops (11%), natural and human-improved grazing areas (28%), plantations of exotic species (2%), natural forests (46%), and infertile soils (13%) (MFAAM Strategic Plan 2009-2012). Agriculture land is mainly covered by cereals and forage crops.

The main sources of employment in the MFAAM are farming, cattle ranging, hunting and forestry activities, which employ 29% of the economically-active population, followed by trading activities (15%) and construction (11%). SEPADE (2003) states that employment in Lonquimay is seasonal due to frequent migrations to Argentina in the past and to the north of Chile at present.

2.3 Model Forest Chiquitano - Bolivia

The Chiquitano dry forest is a transboundary ecoregion, which connects more than 11.8 million ha of parks and reserves from different categories and jurisdictions. Among those protected areas are: the Noel Kempff Mercado National Park (over 1.5 million ha), declared a Natural Heritage of Humanity by UNESCO and designated Ramsar site; the Kaa-Iya del Gran Chaco, one of the largest parks in South America with 3.4 million ha; the Otuquis National Park, and the Tucabaca Valley Reserve, among several others. In addition, the Chiquitania ecoregion has more than 22 forest concessions (about 2.2 million ha), and 12 community lands (more than 6 million ha) including local indigenous groups such as Baure, Chiquitana, Ayoreode and Guaraní, as well as a significant number of private farmlands and reserves. This extensive and diverse mosaic of land use and cover represents a complex scenario in terms of governance.

In 2005, the Bolivian side of the Chiquitano ecoregion was declared a Model Forest (MFC). The establishment of the MFC offers great opportunities to avoid deforestation trends, foster connectivity between large blocks of protected forests, and promote conservation and sustainable use of biodiversity in the territory (Vides-Almonacid and Justiniano 2011).

To achieve the objectives of the EcoAdapt project in a Model Forest of such a vast extension, the MFC team decided to work in a pilot area. This pilot area is the Zapoco river basin, which includes the Zapoco water dam located in the middle basin (see Figure 2-5). The area covers 101,128 ha and is located in the Municipality of Concepcion, First Municipal section of the Ñuflo de Chavez Province, 290 km from the city of Santa Cruz de la Sierra. In 2007, a Municipal Protected Area was established around the water dam to ensure its protection. This area covers 1,901 ha.

Most of the Zapoco river basin is covered by forest and cultivated pastures, but there is also subsistence agriculture in the community areas. The main economic activities are cattle ranging, private and communal farming, as well as traditional use of forest for timber and non-timber forest resources. Agriculture crops are mainly maize, rice, cassava and plantains. There are also industrial crops such as soybeans, but to a much lesser extent. In the livestock sector,

most of the production is for sale; only small cattle rangers raise cattle for domestic consumption. Most of the forest production is marketed as raw material, which has encouraged the development of wood manufacturing.

Private properties (198 in total) occupy more than half of the Zapoco river basin. Private properties differ from indigenous land in that indigenous land is owned by the entire community (i.e. communal land) while private land is owned by a single owner or family. In the basin, there are 20 indigenous communities (some located within the 2 km buffer area around the basin, see Figure 2-5). Table 2-2 lists the communities in the upper, middle and lower basin, and provides data on area and population of each community. In 2009, there were 4,791 people living in the rural communities of the Zapoco river basin. The largest titled land in the basin is the Chiquitano Indigenous Land Monteverde (ETIOC Monteverde) with 22,107 ha. Three indigenous communities live in this area, i.e. Río Blanco, Santísima Trinidad and Santa Mónica.

Figure 2-5: Zapoco river basin, EcoAdapt pilot area in the Model Forest Chiquitano
Source: FCBC 2013

In addition to private properties and indigenous communities, there are 61,453 ha equivalent to 46% of the total basin with various land use rights, i.e. forest concessions; mining concessions; ETIOC Monteverde, and the Zapocó Municipal Protected Area.

Table 2-2: Rural Communities in the Zapoco river basin

Location in the basin	Community (foundation year)	Origin of families	Area (ha)	Population
High	Guadalupe (1980)	Concepción	400	56
	Candelaria (1963)	De la estancia Candelaria	7.127	672
Medium	San Fermín (1983)	Propiedad San Lorenzo	2.996	210
	San Andrés (1962)	Propiedad Santa Anita	632	231
	San Juan (1968)	de San Ignacio	1.100	343
	La Embocada (1964)	Trabajaban en los gomales	300	280
	Altamira (1960)	Chiquitanas	70	267
	Limoncito (1980)	Chiquitanas	30	623
	Mercedes de Guayaba (2005)	Monteverde y San Lucas	99	210
	Monte Cristo (1992)	El Encanto y El Carmen	800	84
	Monte Olivo (1989)	Chiquitanas	508	133
	Porvenir (1985)	San Miguelito del Sur	264	315
	San Lucas (1960)	De Concepción	400	91
	San Miguelito de la Cruz (1972)	Chiquitos	738	252
	San Miguelito Sur (1960)	Propiedad Santa María	2.945	280
	Santa Elena (1983)	Monte Verde	1.000	30
	Santa Rita (1948)	Alta Vista	2.685	301

	Santísima Trinidad (2003)	Lomerío	3.289	S/D
Low	Santa Mónica (1975)	Estancia Las Madrecitas	más de 500	371
	Río Blanco (2008)	Chiquitanos	4.374	42
	TOTAL		**29757**	**4791**

Source: PMOT 2009, FCBC 2012

The Zapocó dam is located near Concepcion village to supply water to its inhabitants. Concepcion is the main town and only urban area in the Zapoco river basin. The dam is one of the Municipality's urban attractions and several streams join the Zapocó dam. In rural areas, communities drink groundwater using pumps. Irrigation water for agriculture comes mostly from rivers and streams, while cattle in private properties and communities use micro dams locally called “atajados”.

The river systems in the Municipality of Concepcion are made up of several rivers such as Río San Julián, Río San Pablo, Río Blanco and Río San Martín, which are fed by the Zapocó Norte, Quizer, Zapocó, Negro, San Luis, Uruguayito, Guarayos, Arroyo Esperanza, Arroyo Méndez and Río Pantano. The hydro dynamics of rivers in the area have a seasonal pattern, i.e. river flows increase in response to rainfall during the wet season (i.e. December to June) and decrease during the dry season (i.e. July to November). The small and medium streams contributing to larger rivers are disturbed by human activity, which changes the natural hydrological regime in the watershed. This is mainly due to water demand by villagers and private properties.

3. Methodology

The methodology used for the socio-institutional context analysis was co-constructed with the Model Forests because we recognise the importance of integrating the knowledge of relevant local actors in the co-generation of legitimate knowledge for development of socially appropriate strategies in the landscapes while maintaining credibility of science (Shaw and Kristjanson 2013). The methodology included several methods, which were adapted to the context of each Model Forest and incorporated into the Terms of Reference (ToR) developed by each Model Forest for the work conducted under Work Package 2 (see Deliverable 2.3). The methods involved semi-structured interviews, social network mapping, workshops to validate results, participant observation, and the identification of strengths and barriers to water resources adaptation planning in each Model Forest (see Figure 3-1). Results were analysed together with the Model Forest teams, who play a key role in contextualising the findings. Preliminary results of this analysis were presented and discussed in synthesis workshops, which provided a space for reflection and helped further complement the analysis presented here.

Overall, the process of co-constructing the methodology and co-generating the analysis presented in this document was iterative and required time, commitment and trust building. We believe that a more in-depth understanding of the socio-institutional context could only be gained if traditional social science methods are co-managed and strategic alliances are co-built with partners who are embedded in their territory. This interaction promoted exchange of new information, and facilitated learning and shared understanding, which build relevant capacities and the basis for joint future action in the landscapes (Pahl-Wostl et al. 2007).

Figure 3-1 illustrates the different social methods applied in the socio-institutional context analysis divided into three phases. Each phase builds on the previous one. The fieldwork phase, which took place for most part of 2012, was followed by a phase of analysis and validation of preliminary results with local actors in the landscapes. This validation was possible through workshops implemented in each MF at the end of 2012. Participant observation allowed systematization of learning processes during the implementation of validation workshops. This method began in the validation workshops but will continue to be applied by the MFs throughout the project. Following validation workshops the analysis continued together with the Model Forest teams. This third phase included the identification of conditions that may enable or constrain the adaptation planning process in the landscapes. New results were presented and discussed in April 2013 at synthesis workshops in the MF landscapes. These workshops also included gatherings with local actors and potential 'agents of change' (see section 5.3), as well as discussions on the next steps in the project (Deliverable 2.5). This section describes the different methods applied for the socio-institutional context analysis, as well as the methodological limitations that we should be aware of.

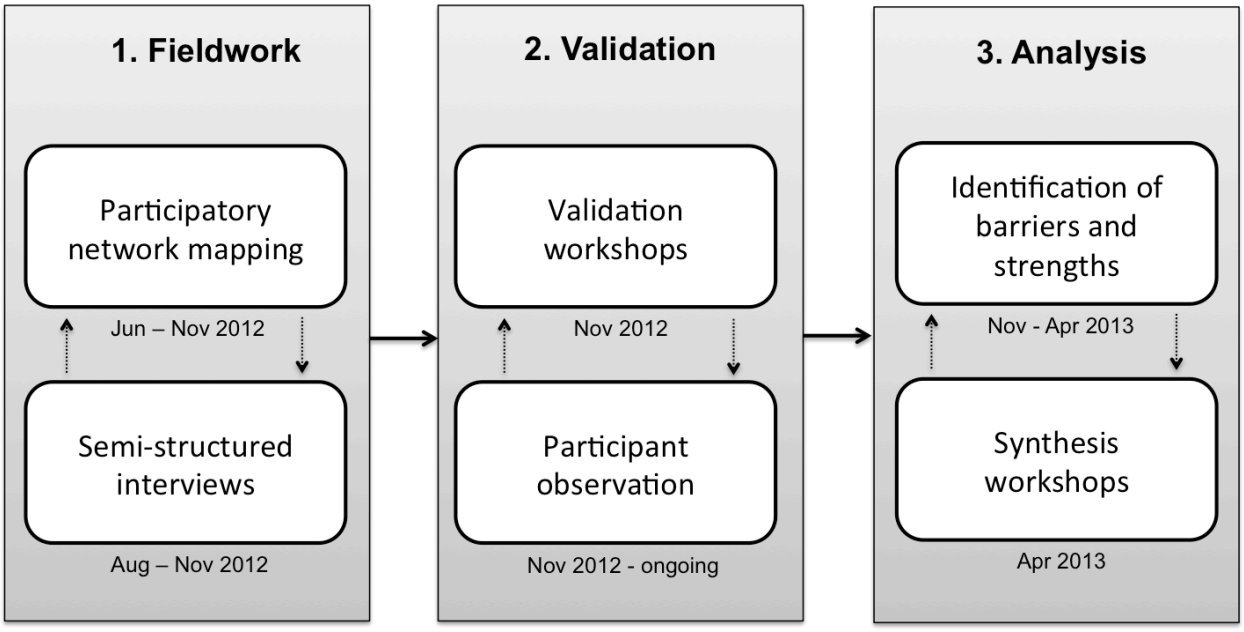


Figure 3-1: Methods implemented in three phases for the socio-institutional context analysis

3.1 Participatory network mapping

There has been an increasing amount of research on the role of social networks to explore social complexity in the governance of natural resources and ecosystems in recent years (Bodin et al. 2006, Bodin and Crona 2009, Newig et al. 2010, Sandström and Rova 2010, Crona and Hubacek 2010, Crona and Bodin 2010, Vignola et al. 2013). These studies help identify key actors that play an important role in the management of specific ecosystems, explore relationships between them, find diverse opportunities for intervention and innovation and identify barriers or potential conflicts to overcome in order to enhance collaboration for more integrated and sustainable management.

A social network approach views a set of actors (i.e. individuals, organisations or other social entities) linked through one or more relationships (Marin and Wellmann 2010). This approach looks for patterns or structures in the network that can facilitate or hinder the objectives of individual actors while shaping the property of the social arrangements that influence specific natural environments (Bodin et al. 2006, Bodin and Crona 2009, Newig et al. 2010). Social processes are not only an expression of the structural patterns and flows within networks, but they can also be outcome variables that influence how the networks change and evolve over time (Borgatti and Foster 2003).

In this particular analysis, we apply participatory network mapping (SNM) as a method to explore relationships between the different actors that are relevant to the governance of water resources in the Model Forests. The information and local knowledge elicited through the participatory mapping is of value to understand the interactions between actors, local perceptions about the influence different actor have on decision making for water resources, and existing capacities and weaknesses to that need to be overcome. This approach also helped us to identify central and bridging actors in the network and understand who dominates the decision space in relation water resources planning and management in the landscapes. The findings also contribute to the identification of potential 'agents of change' who can have influence on the decision space and facilitate collaboration through information and knowledge exchange (Crona and Bodin 2006) and mobilization of resources (Carlsson and Berkes 2005) between different actors and governance levels in the network.

Although social network mapping is a qualitative participatory method and network statistics were not used in this analysis, we do refer to network terminology relating to measures of centrality (i.e. central actors and bridging actors) in section 5 to present some of the network results. We use centrality concepts in a qualitative way (i.e. we conduct a qualitative assessment of the networks), although they refer to quantitative ways of analysing social networks. For a quantitative assessment of social networks, however, a different method is required to elicit data from actors in the study sites, which was not implemented in this instance due to time and resource constraints in the Model Forests. The study did not suffer as a result of this because the qualitative approach has allowed rich discussion and capacity building (appropriate for a project like EcoAdapt), which would less likely be the case with the quantitative survey approach.

Measures of centrality can relate to degree centrality (i.e. based on number of connections), closeness centrality (i.e. distance or proximity between actors), and betweenness centrality (i.e. actors that lie between each other pair of actors). These measures are used to assess if the structural location of actors in the network can be advantageous or disadvantageous in relation to the key question being considered and the other actors in the network, and hence it can help identify key actors. For instance, actors who have more ties may have greater opportunities in the network because they have more ways to influence or to reach other actors in the network (Hanneman and Riddle 2005). These measures can also be applied at the network level. For instance, assessing the overall proximity of actors to each other and the number of links in a network can provide an idea of the level of collaboration in the network. According to Bodin and Crona (2009) the more ties in the network, the more possibilities for joint action and collaboration exist due to increased opportunities for communication, reciprocity and trust.

Furthermore, bridging actors are those actors that link other actors that otherwise would not be linked (i.e. betweenness centrality). Bridging actors can link different types of actors vertically and horizontally, contributing to increased flow of resources, enabling conflict resolution and enhancing cooperation between different governance scales. Bridging actors could be considered potential agents of change, because they are often strategically positioned in the network and can act as boundary agents and enablers of flows between actors and hence, can play a key role in facilitating joint decision-making and action (Vignola et al. 2013).

In the social network mapping exercise, we asked participants to identify and map actors that are relevant to water resources in the landscape either because they are directly using or benefiting from the resources or because they have influence in the decision making process related to water resources. We also asked participants to identify flows between these actors and to agree on the level of influence that different actors in the network have on the decision-making process related to water resources planning. For this, participants were asked to draw arrows between actors representing different flows predefined by the Model Forest teams and to add levels of influence (level 3 being the highest) to each actor in the network. This perceived level of influence on decision-making helps reveal insights on whose decision framing dominates in the network. Actors' influence on the decision making process can be defined as formal or informal (or a combination of both) by the actors mapping the network. Formal influence is bounded by formal level of authority, while informal influence can be defined on the basis of a number of criteria, such as possession of very important knowledge for the problem at stake, personal connections, economic power, etc. (e.g. see Pelling et al. 2008 on 'shadow spaces'). King (2000) argues that the combined effect of number of ties an actor has (i.e. degree centrality) and formal level of authority corresponds to the perceived level of influence in decision-making processes.

The implementation of SNM was adapted to the needs identified by the MFs and modified to suit the local realities in each site. The SNM is based on the NetMap method designed by Schiffer in 2007[2] but with adjustments to include spatial dimensions. The incorporation of

[2] http://netmap.wordpress.com/about/

spatial scales was important to explore synergies and possible tensions between different governance scales in the networks, and how do these play out in the management of water resources. The participatory network mapping is implemented in homogeneous working groups. These groups represent different types of actors in the landscapes. The objective of working with different groups is to develop separate social networks that reflect the different perspectives or worldviews in the territory (Schiffer and Hauck 2010). Results (section 5) are based on the comparisons between these multiple networks.

In the Model Forest Chiquitano, SNM is implemented in a multi-actor workshop with three working groups: a group of representatives of public institutions, a group of representatives of local communities and grassroots organizations, and another group representing the private sector. In the Model Forest Jujuy, SNM is implemented in separate meetings with representatives of three groups: a group of representatives of the MFJ team, a group of representatives of the Municipality El Carmen and a third group of representatives of the *Intendencia de los Diques*. In the Model Forest Araucarias de Alto Malleco, SNM is first implemented in a multi-actor workshop with two working groups: entrepreneurs from the private sector, farmers and NGO members. A third mapping exercise is conducted in a separate meeting with representatives from the public institutions.

The social network maps generated by different actor groups were complemented with interview insights and the joint results were validated and fine-tuned in workshops. The resulting social network maps are visualised with the social network software UCINET v6.411 and NetDraw v2.121. This software also helped calculate and visualise measures of centrality to identify key actors in the networks.

3.2 Semi-structured interviews

Semi-structured interviews were implemented between August and November 2012 with various key informants in the landscapes representing different actor types and interests. Interviews were individual and in some instances, they were also implemented in groups. For example, in the MFC, the community interviews were implemented with a large group of community members in each community (Organising community assemblies, which is common practice among Chiquitano indigenous communities).

In the Model Forest Chiquitano, 16 actors in the urban area of Concepcion were interviewed (3 independent, 2 cattle rangers, 5 civil society organizations and 6 public institutions). In addition, group interviews were conducted in 20 communities of the Zapoco river basin, with participation of about 200 people in total. In the Model Forest Jujuy, there were a total of 28 semi-structured interviews, 15 informants from public institutions, 9 private sector informants, including local media, and 1 informant from a public-private company. These interviews were complemented with 3 interviews to individuals from the rural areas. In the Model Forest Araucarias de Alto Malleco, interviews were conducted to 24 key informants in the communes of Lonquimay and Curacautin. Out of this total, 4 interviews were conducted by email to actors who lived in a different part of the country.

3.3 Validation workshops

Validation workshops were held in each Model Forest to create a space for dialogue and reflection. Local actors who participated in the interviews and network mapping were invited to attend these workshops. At these gatherings, local actors received feedback on preliminary results generated by the fieldwork. The general objectives of these workshops were to validate, share and enrich the knowledge generated during the first year of work, and to build interest and capacity for the next steps of the project. Validation workshops were implemented in November 2012 in all three MFs. Specific objectives of the workshops were to:

1. Provide feedback to local actors who participated in the project fieldwork (i.e. actors who took part in the interviews and in the participatory network mapping) on the information gathered
2. Validate the relevance, quality and usefulness of the information, enriched with comments and contributions from participants
3. Identify gaps in the information generated, or inconsistencies that need clarification, as well as additional information required
4. Learn and engage in line with the vision of the project
5. Identify agents of change able to lead the process of desired change in the MFs
6. Identify new perspectives to overcome barriers to adaptation planning in the landscapes building on existing capacities (i.e. possible entry points)

In the Model Forest Chiquitano, the validation workshop involved 20 people from rural communities and local public institutions. In general, the format of the workshop included presentations of preliminary results and group exercises. Due to space and time constrains, the MFC workshop did not manage to cover all the topics in depth, although they were able to further discuss problems around water resources from the point of view of different actors in the basin. In the Model Forest Jujuy, the workshop was held at the Tobacco Cooperative in the town of Perico. The workshop included two plenary sessions and group exercises in three working groups. Preliminary findings were presented on posters, which were used as input for group discussions. Out of 35 confirmed guests, 17 participants from the middle basin attended the workshop. In the Model Forest Araucarias de Alto Malleco, 45 people from the rural communities, public institutions and private sector attended the workshop. The workshop format included presentations of preliminary results and facilitated group discussion, both in working groups and during the plenary sessions. More detailed information on the validation workshops is presented in Deliverables 1.2 and 2.2.

3.4 Participant observation

Participant observation is the observation of the context from the perspective of the observer (i.e. the researcher), which is uncovered and unstructured (Sabourin 2012). Participant observation will be implemented throughout the project during gatherings and field learning activities. In the validation workshops, participant observation was implemented to systematically observe the behaviour and reaction of participants to the information that is being shared. It entailed observing attitudes, relationships and reactions. Although participant observation is a methodology that informs mainly the analysis of Deliverable 2.2 (i.e. Knowledge and Learning Processes), it is a method that enriches the socio-institutional context

analysis because it contributes to the validation of results. In each MF, one person or more who were not facilitating the validation workshop carried out the participant observation. Observers were trained prior to the workshops to take note on specific aspects. Participant observation will continue to be implemented in future project meetings, although the aspects to be observed may be modified according to needs.

3.5 Identification of strengths and barriers

Moser and Ekstrom (2010) developed a framework for identification of barriers to climate change adaptation. Although we do not strictly apply this framework, we use elements of it to identify conditions or factors that may hinder (i.e barriers) or enable (i.e. strengths) water resource adaptation planning in the MF landscapes. The purpose of this analysis is to systematize the identification of barriers and strengths that may hinder or facilitate the adaptation process, to inform the next phase of the project, which aims to develop context-tailored and long-lasting adaptation strategies. This analysis builds on the findings generated by the combination of methods described above.

Barriers are defined by Moser and Ekstrom (2010) as obstacles that can be overcome with concerted effort, creative management, change of thinking, prioritization, and related shifts in resources, land uses, institutions, etc. Important here is that a descriptive (i.e. positive or explanatory) approach is taken rather than a normative approach in which barriers are simply factual statements about impediments that can stop, delay, or divert the adaptation process. Strengths, on the other hand, are existing capacities in the landscapes that can help overcome these barriers and facilitate the adaptation process.

Similar to the framework developed by Moser and Ekstrom (2010), we relate to the process of adaptation as the foundation for identifying and organizing the barriers and strengths. We use the common phases of decision-making process, including understanding the problem (i.e. diagnosis), planning for water resources and adaptation strategies, and managing the implementation of the these strategies. Barriers may hinder progress from one stage to another or result in problems or unintended consequences later (ibid).

Moreover, barriers (and strengths) could be considered part of the current situation, and hence circumstantial and contemporary, or they can be structural, if for example a barrier is a legacy of past science-policy decisions or something that has taken long time to form such as a cultural barriers. According to Moser and Ekstrom (2010), structural barriers can only be overcome by addressing them at their source (e.g. through changes in regulation) and locally only with significant resources, time, and expertise. In contrast, a barrier that is both contemporary and proximate (e.g. the problem originates in the study site) may be easier to overcome as local actors may have more direct ways to address them. It will ultimately depend on the existing strengths in the landscapes.

Finally, based on the analysis of barriers and strengths to water resource adaptation processes in the landscapes, we identify possible entry points which build on existing strengths to overcome some of the barriers affecting adaptation planning. Entry points can be considered

first steps that provide guidance towards possible ways to start working on the transformation that EcoAdapt would like to promote in the MF landscapes. These entry points are inputs to Work Packages 3 and 4 where they could be further explored in the formulation of future scenarios and water-related adaptation strategies in collaboration with a range of actors in the landscapes.

3.6 Methodological limitations

This section points out some limitations regarding the methods implemented for the socio-institutional context analysis. Some of these points are important concerns raised by the MF teams, or lessons learned along the way that could improve the implementation of these methods in the future. Other points relate to unforeseen circumstances that have an effect on the results and require some adaptive management.

Some concerns around social network mapping identified prior to its implementation:

- Possible bias in building social networks from the point of view of the participants without including the entire population of actors in the basin. To deal with this, it is of great importance to engage representatives of the different types of actors in the territory, as well as to identify actors that do not participate in the mapping exercise to fill in potential gaps. Although results generated by participatory network mapping are subjective because of the nature of this method, the method can capture the view of different actor types and generate insightful discussions between participants.
- Sensitive issues may arise when discussing levels of influence in the networks and the flows between actors. Thus, facilitation and its perceived legitimacy are very important during the exercise, as well as a good understanding of the method and its purpose.
- There may be actors who dominate the discussion in the working groups and hence, impose their views on the rest of the participants in a way that may create bias in the results. Again, good facilitation is key to address these potential group dynamics.

Limitations identified after the implementation of social network mapping:

- Some working groups had limited participation and low attendance. In the MFC and the MFAAM, representation of the private sector was low, while in the MFJ this was the case with the public institutions. This posed a challenge as results captured the perspectives of only few actors representing a particular group and could generate a bias in the findings. Where possible, this was addressed with follow-up interviews to complement missing information. This also gives a hint about constrains we face in each site given the socio-institutional context.
- Network mapping does not always capture the local dynamics of politics in the study areas (e.g. culture of cronyism, hierarchies, clientelism, mismanagement of public funds, etc.). Although this applies to all three MFs, it is of particular importance for the MFJ given the current political dynamics affecting the governance structures.
- In the MFJ, it was revealed after the validation workshop that the representatives of the *Intendencia de los Diques* were not qualified representatives i.e. the participants were not legitimate representatives of the point of view of the organisation. Therefore, their inputs were considered with particular care in the analysis.

- In the case of MFJ and MFAAM, adaptations to the social network mapping method were discussed and co-constructed between scientists and MF teams via Skype meetings and email exchange. This process was time consuming and was challenged by distance and in some instances technical barriers. A better way to facilitate this process would have been face-to-face interaction. This would have probably resulted in more ownership of the method, more effective and efficient ways of exchanging knowledge and facilitating learning, and better local capacity to implement the method. Such results were observed in the case of the MFC, where face-to-face interaction was possible prior to and during method implementation, as scientists and the local MF team facilitated the social network mapping workshop together.

Limitations in relation to semi-structured interviews:

- The main limiting factor was time availability of key informants in certain institutions and time required to travel to distant communities, which in some instances required reducing the number of questions asked.
- In the MFJ, timing for fieldwork was not the most appropriate for some of the actors due to the production calendar (e.g. tobacco producers) and political issues (e.g. public institutions).

Limitations to the validation workshop include:

- Data presented for the validation could have been based on a more in-depth analysis to avoid misunderstanding or bias. This was constrained by lack of time for analysis between completion of fieldwork activities and the workshops.
- The workshop environment in the MFC was not appropriate for a full day of work and not necessarily conducive to group work. This resulted in a last-minute decision to shorten the workshop, which affected its implementation and did not allow full coverage of all topics.
- Low participation of some actors (i.e. the private sector in the MFC, and the public sector in the MFJ) to some extent compromised the validation of the information shared. To address this and also to start a feedback process in the landscapes, actors were engaged after the workshop in separate meetings and at community assemblies.
- In general, but particularly in the MFJ and MFC, there is low motivation among participants when workshops or meetings are held without any follow-up with concrete actions. Workshops tend to generate expectations among the participants and fatigue if no concrete actions are envisaged. Different modes of interaction need to account for these expectations and create incentives for actors to participate.

Finally, some limitations related to the participant observation method are:

- The MF team workload restricted the implementation of this method, as there were not enough people to fulfil all the roles required to facilitate a workshop and conduct participant observation at the same time.
- In most cases, only one or two persons from each Model Forest could be trained in participant observation limiting the capacity of implementing the method in future project activities.

4. Water resources in the landscapes

Understanding how local population and key actors perceive the current situation of water resources in the landscapes helps to gain i) a broad perspective on the drivers affecting these resources and potential future problems that may arise if current trends continue into the future, and ii) a deep understanding of what are main issues that local population perceive and is interested in addressing. This also helps contextualize the analysis of barriers and strengths to water resources adaptation processes, and of possible entry points that could be explored to improve the management of water resources to prevent possible future problems. Moreover, current trends help gain basic understanding of the interplay between humans and water resources in the context of their environments (complementing the work in Task 2.5). This section has been developed based on interview insights gained from multiple informants in the Model Forests (MFs) over 2012 and is the basis for the analysis in the next sections.

4.1 Current situation

Although each territory is one of its own, there are commonalities between the three Model Forests around current drivers affecting their water resources. To varying extent, increasing competition for water resources is already posing a challenge in terms of availability of good quality water in all three landscapes. The demand side of this challenge is represented by a growing population and development practices that are altering land use patterns, degrading the natural resource base and as a result changing the composition of the landscape. The supply side of this challenge relates either to biophysical factors such changes in water flows due to decreased precipitation, diversions or sedimentation processes, or to social factors such as regulatory frameworks that lead to an uneven access to water resources, or water contamination caused by anthropogenic activities. In all cases, feedbacks between these processes exist and will be further exacerbated in the future if these drivers continue building and converging and are joined by new ones such as changes in the climate regime.

Model Forest Jujuy

The main problems affecting water resources in the Model Forest Jujuy (MFJ) can be divided into dynamics in the upper basin and dynamics in the middle and lower basin. These dynamics interact generating problems of water availability and quality, which the MFJ is currently facing.

In the upper basin, the core problem is about unsustainable land management. Deforestation and lack of appropriate soil conservation practices in this area have led to high levels of erosion and seasonal landslides in the central part of the basin, which have altered hydrological regimes in the mountain ecosystems. As a result, valleys in the central and lower basin are affected with high levels of sedimentation, transformation of river flows, and floods, which in turn have negative economic and social impacts.

In addition to problems that originate in the upper basin, water resources in the MFJ are affected by dynamics in the middle and lower basin, particularly around the 'Area of the Diques and Perilagos' (ADP), which encompasses the main water dam and its surroundings. The ADP

was declared Protected Area under Provincial Law 5.378 (Ley de Los Diques) in 2003 and it is subjected to the management and leadership of the *Intendencia de los Diques* (ID) created that same year. Currently, the ADP is undergoing fast processes of change, which have resulted in the pollution of the water dams, tensions around access to its water, and concerns about water storage capacities in the long term.

Local actors in the MFJ perceive that several factors contribute to the local dynamics that affect water resources in the ADP. First, local inhabitants living in the surroundings of the area lack a proper waste management system. As a result, they dispose domestic waste in water streams and the water dam. The situation is aggravated by a lack of waste-water treatment in the area, further contributing to the contamination of water in the water dams. A result of this pollution is the proliferation of bacteria and other pathogens in the water, causing illness among the population that consumes it. In addition to local inhabitants, tourists and weekend visitors also contribute to the contamination of water by disposing garbage in the surrounding area.

Second, the ADP is affected by overgrazing. This unsustainable activity has led to deterioration of vegetation around the water dams, exacerbating erosion processes and facilitating runoff of faecal waste from cattle. Over time, overgrazing has resulted in the eutrophication of the water dam and proliferation of algae. This has in turn affected the aquatic fauna in the water dams increasing fish mortality rates and distressing fishermen that depend on this fauna. In addition, overfishing is further destroying the trophic equilibrium of ecological dynamics in the water dams.

Third, deforestation processes are affecting the landscape, as well as geochemical and hydrological dynamics around the water dams. Local actors notice a significant change in land cover over the years, particularly around Los Naranjos and Las Lanzas. Deforestation has not only had a negative effect on the local biodiversity of the area, but has also contributed indirectly to the biological and chemical contamination of the water dams.

Finally, other factor contributing to the dynamics influencing water resources in the middle and lower basin are the tensions around water access and management. On the one hand, there is an increase of water demand by the tobacco and sugar cane producers for irrigation purposes. On the other hand, population growth in the area has increased the demand of water for domestic consumption. This competition for water resources is further accrued by the sedimentation of the water dams, which implies loss of storage capacity and a decrease in water availability in the mid to long term.

Model Forest Araucarias de Alto Malleco

Different water sources in the Model Forest Araucarias de Alto Malleco (MFAAM) contribute to the human and economic development in the territory. Domestic water in the main towns of Lonquimay and Curacautin come mainly from water springs. Although there is a lack of consumption monitoring, water authorities estimate an average consumption of 120 litres/day in urban settlements. More than half of the population in both communes of Lonquimay and

Curacautin had access to drinking water through the public network in 2009, but this mainly represents the urban sector (Casen survey 2009). In the rural area, the main sources of water are rivers, wells, and estuaries. In general, the population in the MFAAM indicate that water quality is good. In the urban area, this is particularly the case after the establishment of water treatments plants in recent years.

In the urban area, drinking water is managed by the private company Aguas Araucania, who are responsible for water capture, storage, treatment, quality control and distribution. Aguas Araucania have to coordinate with the Direccion General de Aguas (DGA) for monitoring water quality and quantity using meteorological stations and flowmeters distributed across the main rivers of the Bio Bio and Cautin river basins. In the rural sector, drinking water in local communities is managed through projects of Agua Potable Rural (APR), which oversee the capture, treatment, distribution and regularization of water. These projects are managed by local APR committees formed by inhabitants of the rural communities, who are responsible of the local distribution network. In many cases, local communities lack legal rights for water use, and hence water consumption is not regularized. Critical cases facing lack of regularization and distribution networks are rural communities with dispersed populations.

In addition to drinking water, rural communities have access to irrigation channels, which are managed by local associations that are not always formally constituted. This has led to some conflicts between local actors over time and a general lack of maintenance of such irrigation channels, which in most cases are very old (e.g. obsolete designs of more than 20 years ago). Building irrigation channels is also common practice among private actors involved in the agribusiness sector. Both the rural communities and the private sector have been benefited by the introduction of new forage and pasture crops and technical improvements in irrigation systems during the 1990s, which were feasible through the support of public institutions and investments from the State aimed at enhancing forage production in the territory.

In the MFAAM, water uses relate to the local reality of the multiple actors in the territory and can be classified into extractive uses (i.e. consumptive uses) and non extractive uses (i.e. non consumptive). Consumptive uses correspond to those that consume water and involve for instance domestic consumption and uses such as irrigation of agricultural fields and water consumption by cattle. Non consumptive uses do not require the consumption of water, because the resource is returned back to the environment after being used temporarily. Some non extractive water uses in the territory are generation of hydroelectric energy, acuaculture, and tourism activities linked to water such as fishing or water sports.

Local actors in the MFAAM perceive that there are currently several factors affecting the water resources in the landscape. One of the main factors is the existing legal framework, which over time has contributed to a situation of legal water scarcity in the territory. Water resources in the territory and in Chile in general, are legally regulated by the new *Codigo de Aguas*, which came into force in 1981. This legal framework promotes the privatization of water resources, transforming water into a tradable good. This has direct consequences on water use and more specifically on freedom and justice associated to water usage, because the legal framework

tends to benefit those who can afford buying water rights and have resources to access relevant legal information. As a result, in the MFAAM water rights for consumptive use are currently unavailable (i.e. all rights have been given away), and it is only possible to acquire rights for non-consumptive use. In general, the latter are acquired by a small hand of private enterprises. As an alternative path to access water resources, rural communities can send a request for water regulation if they can demonstrate historical use of water prior to 1976.

Linked to the dynamics above, another important driver affecting water resources in the territory is the establishment of hydroelectric plants in the Bio Bio river basin. This development was encouraged on the one hand by population and industrial growth in the area, which generated an increase in energy demand, and on the other hand by legal aspects that promote water use among the sectors that have accumulated or have the resources to start acquiring the rights to use it. Thus, this process is in a way supported by the current regulation, which prioritises water use for energy generation and irrigation (non consumptive use) over water for human consumption (consumptive use).

An additional factor that represents a threat to water resources in the MF is deforestation and unsustainable land use practices (i.e. overgrazing). Both processes can have a negative impact on the hydrological cycle in the basins over the long term and hence negative consequences in terms of water quantity and quality. Rural communities already perceive effects of land use change and deforestation, such as a decrease of non timber forest products (NTFPs), alterations in flowering patterns with negative effects on production (e.g. Araucarian pinones), and presence of new invasive species and plagues. Side to side with these processes is the introduction of new forest plantations using species such as eucalyptus and pine, which pose an additional burden on water resources.

Next to the land use change, climatic variability adds to the current stress of water resources. Local actors have already noticed diminishing water quantity due to a decrease of water volume in the sources (e.g. river flows) in periods of intense frost or during the summer. An overall decrease in precipitation has been observed, as well as an increase in temperature particularly during the winter season. The latter could also represent an opportunity to agriculture in the territory with a potential increase of water demand for irrigation in the future. Extreme events are also observed, particularly intense snowstorms over the past years locally called “white earthquakes”.

Model Forest Chiquitano

Sources of water in the Model Forest Chiquitano (MFC) are diverse and include rivers, groundwater (wells), micro dams, water streams, and water springs in the rural area. In the urban area, water sources are the Zapoco water dam integrated with a public distribution system and private wells. All rural communities in the pilot area of the MFC have free access to water, except for those who are connected to the public distribution system and have to pay for drinking water. Most rural infrastructure established to access drinking water, such as tanks, well, water pumps and micro dams, were partially donated and built by the Vicariate (Catholic

Church). Non-governmental organisations such as Plan International and the *Fundacion para la Conservacion del Bosque Seco Chiquitano* (FCBC) also contributed to the establishment and maintenance of some infrastructure, working together with the Local Municipality or the Departmental Government.

While access to water does not seem to be a problem for most rural communities, water quality and infrastructure maintenance proves to be a challenge. Some water pumps are abandoned due to poor functioning and resources are scarce to acquire new ones. Among the communities, only San Andres and Limoncito have Water Committees, which are local associations responsible for the management of the water infrastructure an distribution system in the village. These committees are formed by individuals from the communities and have formal statutes and regulations. Decisions around further development of infrastructure, management of micro dams, and internal regulations and penalties in relation to water resource use in the communities are taken in community assemblies.

In the town of Concepcion, the water dam and public water network is managed by the Water Cooperative (COSEPCO). Almost all neighbourhoods in the town are covered by the distribution system, although some are still missing and they source their water from private wells. The Cooperative started functioning informally in 1973, working first with a well located in San Antonio. In 1977, COSEPCO was officially founded and the water dam, which currently constitutes the main water source in Concepcion, was built between 1987 and 1988. In 1990 an additional well was constructed together with the first public network. At the beginning, inhabitants of Concepcion disapproved the water quality of the public system. This has improved over time, particularly with the establishment of a treatment plant in 2001 and the construction of a new distribution system. In tandem with these improvements, the tariff system has ameliorated, which is now based on the amount of water consumed measured by water meters installed in each household. The water system will continue improving in Concepcion, as a new project to build the sewer system started in 2013 and betterments to the current water treatment plant are envisaged for the short term. Improvements to the treatment plant, which is currently incomplete, and the extension of the public network are two strong demands among the local population, who are still concerned about the current drinking water quality. When water supply does not cope with demand in some neighbourhoods of or communities near to Concepcion, local inhabitants draw upon private wells that they have build in their properties.

Local actors in the Zapoco river basin perceive that several drivers are affecting water resources in the basin. The problems in the rural area are different from the problems in the urban area. In the rural area, land use patterns such as the expansion of pastures for cattle over forests and unsustainable logging are influencing the hydrological cycle and resulting in high erosion and sedimentation levels in riverbanks and the water dam. In addition, the growing number of cattle increases water demand, which in turn results in the establishment of a larger number of micro dams in the farms across the basin, particularly in the upper and middle part of the basin affecting water flows that contribute to the water dam in Concepcion. In the lower basin, mining activities and sawmills are negatively impacting water quality of rivers, which are used

as water sources for communities located in that area like Rio Blanco. Negative impacts are particularly felt by rural communities during the dry period, when water levels decrease and some water sources dry out. Competition for water resources is particularly acute over this season, and all sectors in the rural area (i.e. cattle rangers, rural communities, mining and forestry) are affected.

In the urban area, activities in the surroundings of the water dam have a direct impact on the water quality. This includes cattle ranching activities, clothes and car washing, tourist activities such as fishing and water sports, and disposal of waste and waste water. Sedimentation is another problem, as already mentioned above. Although the area surrounding the dam has been declared Municipal Protected Area in 2009, these activities are not controlled and are currently contaminating the water and posing a burden on the water dam storage capacity in the long term. Pollution in the dam accumulates particularly in its discharge zone, which is also where the outlet pipe that takes water to the water treatment plant is located. As a result, pollution of the water dam has a direct effect on the drinking water of the population in Concepcion, adding to the flaws of the current water treatment system.

4.2 Potential problems in the future

At present there are several factors affecting the water resources in the landscapes of the MFs, both in terms of water quantity and quality. However, this current situation is not yet perceived as critical by most of the local actors, who are generally aware of the problems but have not translated their concerns into practical actions to improve the management of water resources.

Although the situation of water resources in the MFs is not currently critical, existing biophysical and social drivers may continue and converge resulting in possible social tensions around access to water for domestic consumption and productive activities in the future. Current problems of water contamination due to a lack of environmental awareness (e.g. inhabitants disposing domestic waste in water streams), insufficient treatment facilities (e.g. waste water leaking into water dams), and unsustainable land use practices (e.g. deforestation, overgrazing, lack of soil conservation practices) combine with socio-institutional and political dynamics (e.g. population growth, lack of inter-institutional coordination, legal water scarcity, poor water use prioritisation) around water use and management that in the long-term may create a more acute problem of water availability and unequal distribution.

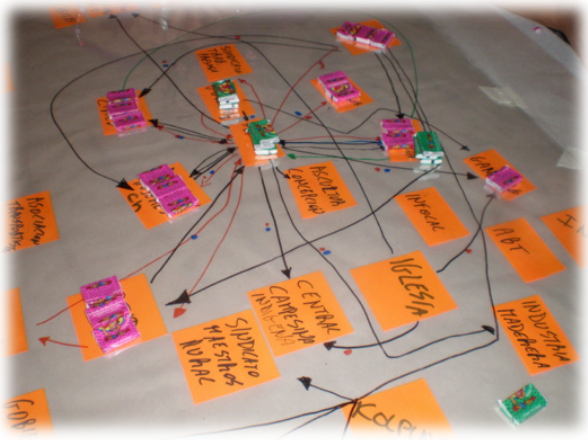
The future of water resources in the landscapes will be further aggravated by changes in climate, which may affect natural hydro meteorological cycles in the basins. With this in mind, it can be expected that the future situation of water resources in the landscapes will become critical with potentially serious social and ecological consequences if strategies are not envisaged and put in place to prevent them.

5. Socio-Institutional Networks for Water Governance across the three Model Forests

Social network mapping and interviews help gain an understanding of the relationships between actors in the landscape that are directly or indirectly influencing water resources. Mapping these relationships allows the identification of network structures that give us an idea of how different actors exchange information and knowledge around water resources and how they collaborate for the governance of these resources across different spatial scales. Networks also help us identify actors that are key for water governance, either because they i) play a central role in the networks, i.e. they have high degree centrality, or many connections to other actors, ii) are influential in the networks, i.e. they have high formal or informal influence in the decision making process around water resources, or iii) are important bridges between different scales or actor types with differing interests, i.e. they have high betweenness centrality (see section 3.1).

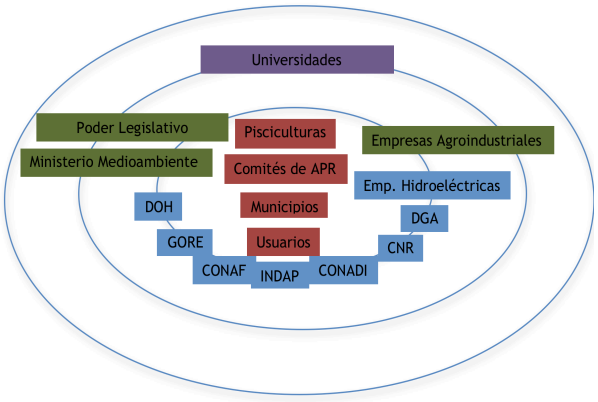
In the Model Forests, social networks were mapped from different perspectives using a participatory approach. This resulted in a series of network maps that informed the analysis of relationships and identification of key actors explained above (see Figure 5-1 for examples). The first set of networks captures information flows between different actors in the landscapes. The different types of information flows were chosen by the Model Forest teams. The second set of networks maps the interaction between actors in relation to water resources planning and management. Both help understand how actors collaborate in the territory and what could be strategic entry points to consider when developing adaptation strategies for water resources.

For example, identifying key influential or well-connected actors could show us which actors are key to reach to access information or which actors should be considered important because of their influence on decision making concerning water resources. As another example, weak relationships in the network could show us strategic ties to strengthen if collaboration between actors is to be improved for a more inclusive and integrated management of water resources. Closely linked to this is the identification of 'agents of change'. The analysis presented in the following sections synthesises results from the network mapping workshops conducted in all three landscapes integrated with insights from follow-up interviews. Actors engaged in the network mapping appreciated the discussions around the networks and the visualisation of results presented at the validation workshops.

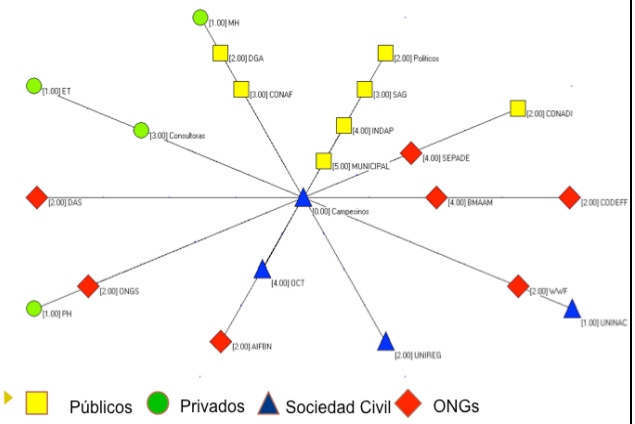


Network map showing different information flows (arrows) and influence levels (coloured blocks for formal and informal influence), working group of the private sector in the MFC.

Working group representing rural communities and grassroot organisations in the MFC is mapping the information network considering different actors and information types (i.e. flows).

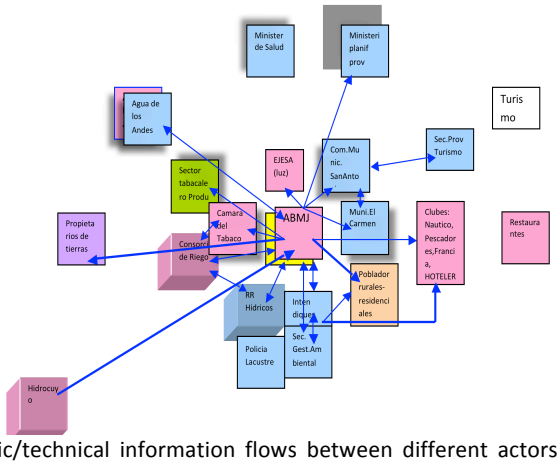


Spatial coverage by different actors in the MFAAM, working group is representing entrepreneurs from the private sector. The inner circle represents the communes of Lonquimay and Curacautin, the middle circle represents the Araucania region, and the outer circle represents the national territory, i.e. Chile.



Distance (closeness) between actors in the MFAAM showing intensity of interaction between the actors in the network and the central actor. In this particular case, the central actor is represented by the rural communities (i.e. farmers and indigenous people) and local NGOs in the MFAAM.

Identification of relevant actors to the water resources in the MFJ, working group is representing the MFJ board.



Scientific/technical information flows between different actors of the MFJ mapped in the information network, working group is representing the Model Forest board.

Figure 5-1: Participatory network mapping, different working groups in the Model Forests

5.1 Information and knowledge networks

Information networks in the MFs are mapped from the point of view of public institutions, local communities and representatives of the private sector. Relations in these networks are directed, which means they have a directional flow in which information is transmitted in the network. As a result, there are actors in the network that can be considered information 'banks', i.e. they receive information flows from many actors, and information 'sources', i.e. they provide or disseminate information to many actors in the network. Information flows in the networks include technical/ scientific information, local knowledge on the management of water resources in the landscapes, and information related to project/ system operation and monitoring that are relevant to water resources. The Model Forest teams selected the different types of information flows mapped in the networks according to what is relevant in the landscapes. In some instances, information networks also help identify actors that are isolated and lack access to information or channels to transmit information. Information exchange is represented by bidirectional relationships in the network.

In general, actors that participated in the network mapping and interviews perceive an overall lack of environmental awareness in the landscapes. In many instances, this is due to a lack of information on topics related to water resources use, management and protection, or absence of appropriate channels to access this information in formats that are relevant to the user. Information about climate change is also considered sporadic and different actors in the landscapes had different ideas about climate change and variability. In most instances, actors could relate to current problems of resource degradation and increased competition for water resources from different sectors, based on personal observation and experience. In this context, local actors perceive that it is difficult to discern the consequences of climatic changes from non-climatic changes affecting the landscape. It was also difficult for them to make a distinction between the effects of natural variability or disturbance and anthropogenic disturbances affecting their landscapes.

Across the three Model Forests, local authorities are generally considered information 'sources', as they are recognised as important providers of technical, operative and planning information for water resources in the landscapes. In MFC this was particularly the case for the Municipal Government in the urban area and the *Autoridad de Fiscalizacion y Control Social de Bosque y Tierra* (ABT) in the rural area, who play an important role in the regulation of water resources in the basin. In the case of the MFAAM, this is also the case for the Municipal authorities and for other public entities such as the *Direccion General de Agua* (DGA), and the *Direccion de Obras Hidraulicas* (DOH). Although all three MFs recognise public entities as important information providers, it is insightful that local informants from all three MFs also stated in the interviews and workshops that the format of this information had to be adapted for it to be effectively processed and used by the different actors in the landscapes.

In addition to local authorities, other public entities, research institutes and actors of the civil society were identified as important information 'sources' in the landscapes and were recognized a key players in building capacity and providing technical advice in relation to water resources planning and management. In the MFJ, these actors were the National University of

Jujuy and the *Instituto Nacional Tecnologico Agropecuario* (INTA), as well as the local hospital and schools. The last one was recognised for its role in generating environmental awareness among the younger generations. In the MFC, actors identified the *Central Indigena Chiquitana* (CICC), the Vicariate (Catholic Church), the Water Cooperative COSEPCO (although to lesser extent) and NGOs such as Plan International and the FCBC as important entities that facilitate knowledge transfer in the rural communities, build capacity in relation to access and maintenance of water sources, and provide technical advice for land planning and local development in the territory (e.g. development of the Municipal land use plan – *Plan de Ordenamiento Territorial* or PMOT – with support from the FCBC). Interestingly, local research institutes such as universities, or the *Centro de Investigacion and Agricultural Tropical* (CIAT) or *Instituto de Formacion y Capacitacion Laboral* (INFOCAL) were not identified in the MFC as important 'sources' of information, in fact, they show few connections to the rest of the network, denoting a high degree of isolation or lack of presence in the territory.

On the other side of the spectrum, important information 'banks' were also identified in all three MFs. These included the local Municipalities and Provincial Governments for all MFs, but also the local population, COSEPCO, the Vicariate and the *Asociacion de Ganaderos* (AGACON) in the case of MFC; and the *Consorcio de Riego del Valle de Los Pericos* (CRVP) and the *Intendencia de los Diques* (ID) in the MFJ. Information 'banks' could be considered as actors with high credibility in the territory for the amount of information they accumulate. In some instances, information flows received by these actors relate to legal provisions that require specific information to be sent to a public entity. For instance, in the MFAAM, entrepreneurs have to send information to the Ministry of the Environment (MMA) to fulfil environmental evaluations required by Law. In other instances, however, information is sent to an actor because they are considered a main channel of information and legitimate representatives of sectorial interests in the territory. For instance, in the MFJ different actors consider the CRVP, which is a private institution, as a credible actor that has influence on water planning in the landscape, and has legitimacy among producers (80% of them tobacco producers) to oversee (monitor and operationalize) the water distribution for irrigation in the middle basin.

In all instances, the Municipal Governments were identified as both information 'sources' and 'banks'. Such a role was also particular to the MF platforms in the MFJ and the MFAAM. In both instances, but especially in Chile, actors in the landscapes identified the MFs as a legitimate entity that represents multiple interests and sectors, and provides technical information to inform decision-making and build capacity. In the case of the MFC this is still not the case, probably because the presence of the MFC platform in this territory is still relatively new and unknown and has not been recognised by most of the actors in the network.

Arguably, actors that seem to show high credibility and legitimacy as information banks and sources in the network can also lose it over time. For instance, this has been the case of the *Intendencia de los Diques* in Jujuy, which stopped generating monitoring and operational information on the water dams and collaborating with other actors in the network after a politically-driven change of personnel in 2012. This also shows how political dynamics and other

social processes can influence the relationships between actors, and hence change network structures and institutional stability over time.

Finally, some actors that are isolated in the networks or lack flows to other actors are also important to consider, as they may be potential sources of information that could be interesting to connect to in the future. For instance, in the MFC we already mentioned the universities and research institutes as potential information providers that are currently isolated, but there are other actors such as the *Instituto Nacional de Reforma Agraria* (INRA), the cattle rangers, forestry and mining sectors. Although the INRA plays a key role in Bolivia in the land distribution process, it does not seem to have any information links to actors in the network, probably catching a glimpse of a latent conflict between this national-level actor and local-level actors in relation to land planning (i.e. the INRA does not recognize the PMOT and Municipal protected areas such as the Municipal Reserve Copaibo in the land distribution process causing conflicts around land use and rights in the territory). Moreover, despite cattle rangers, forestry and mining play a major role in the local economy of this territory, actors participating in the network mapping did not know much about these sectors or the information they share with other actors in the network, except that they have to send legally required information to local authorities for the functioning of their enterprises. Poor links with the private sector may require strengthening if an integrated and inclusive approach is to be achieved in the management of water resources at the basin-level. In the MFJ, some actors that are isolated in the information network but could be potential sources or channels of information are the local media (e.g. environmental journalists), *Agua de los Andes* (a private-public enterprise in charge of treating the drinking water in Jujuy), and *Hidrocuyo* (a private enterprise in charge of hydroelectricity generation). The former could play an important role in the generation of environmental awareness in the territory, while the latter could potentially provide relevant information for water resources monitoring and planning.

5.2 Planning and management networks

Water resource planning and management networks depicted in the workshops include all actors that relate to (i.e. are relevant to) water resources in the landscapes, either directly because they use it for domestic consumption or productive activities, or indirectly because they are involved at some stage in the decision-making process and management operations of water resources in the urban or rural areas. Actors in these networks operate at different spatial scales, namely at the national, regional, or local level, and interact with each other through formal or informal relations due to differing interests. Different from the information networks above, relationships in these networks are assumed to be bi-directional, which means that the links between actors are two-way or that actors share a relationship (although the flows that these relationships represent may not be reciprocal, in equal quality or amount). As mentioned before, planning and management networks were mapped from different perspectives in each Model Forest, to gain an overall understanding of the landscape of actors and their relationships to water resources in the landscapes.

In general, across the three MFs there is a shared confusion or lack of clarity about the actors that should be coordinating the management of water resource at the basin-level. Mandates of public institutions are at times over-lapping or contradictory, and not all actors are aware of the role or functions that public institutions play. For instance, in the interviews conducted in the MFC, informants recognise that they know less about public entities operating at the national level than about authorities that operate at the local level. However, in many instances national-led operations have priority over local plans (although this may change with the process of Municipal Autonomy in the coming years, see *Municipal Cartas Organicas* section 6). Another example is the *Intendencia de los Diques* in the MFJ, which is legally responsible for the water dams and surrounding area. However, the leader of this organisation argues that management of water resources is competence of the *Direccion Provincial de Recursos Hidricos* and the *Consorcio de Riego*, conveying the confusion generated by overlapping mandates.

Nevertheless, in most MF networks, actors identify the public institutions as key actors for the management and planning of water resources in their landscapes. Public institutions that play a central role in the network due to the high number of connections to other actors are: in the MFAAM, the Municipal authorities, the Ministry of Environment, INDAP, DGA, and CONAF; in the MFJ, the Provincial Government, Municipal Government of El Carmen, *Recursos Hidricos*, and the *Intendencia de los Diques*; and in the MFC, the Municipal Government, ABT, the Provincial Government, and INRA.

To varying extents, all these public entities have the legal mandate to oversee and support the management of natural resources and development processes in the landscapes (see Annex 1). An indication of this is that most of the public entities identified as central nodes in the networks are also perceived to have a high level of formal influence in the decision-making process related to water resources (see Figure 5-2). However, it is important to highlight that this is not always the case. For instance, when actors lose legitimacy in the territory, influence in the decision-making process can be perceived as low despite its legal mandate, as in the case of the *Intendencia de Diques* in the MFJ. In the context of the MFJ, it is also worth highlighting that formal influence can be superseded by informal forms of influence (i.e. personal connections, clientelism, economic power, high visibility or levels of public exposure, etc). Thus, while institutions may have formalised influence (due to legal mandates) in managing water resources in the landscape, in reality, actions may be more motivated by political, economical or inter-personal factors that influence the decision space in informal ways.

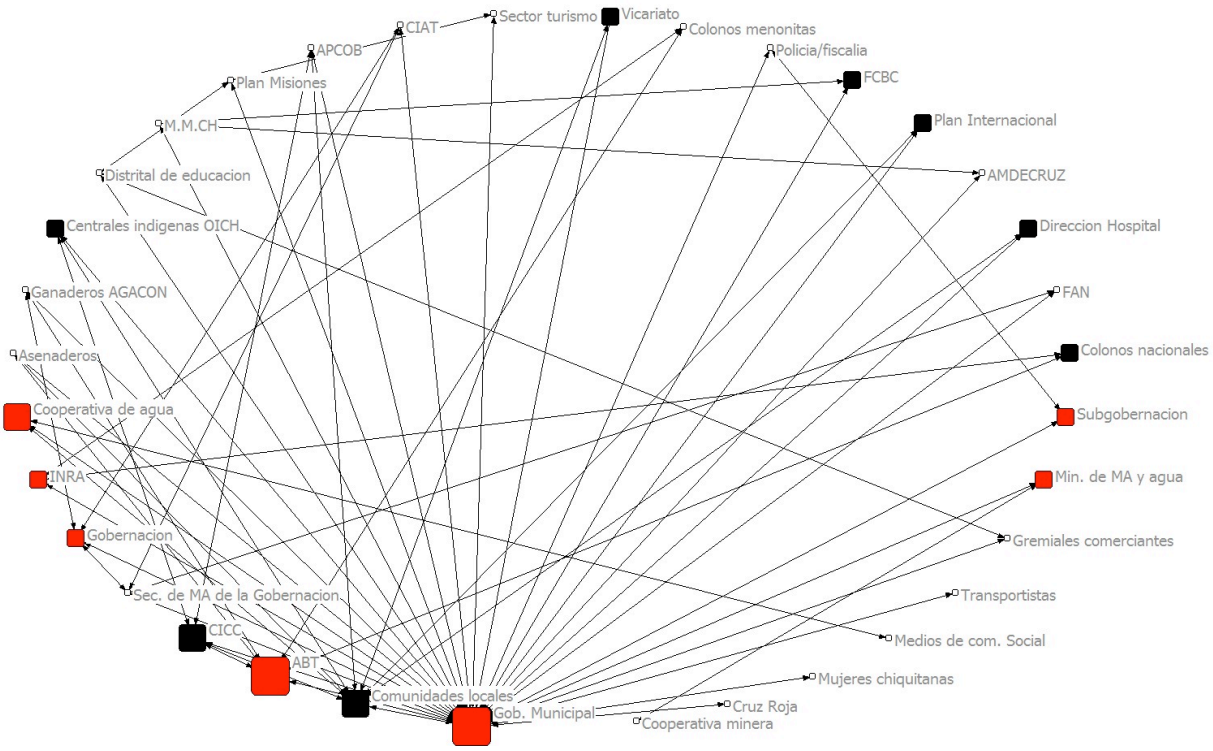


Figure 5-2: Interaction and influence, from the perspective of public institutions in the MFC Actor colour is related to influence type: formal influence (red), informal influence (black). Actor size relates to perceived level of influence: large size denotes high influence.

In most of the networks analysed, public entities were not the only type of actor showing a central role in the governance of water resources. Other actors with high numbers of connections are representatives of the civil society such as the Model Forest platforms in the case of MFJ and MFAAM (see Figure 5-3), local inhabitants, restaurants and clubs in the surrounding of the water dams in the MFJ, representatives of the local population like CICC, rural communities and the *Comite Civico* in the MFC, and famers and agricultural entrepreneurs in the MFAAM (see Figure 5-3). This is important to bear in mind, as during the validation workshops many actors highlighted that civil society needs to be included in the governance of water resources as they are the direct users/beneficiaries of the resource, and hence also the affected parties if management is lacking. However, these actors identified themselves as having low influence or advocacy in the decision-making, with exception of rural communities in the MFC where formal channels exist for local participation in the planning process. Endorsed by decentralised planning and popular participation laws, rural communities in the MFC gather in annual general assemblies with their representatives to propose consensus-based annual operative plans (POAs) to the Municipal Government. Once approved, rural communities implement the activities included in the action plans with financial resources from the Municipality.

In addition, some NGOs also seem to play an important role in the water resource planning and management networks. For instance, in the MFAAM, actors identified SEPADE, WWF and other NGOs as actors that are influential, despite a low number of connections to other actors in the network. A similar situation relates to the FCBC, Plan International and the Vicariate in the MFC (although the latter is not necessarily an NGO, it acted like one for many years in the landscape). In all cases, NGOs were assigned medium to high levels of informal influence. This points to the importance of building on previous or on-going capacity building processes generated by these organisations in the landscapes as a way to create synergies and improve capacities and collaboration in water resources management.

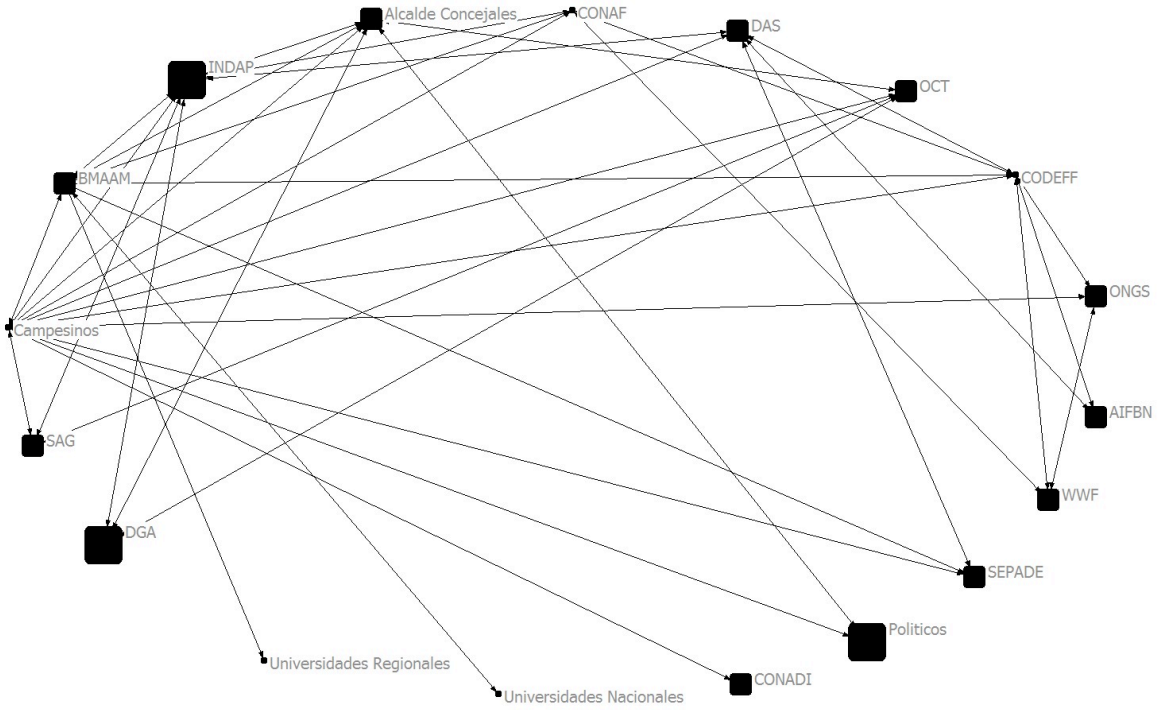


Figure 5-3: Interaction and influence, from the perspective of rural communities in the MFAAM Actor size relates to perceived level of influence: large size denotes high influence.

Although most representatives of the civil society sectors are mapped in the networks, not all are depicted as well connected. Generally, the private sector shows fewer connections to other actors in all three landscapes, in most instances linking to entities they are legally expected to respond to. This resonates somewhat with their level of participation in validation workshops, which was low in most of the cases, particularly in the MFC.

In certain instances, the private sector is identified as having high level of informal influence in the decision-making process. This is the case of *Hidrocuyo*, the *Consorcio de Riego* and the *Camara de Tabaco* in the MFJ (see Figure 5-4), hydroelectric plants and agriculture and forestry enterprises in the MFAAM, and AGACON and the *Camara Hotelera* in the MFC. Some of these actors have high legitimacy in the landscapes, such as the *Consorcio de Riego* which has been overseeing water distribution for irrigation among producers very effectively. Links to highly

influential actors of the private sector may need to be strategically strengthened if the water resources adaptation planning process is to be inclusive of different influential views and interests in the territory. However, this needs to address contradictory views and tensions due to competitive uses of water resources, such as current tensions between *Hidrocuyo* which uses water for energy generation and the *Consorcio de Riego* which prioritises water for irrigation in the Model Forest Jujuy.

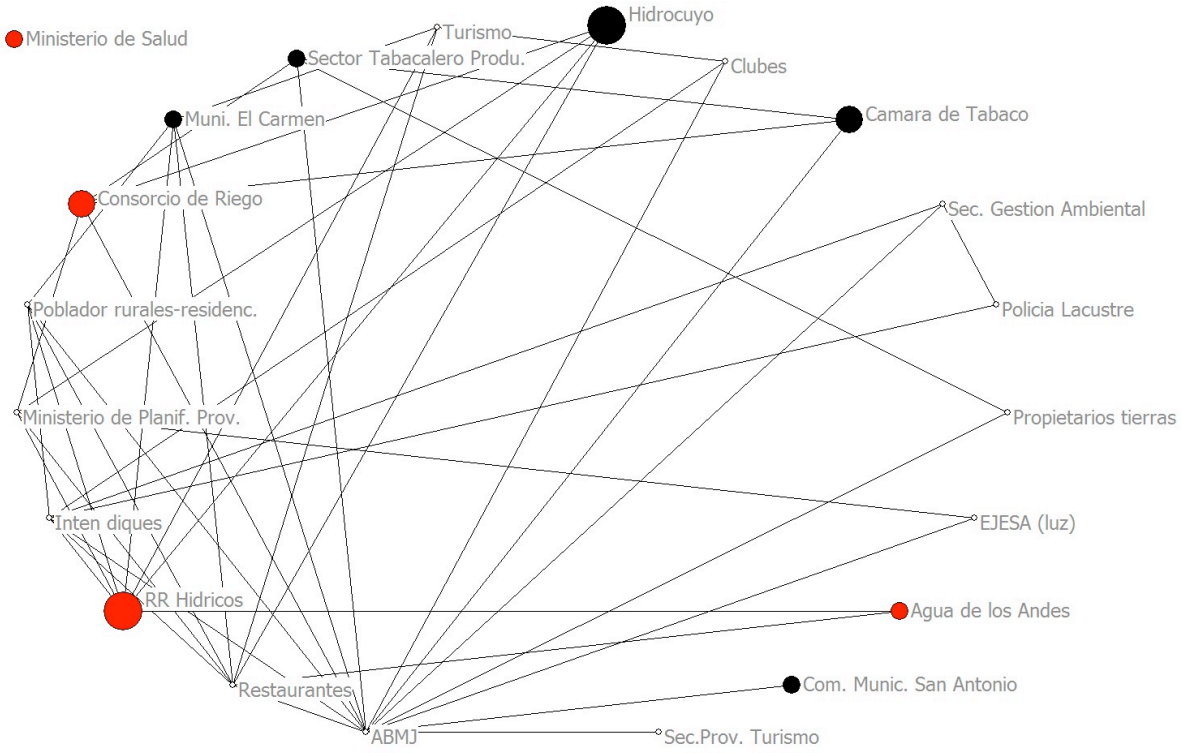


Figure 5-4: Interaction and influence, from the perspective of actors in the MFJ board
Actor colour is related to influence type: formal influence (red), informal influence (black). Actor size relates to perceived level of influence: large size denotes high influence.

Finally, it is important to highlight the role of some actors as bridges in water governance networks in the different landscapes. In the MFC, the Municipal Government plays a particular role as a bridge between different types of actors – those with different perspectives and interests, and those at different spatial scales (see Figure 5-5). This is partly due to the decentralisation process in Bolivia, where an important part of local development planning takes place the Municipal level. The local rural communities also have access to national actors and funds through different bridging organisations, such as the CICC and the *Organizacion Indigena Chiquitana* (OICH). This is particularly relevant in the current political context with a National State that pays particular attention to demands of indigenous communities and 'colonos' (i.e. in-migrants to the eastern lowlands from poor western highland and central regions of the country). Some NGOs also seem to access rural communities through the Municipal Government, increasing its legitimacy as an important bridge. It is also a bridge to the

private sector, which is not linked to other actors, such as the cluster of NGOs or the local communities. The bridging role of the Municipal Government could be an entry point to reach to and incentivise the participation of the private sector if multi-actor dialogue is to be considered in the water resources adaptation planning process.

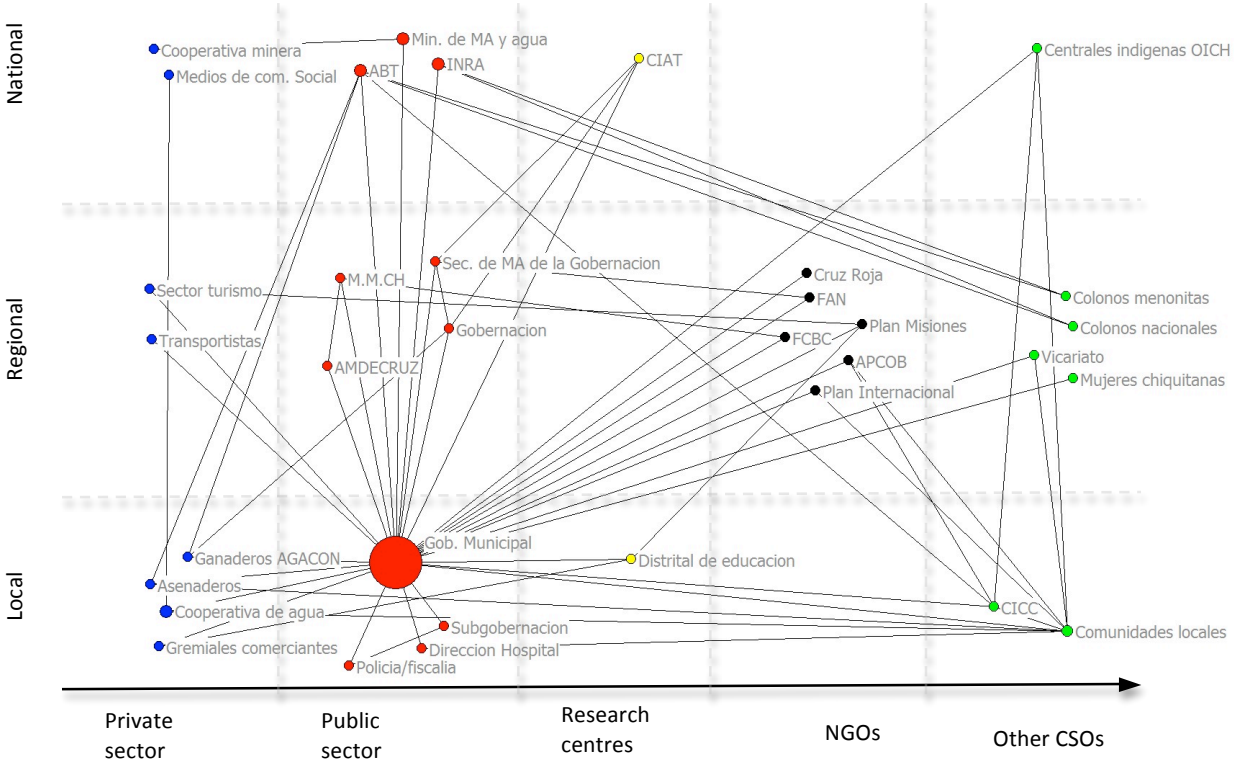


Figure 5-5: Interaction and scales, from the perspective from public institutions in the MFC
On the x-axis, actors are categorized by actor type (and by colour). On the y-axis, actors are categorized by their territorial coverage: local level is the Zapoco river basin, regional level is the Chiquitania region, national level is the entire country of Bolivia. Actor size represents their importance as bridges in the network (i.e. level of betweeness centrality).

In the MFAAM and the MFJ the situation is different. In both landscapes, the Model Forest platforms appear as important bridging actors between organisations with different worldviews and interests in the landscapes. The platforms are considered important spaces for dialogue by many actors and as entities that have a more holistic view of the problem. As such, MFs in Chile and Argentina are also considered potentially important for conflict resolution regarding water resources should this arise in the future. The MFs also seem to be bridges between central actors in the landscapes and between the local scale and the national and regional scales, although the MFJ does not show many links to national level authorities. In fact, the MFJ team expressed that this is a strategic relationship they would like to strengthen in the future. In the MFJ, another important bridge is the Municipality of El Carmen, both between actor types and governance scales.

Last but not least, from the point of view of public entities, the central actors and bridges in the MFAAM water governance network are mainly entities from the public sector, which are linked from national to local scales. In Figure 5-6, the Ministry of Environment has the highest level of betweenness centrality followed by the Municipalities. This reflects the centralised and top-down planning approach adopted by the Chilean Government, where hierarchies are respected and local actors, either public or private (see links between the private sector and the Central Ministry in Figure 5-6), respond to the Central Government. This decision context – the hierarchical governance structures defining the decision space in Chile – is important to bear in mind when engaging actors in adopting a more bottom-up approach to water resources adaptation planning.

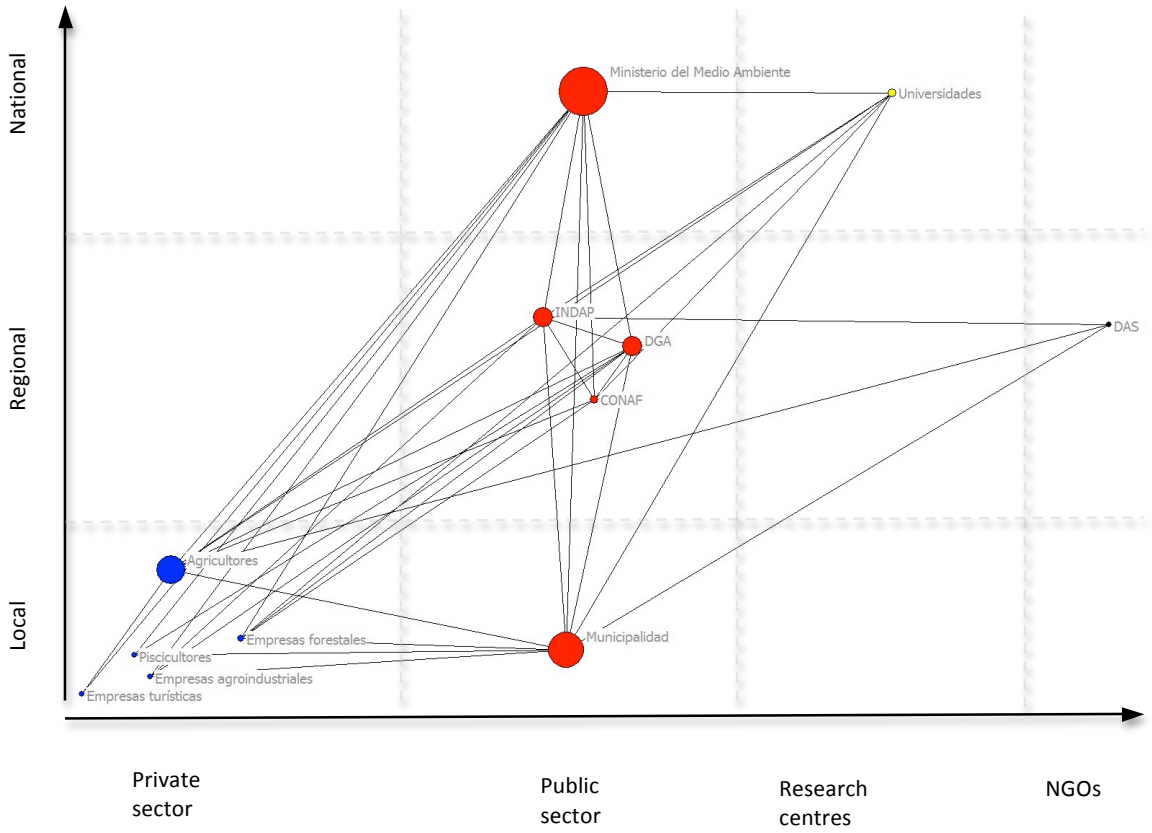


Figure 5-6: Interaction and scales, from the perspective of public institutions in the MFAAM. On the x-axis, actors are categorized by actor type (also categorized by colour). On the y-axis, actors are categorised by their territorial coverage: local level is for the Lonquimay and Curacautin communes, regional level is the IXth Region in Chile, national level is the entire country of Chile. Actor size represents their importance as bridges in the network (i.e. level of betweeness centrality).

All in all, network maps and interviews reveal multiple relationships between actors in the landscapes in relation to water resources. Some actors play more important roles in the exchange of information, while others seem to be more central in the actual decision-making process. Influential actors are generally perceived to be public entities, although there are other actors from civil society that have informal influence and therefore, could be important to consider in the decision-making process. Improving information flows is a clear recommendation to support processes of policy influence and advocacy, and thus attention could focus on strengthening relationships with potential information sources such as research centres, as well as translating existing information into a format that can be used by different actors in the territory.

Decentralised governance of water resources is meant to involve multiple types of actors and thus account for different worldviews and interests in the landscapes. However, despite the fact that public entities and civil society actors seem to be linked (to more extent in the MFC and MFAAM, and to less extent in the MFJ), coordination around water resources also seems to be poor in all three sites due to a lack of clarity around roles and mandates. Political dynamics that erode the legitimacy of some key actors, and an overall lack of awareness and collaboration amongst actors on this topic also contributes to this. Furthermore, links to the private sector (a different actor type with a different worldview) are currently weak in all the water governance networks. In the MFJ validation workshop, participants highlighted that "there is a lot of talk but less action". This is a challenge that the project needs to overcome in the next phase to engage committed actors, not only in the design, but also in the implementation of water-related adaptation strategies that resonate in the context of local development and sometimes diverging priorities. Such an endeavour will require engaging key actors that have been shown to have high centrality and formal and informal influence in these networks, as well as important bridges that can help build a holistic approach to tackle future challenges through an inclusive process of dialogue and collaboration between actors. For the latter point, working with the MF platforms, at least in Chile and Argentina, seems to be a promising entry point. In the case of the MFC, the decentralised planning process in the country may be an important entry point to support a bottom-up approach to water resources adaptation planning at landscape level.

5.3 Agents of change

On the basis of results generated with the network mapping and the interviews (see sections 5.1 and 5.2), we identified key actors in the water governance networks - public institutions and civil society organisations. In some cases the latter would represent also the private sector. Key actors have one or more of the following characteristics:

- High number of connections to other actors in the network
- High influence, either formal or informal, in the decision-making process related to water resources
- Bridging role between different actor types (different perspectives and interests) and spatial scales

- Has a central position in the network, and hence some dominance in the decision space

In addition to these positive characteristics, an actor defined as 'key' may also be a bottleneck in a decision-making process or desired outcomes.

An 'agent of change' will not necessarily be a 'key actor' as defined above, although it may be one if it exhibits one of the above characteristics. While a key actor is defined by a (current) socio-institutional structure, an agent of change is defined as an ally for transformation. An agent of change is considered under the project framework as a 'strategic ally to generate the desired change in the territory'. In other words, an agent of change is a 'project companion' committed to transformative activities that the project is expecting to promote.

Agents of change are actors that need to be considered in the 'theory of change' envisaged by each Model Forest in the project, and hence they need to be engaged in the monitoring and evaluation process. They are also going to play a key role in the development of scenarios and adaptation strategies under Work Packages 3 and 4 in the next phases of the project. To achieve this change, it is strategic for an agent of change to be connected to, or able to have influence on key actors in the network. Attributes of an agent of change are:

- To be proactive and reflexive
- To be immersed in its territory
- To have the capacity to mobilise its own social group or various groups
- To be connected to one or more key actors or have influence on them
- To have the capacity to link, integrate, and communicate different worldviews, knowledge and visions
- To have time to commit to transformative activities
- To be motivated to support the process of desired change in its territory

Sometimes agents of change are not easy to find in networks of actors related to a specific topic such as water resources management. However, it is important for these allies to have capacity to influence these networks and their key actors in order to be able to promote change. For instance, in the MFC, a key actor is the Municipal Government, but an agent of change may be the Vicariate or the Water Cooperative COSEPCO because of the connections they have to many key actors in the network and their capacity to create awareness about current problems with water resources in the territory.

While some agents of change were identified through the interviews and network maps, others were engaged in the validation workshop or later on in small targeted meetings. Nevertheless, this process requires time and several interactions with potential candidates until they can commit to the process. Annex 2 presents a list of potential agents of change identified in each MF by mid-2013. In the MFC the group of agents of change is diverse and represents different sectors and interests in the territory. Over time, and through the EcoAdapt project, this group has been consolidated into what is now called the '*Grupo Impulsor*' ('Driving Group'). In the MFJ and MFAAM, the process of consolidating a group may require more time, particularly in Jujuy

where political dynamics are constantly changing the landscape of influential actors in the basin. Nevertheless, all three MF teams have identified and contacted potential actors of change and are in constant interaction with them (either organising group gatherings or small meetings) to engage them in the process and prepare them for the next steps of the project.

6. Strengths and Barriers for Water Resources Adaptation

The interviews, network mapping and validation workshops helped identify a series of conditions that could constrain or enable water resources adaptation planning processes. The analysis on strengths and barriers for water resources adaptation planning presented below was conducted in collaboration with the three Model Forest teams. As actors embedded in their landscape and deeply involved in fostering dialogue and collaboration, they are key in contextualising the findings and hence, in helping deepen the understanding of the socio-institutional context. This understanding is the basis for facilitating a bottom-up process for water resource adaptation planning in the landscapes, building on synergies between already existing strengths that could allow overcoming current barriers to the process. Furthermore, such an analysis helps identify possible entry points, which could be considered as first steps in the process of generating the desired change in the landscapes. These entry points are described in the next section of this report.

Similar to the framework developed by Moser and Ekstrom (2010), we use the common phases of decision-making to identify and organize barriers and strengths. This includes three phases: understanding the problem (i.e. diagnosis), planning for water resources and adaptation strategies, and managing the implementation of these strategies. Barriers are considered obstacles to the adaptation process that can be overcome with concerted effort, creative management, change of thinking, prioritization, and related shifts in resources, land uses, institutions, etc. Barriers may hinder progress from one stage to another of the adaptation process or result in problems or unintended consequences later. Strengths, on the other hand, are existing capacities in the landscapes that can help overcome these barriers and facilitate the adaptation process.

Moreover, barriers could relate more to current circumstances in the landscapes and be more contemporary in nature (i.e. situational), or part of a legacy and more embedded in structures that have been created over longer periods of time (i.e. structural). According to Moser and Ekstrom (2010), situational barriers are also more proximate (i.e. originate in close proximity of the territory), while structural barriers might have more remote origins both in location and time. In general, structural barriers are more difficult to overcome requiring significant resources and long-term strategies, while situational barriers are more contemporary and proximate and may be easier to address with locally based short-term actions. This will ultimately depend on the existing strengths in the landscapes.

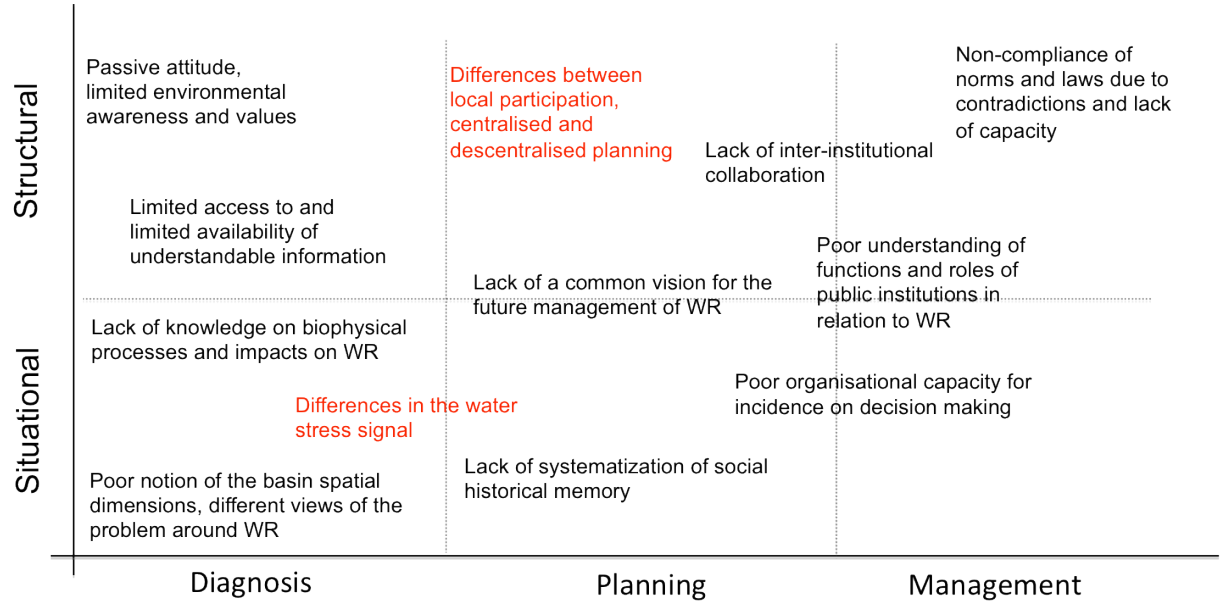


Figure 6-1: Barriers to the water adaptation planning processes in the three Model Forests. Common barriers in all three sites are shown in black, differences in red.
WR = water resources

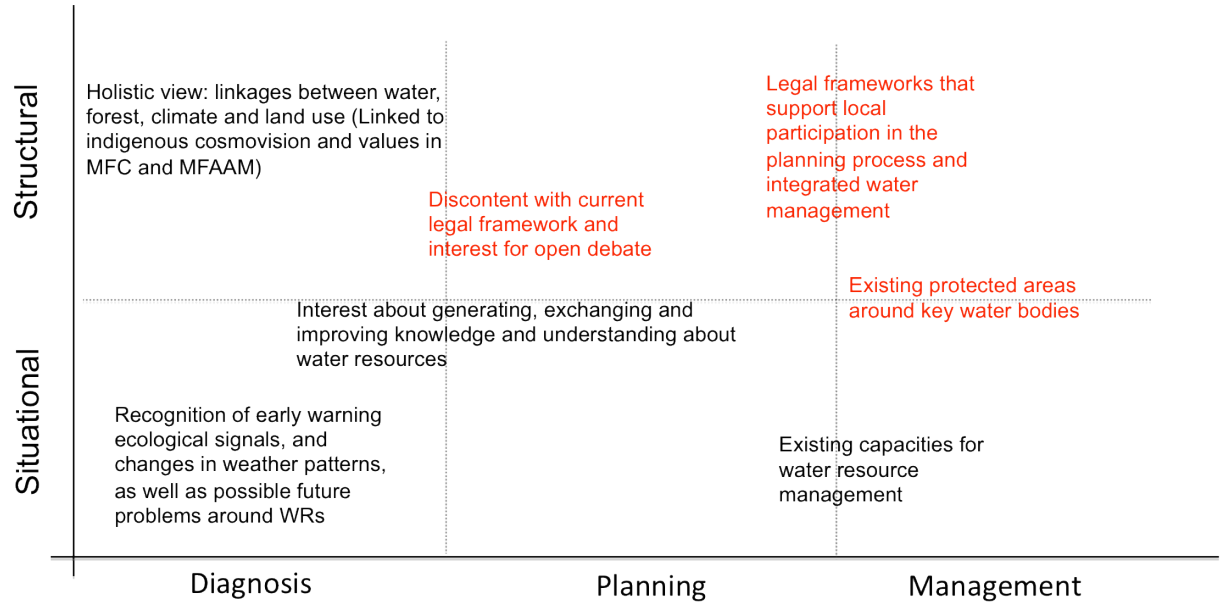


Figure 6-1: Strengths in water adaptation planning processes in the three Model Forests. Common strengths in all three sites are shown in black, differences in red.

Figures 6-1 and 6-2 above show some of the common barriers and strengths between the Model Forests. While the figures provide common maps that structure, organize and compare similar and different barriers and strengths between Model Forests, it is important to highlight that the nature, origins and drivers of these barriers and strengths are distinct in each territory, and hence they have to be approached in a context-specific manner. This section describes these commonalities and differences in more detail. For a full description of barriers and opportunities in each territory please refer to the specific country reports, available in the EcoAdapt project website.

6.1 Barriers: factors obstructing water resources adaptation planning

One of the common barriers across all landscapes is a **lack of some notion of the spatial dimensions of the basin** and where the different local actors are located in it. This is particularly the case in the Zapoco river basin in the MFC, where topographic conditions do not help actors distinguish between the lower and upper basin. Moreover, **in different parts of the basin, the problems around water resources are different**. In the urban area, located in the middle of the Zapoco river basin, the main problems relate to water contamination and sedimentation levels of the water dam, while in the rural area, problems relate to changes in river flows during the dry season or due to micro dams in farmlands, erosion, and river water contamination from mining and forestry sectors. In the MFJ, the problems in the upper basin were also different from the middle and lower basin, where most of the population is settled. Different points of view of the problem can be a barrier to a shared understanding of the issue and to the development of an integrated and holistic approach to deal with it.

One of the main **differences between the three MFs is the water stress signal**. While in the MFC and the MFJ physical water scarcity is a current issue due to water contamination and changes in the hydro meteorological system, this is not the case in the MFAAM where actors argue that a threshold has not been reached for water to be perceived as scare due to a lack of **physical availability**. In fact, in the MFAAM, it is the legal framework that turns water into a scarce element, which limits access to water to those that cannot afford acquiring or regularising water rights. **Legal water scarcity** is felt among many actors of the MFAAM, particularly among those that feel their access to water resources is threatened by large private investments that have accumulated water rights (as economic goods) over time to invest in large irrigation or hydro energy projects (see section 4).

In all three landscapes there is a general lack of knowledge on the dynamics between forests, water and soil, although there is awareness about their interactions. One of the main reasons for this, according to local actors, is the **lack of technical studies in the landscapes investigating hydrological, climatic and land use dynamics.** Neither is there a good understanding about the **impacts of different human activities on water resources**. Actors in the MFJ argued that without this knowledge it is difficult to design adaptation strategies because of a lack of guidance about what could be causes and effects, and positive or negative feedbacks both now and evolving in to the future. This also links to a general confusion about attribution in the MFJ, where actors find it difficult to discern between the differential effects of natural variability and human action on changes (i.e. impacts) they observe in the territory.

Lack of information is not only a problem in the landscapes, **but also a lack of access to existing information**. While in the MFJ this is expressed as a lack of appropriate dissemination channels and barriers that obstruct or confuse information from different sources, in the MFAAM this is identified as a format problem. This means that when information in the MFAAM is accessed (Endorsed by the *Ley de Transparencia*, which makes information access a public right), this **information is given in such a format that it cannot be assimilated by the user**. For some users such as rural communities, the transaction costs to access information are very high, but when they finally access it, they cannot use it to make any decisions because they do not understand it. As a result, actors in the MFAAM find that there is a lack of an information base to support advocacy processes and decision-making in the territory. The consequences of this are larger gaps between informed and uninformed people and associated power dynamics, higher speculation over water resources and less effective and efficient application of the legal framework.

Barriers to information and to information flows lead to an understanding and decisions that are based on individual mental models and experiences (which may evolve and converge through collective learning). This process combined with a lack of communication between actors can result in conflicting visions about the same topic. A barrier mentioned in all three landscapes is the **general lack of a common vision for the future of water resources**. There are conflicting interests in the landscapes, diverging ideas and power relations that obstruct the formation of a shared understanding of the problem and a common vision for the management of water resources. Some dominant visions exist in the landscapes, which will require negotiation. For instance, in the MFC and the MFAAM the dominant vision is commercial. Both the public and private sectors foresee the landscapes as highly productive agricultural regions. Under this vision water is a productive factor, but there are other interests (other particular visions) in the basins that also need consideration and negotiation, such as energy generation, domestic consumption and ecotourism.

Poor understanding and lack of a common vision weakens the decision-making process and erodes the potential for collaboration. In all three landscapes, actors highlighted the **lack of inter-institutional collaboration** either between different types of actors, between public entities, or between spatial scales. In the MFAAM, public entities take a sectoral approach and coordination and planning is therefore fragmented. In the MFC, there are serious contradictions between public entities at different governance scales that lead to legal insecurity of land property and perverse incentives to increase agriculture expansion over forests and promote new settlements in forestland that is unsuitable for agriculture.

The lack of collaboration is further hampered by the **lack of clarity on the roles and functions of public institutions in relation to water resources**, and **socio-political dynamics in the landscapes, which re-shape the network of actors**. For instance, in the MFJ the *Intendencia de Diques* is legally mandated to be the main institution in charge of overseeing and coordinating activities for the management of the protected area surrounding the water dams. In practice, however, the I*ntendencia* has not been able to consolidate this role because of high rotation of personnel, and political interests that interrupt the process. In the MFC, the water governance

network has seen two new dynamics in 2013 that have an effect on the information flows and collaboration between existing key actors in the water governance networks. One is a new project launched by the national Government called *My Agua*, which aims to establish drinking water distribution systems in many rural communities of the Zapoco river basin. The other one is also a large project by the National Government called *ProTierra*, which aims to establish new communal pastures and provide cattle to rural communities in the basin. Social processes are also dynamic, and therefore it can be expected that the networks of actors and relationships between them will be constantly changing in the landscapes, creating new opportunities and also possibly new tensions.

Weak collaboration may also relate to **passive attitudes among the local actors in the landscapes**. In the MFJ, passive attitude seems to be related to a **general lack of environmental awareness and values attached to nature**, particularly among adults (i.e. changes have been noticed among the younger generations), which has resulted in a culture that is more reactive than pro-active when it comes to environmental issues. In the MFC, a passive attitude is observed among indigenous communities who have become used to receiving support from NGOs over decades and more recently from the State. In the case of the MFAAM, the high dependency on the vertical governance approach of the Central Government has also promoted a passive attitude amongst actors in the territory.

A **key difference between the Model Forests** is the **local participation in the planning processes**. In the MFAAM there is a sense of fear in opening planning processes to local participation because of perceived potential loss of control or possible chaos, probably a legacy of the dictatorship. Instead, the *Ley de Participacion Cuidadana* and the *Convenio 169* in the country promote social consultation, which is a more moderate form of involving local actors in the planning process. However, local actors engaged in the interviews and workshops emphasised the need to strengthen local organisational capacity to increase advocacy and influence power on decision-making, which is currently very weak. In the MFJ, local participation seems to be hindered by contradictory interests in the landscape, political dynamics and fatigue around gatherings and discussions that, according to local actors, do not lead to any concrete actions. In the MFC, local participation is actually a strength, as there are legal instruments facilitating a structured process for engagement in the planning process. Through the *Planes de Desarrollo Municipal* (PDM, 10 years), *Plan de Ordenamiento Territorial* (PMOT, 5 years) and the *Plan Operativo Annual* (POA, 1 year) rural communities have windows of opportunity to agree on strategies and activities they would like to see implemented in the future. Although all actors should participate in this process, the involvement of the private is minimal.

Finally, a further barrier that is common to all sites, is the **lack of implementation of the regulatory framework**. This can result from different problems such as **contradictory rules, poor implementation and regulation capacity, lack of knowledge about the regulatory frameworks and problems with the regulatory frameworks themselves.** In some instances, this is caused by insufficient technical and human resources. For example, in the MFC, the Water Cooperative has not been able to build the necessary capacity over time to achieve the

system coverage they envisaged and complete the water treatment system to required standards. In other instances, this is due to a lack of knowledge of the regulatory framework. For example, in the MFJ many local actors admitted they were not aware of the *Ley de Diques*, which regulates the planning and management of the protected area surrounding the water dams. In other instances, it relates to the regulatory frameworks themselves. In the MFAAM, the legal framework adopts a market approach and treats water as an economic good. This has led, on the one hand to an unequal distribution of water rights, with most rights being in hands of a few large private investment groups. On the other hand, it has resulted in a large number of local communities without regulated water use, because of high transaction costs, and conflicts with other users. Problems of this nature are critical barriers to an integrated management of water resources.

6.2 Strengths: factors enabling water resources adaptation planning

One of the main common strengths shared amongst the three landscapes is the **recognition of early warning of ecological signals**. In all MFs, actors recognise **disturbances in the landscape with ecological impacts** such as deforestation patterns, erosion problems, and over-exploitation of resources. They also acknowledge a **change in the precipitation patterns and an increase in temperature** over the past decades, with consequences on the production calendar. Whilst in some instances these consequences are negative (e.g. longer dry periods and more intense rains in the MFC), in other instances, like in the MFAAM, some actors realise that climatic changes may bring opportunities with potential positive effects on the agricultural sector (e.g. higher temperatures during the winter season would allow the production of some crops during this period, that are not possible at present). Actors in all three MFs also recognised the **increase in competition for water resources** in their landscapes. Priority is not given to human consumption, which is already causing tensions between different sectors.

Equally important is the recognition in all three MFs of the **linkages between water, forests, land and climate**, although the mechanisms behind these linkages are not well understood. This **holistic view of the system is linked to cultural values** in the sites, **particularly in the MFAAM and MFC and less so in the MFJ** where values linked to the natural resource base seem to be somewhat eroded among the adult population. In the MFAAM, this holistic view is rooted in the belief system of the Mapuches indigenous people, who are well aware of the value of managing their land (including forests) to protect water resources. In the MFAAM, ecotourism is also playing an increasingly important role in placing value on natural spaces in the landscape. In the MFC, an important cultural base for the protection of water resources is the 'Jichi'. This character, who is part of the Chiquitano indigenous people's cosmology, is considered a being that lives in and protects water resources. For Chiquitano indigenous people the 'Jichi' is represented by local aquatic fauna or takes the form of a spiritual being that leaves and dries the water source/body if water is contaminated. Amongst these indigenous communities, it is therefore of great importance to keep the Jichi in the water and prevent water pollution.

A strength across all sites is the **existing interest in generating, exchanging and improving knowledge and understanding about water resources**. In the MFAAM, the general **discontent with the current legal framework** (Codigo de Aguas) because of the perceived negative effects it has on water management in the landscape has created a genuine interest in a larger open debate about water resources. In the MFJ, there is predisposition for knowledge exchange, capacity building and awareness-raising on water resources and the environment in general. In the MFC, there is an interest to increase already existing capacity on water resource management creating synergies and linking with other initiatives in the territory such as the project MiAgua, which has a component on capacity building in rural communities to establish water committees.

Furthermore, all three MFs have **existing capacities** on which to build **for better water resource management.** In the MFC, **several trainings and capacity building activities were conducted in the past** by actors such as the Vicariate, Plan International, the FCBC, and the Water Cooperative to raise awareness about water resources both in the rural and the urban area. In the MFAAM, trainings on water management were conducted by SEPADE for APR committees, although it is generally recognised that more work is necessary. Organisational capacity does exist, although it is still incipient among social networks in the territory such as the water committees linked to the APRs, territorial tables and the MFAAM itself. In the MFJ, awareness-raising and capacity building activities around water hygiene and management were previously conducted by the hospital, schools, INTA, and the MFJ. The MFJ is considered an important reference for the integrated management of natural resources in the area surrounding the water dams and it has high legitimacy as a bridge between different actors in the territory.

An additional strength, **that is not equal in all sites,** is the **existence of legal frameworks that support local participation in the planning process**. In the case of the MFAAM this strength is the weakest of all sites. In the previous section we explained the reasons for this, but it is worth highlighting here that the *Ley de Participacion Cuidadana* could be a window of opportunity to increase local participation in the planning process and strengthen the capacity for local influence in the decision-making. Moreover, recent modifications to the *Codigo de Aguas* made in 2005 and 2006 (e.g. fines for not using water use rights) also point towards a positive direction in finding ways to change regulation in the future. The *Ley de Transparencia* is also a window of opportunity to improve information flows in the territory, including the capacity to inform decisions. In the MFC, the process of decentralised planning will be consolidated through the formulation of *Cartas Organicas*, which represent Municipal Constitutions in their own right and windows of opportunity to integrate water resources into the local development planning taking into consideration the perspective of local actors in the landscapes. To some extent, this is already possible through the POAs, PMOT and PDM, which integrate the demands and views of rural communities in development planning (see previous section). The new Law 337 promulgated in 2013 may also be a window of opportunity to include the private sector in this process, particularly cattle rangers. Through this new law, land that was illegally deforested between 1996 and 2011 will be regulated and reforested to varying extents. Actors who observed the regulations are ensured land property rights security. This has created great interest amongst the private sector, intensifying their relationship with other actors in the

network, particularly public institutions and NGOs who have the technical capacity to help in the regulation process. In the MFJ, an important regulation supporting local participation in the management of water resources is the *Ley de los Diques*, which includes specific information about participatory co-management of the water dams and its surrounding area.

Finally, strengths that are **not common to all sites** but are important instruments for future water resource management are the **existing protected areas around key water bodies** in the MFJ and MFC. In the MFJ, the *Area of the Diques and Perilagos* (ADP) was declared Provincial Protected Area in 2003. Although it is currently not well managed because of a lack of leadership in the *Intendencia de Diques* (see section 5) and barriers to collaboration (see previous section), its constitution and management has legal support. In the MFC, the area surrounding the water dam Zapoco in Concepcion was declared Municipal Protected Area in 2009. Although this protected area is not yet recognised by the regional or national governments, it has some legal support at the local level, which will most likely gain importance when the Municipal *Carta Organica* will enter into force. In both cases, technical capacity exists to backstop the management of the protected areas, either with support from the FCBC for the Zapoco protected area or from the technical team in the MFJ for the ADP protected area. These protected areas could provide a pilot area to put into practise integrated co-management strategies for water resources adaptation that could later on become exemplars at the basin level.

7. Discussion

Combining insights from the analysis in the above sections and through discussions at the validation workshops with multiple actors in the MFs, we identified a series of entry points, which can be considered first steps (or low hanging fruit) when thinking about possible strategies that could be envisaged to promote desired change in the landscapes. These entry points are important inputs to Work Packages 3 and 4. Under these WPs, entry points could be further explored in the formulation of future scenarios and water-related adaptation strategies in collaboration with a diversity of actors in the landscapes. As a way to discuss results generated through the network mapping and follow-up interviews, this section provides a synthesis of entry points identified across the three Model Forests.

In addition to entry points for future adaptation strategies in the MFs, we learned several lessons from co-managing this research with the MFs and working closely with local actors in the landscapes. The lessons learned are contributions to the working modality for future project activities. They serve as guidance for improving the use of resources, spaces and processes of interaction in the landscapes to conduct the work in a more efficient and effective way, while achieving important outcomes such as collective learning, development of new skills, and co-generation of knowledge. Lessons learned are also discussed in this section.

7.1 Strategic entry points to promote change in the landscapes

Entry points are first steps that provide directional guidance on possible ways to start working on the transformation that EcoAdapt would like to promote in the MF landscapes. Several key entry points are identified across all three landscapes related to processes of empowerment, decision-making and advocacy, strengthening and expansion of networks, management capacity, and mainstreaming water resources into the local development agenda.

The main entry point, which has strong resonance in all three sites refers to processes of empowerment and capacity building for participating in and influencing decision-making. In the context of the landscapes, this process aims at i) modifying the regulatory framework and policies around water resources, ii) developing water resource adaptation strategies, and iii) supporting participatory processes for water resource planning and developing the lead role of local actors in decision making. A series of entry points were identified through the socio-institutional context analysis, which could facilitate empowerment and local participation in the water resources adaptation planning in the landscapes.

A first entry point is the generation of new technical information through studies on hydrological, ecological and climatological processes in the landscapes. Complementing this scientific information is existing local knowledge, which needs to be systematized to collect and analyse the social and historical memory around water resources in a structured manner. Some capacity to generate these types of information already exists in the landscapes, such as credible local universities and research institutes, but they are not well exploited, or are isolated sources in the water information networks (section 5).

An important aspect in the generation of new information is how this information is presented. To be able to inform decisions and actions, the information needs to be presented in formats that are relevant to different users of diverse backgrounds and interests. An entry point identified in the MFJ and MFC in this respect is working with the local media (i.e. environmental journalists) to reach the general public and schools to reach the youth. These two actors have the potential to play an important role in raising environmental awareness in the territory and translating new information into formats that are easily assimilated by different actors. However, to make this possible, closer collaboration will be required between these actors and those that generate the information in order to make sure the messages are not confused or misleading. Another important entry point to generate relevant information is the collective generation of knowledge in processes such as the one adopted for this socio-institutional context analysis (see section 3 and section 7.2).

An additional aspect related to information is to improve the understanding of the governance structures and public institutions in the landscapes. In this respect, an entry point identified in the three sites is to improve the information about the roles and functions of different public institutions in relation to water resources. Currently, the lack of clarity about roles and functions has generated confusion and inaction in the landscapes in relation to water resource management and development of a common vision for water resources.

A further entry point is building organisational capacity and leadership for decision-making. This has been identified in all three MFs, particularly in the MFAAM. Strengthening organisational capacity is fundamental to assimilate and manage information and increase the capacity to participate in or have influence on decision-making. This process supports a bottom-up approach to planning, which can have cascading effects across multiple scales if appropriate spaces for participation are created.

This links to the next entry point, which relates to the creation and strengthening of mechanisms that enable participation and dialogue between local actors. In the MFC, these spaces or environments are supported by the legal framework that encourages decentralised planning, but there are also informal spaces that could be strengthened such as emerging committees for water management, committees for Municipal Protected Areas, ABCrea (learning network of cattle rangers for integrated management of farms), and others. In the MFAAM, these spaces are not necessarily supported by the current legal framework, but there are existing spaces for local participation like the *mesas territoriales* that could be strengthened to promote exchange of knowledge, dialogue and participation in planning processes.

Creating spaces for dialogue and local participation in decision-making is closely related to another entry point identified in all three sites: building, strengthening and expanding social networks. In the MFAAM, some networks exist but are still in an early stage of development such as the *mesas territoriales* and the APR committees. In the MFC, the creation of the *Grupo Impulsor* (or Driving Group) is an important entry point to work on a common vision for water resources in the territory and possible adaptation strategies integrating points of view and interests from diverse actors. In the MFJ, such networks have not emerged yet, but there is a predisposition for knowledge exchange and collective learning, which could be used as the basis to create a learning network around water resources. In all three cases, an existing network on which to build is the International Network of Model Forests, which has resonance in many Latin American countries and beyond.

Building social networks also means creating new or strengthening weak relationships among actors that are difficult to connect or have not collaborated in the past. For instance, the MFs highlighted the need to create more feedback channels between public institutions, civil society and the private sector. The network mapping and interviews helped identify key actors and important bridges that link different types of actors in the landscape. These key actors and strategic bridges could be considered entry points to enhance collaboration in the network, and hence they are important to reach to in processes of influencing decision-making concerning water resources. Agents of change play a strategic role in this respect, connecting to these key actors and developing new or more feedback channels in the network.

In addition to the aspects highlighted above, another entry point is the need to improve existing capacity on natural resources management. While some MFs have already developed instruments for this, there is a general lack of implementation. For example, in the MFC, the PMOT is a key instrument to guide land management in the landscape and the Zapoco Protected Area is an instrument to help oversee land use in the urban area surrounding the

water dam. However, the capacity to implement these instruments is lagging behind. A similar situation exists in the MFJ, which has an instrument to manage the area surrounding the water dams, but due to lack of coordination and capacity, it has not been applied. This lack of technical capacity is also affecting rural communities in the landscapes, who have not always been able to maintain their local water infrastructure (i.e. water pumps that could not be repaired, or damaged distribution systems). The technical capacity to backstop these processes exist in the landscapes, within actors like NGOs for example, but need to be transferred to more actors in the network. Land use plans, technology and infrastructure are of no use in the long term, if the capacity to implement and maintain them in the long term does not accompany the process.

Finally, another entry point is the integration of water as a strategic theme in the existing development agendas in the landscapes. Mainstreaming water resources management in local development strategies is partially adopted in some MFs, but the process is highly fragmented and it does not consider possible climate futures. The challenge ahead lies in developing integrated approaches to manage water resources at the landscape-level considering multiple worldviews, development interests and a changing climate.

7.2 Lessons learned throughout the process

Several insights have been gained in this first phase of the project working together with the MFs. Lessons learned are important inputs to consider in future project activities, as they provide insights about processes of interaction in the landscapes that can contribute to continued collective learning, collaboration and ultimately positive change.

The co-construction of the socio-institutional context analysis (i.e. from method design to analysis) enables the integration of local and scientific knowledge through an iterative process of constant exchange between MFs and scientists. This first phase of the project required a significant investment of time for fieldwork and later on for validation, collective analysis and writing in each Model Forest. This process of co-construction allowed the generation of project impacts along the way and not only at the end of the process.

On the one hand, this process of co-construction promoted empowerment among the local actors who participated in the MFs. Local actors, particularly potential agents of change, are engaged in a process that goes beyond a consultation. They are engaged in a process where they adopt the lead role in achieving the desired change that EcoAdapt would like to promote in the landscapes. In this sense, the process of co-construction also promotes ownership and commitment, which are key to support a bottom-up process for adaptation planning in the landscapes.

On the other hand, scientists and civil society working together facilitates collective learning and in some instances development of new skills. The exchange of knowledge was possible through different channels, either through face-to-face interaction during workshops or field visits to the MFs, or through virtual settings such as Skype meetings. This exchange also

contributes to trust building, which is essential for long-lasting partnerships and the next phases of the project.

Of course, there are also challenges inherent to the participatory process of the co-construction of knowledge. One of the main challenges is time. These processes are very time-intensive due to the iterative nature of learning. Time investment is also a requisite if adaptation strategies developed in the territory are going to be long lasting, legitimate and supported through a bottom-up process.

Another challenge is balancing differing interests in the process and unexpected changes along the way. This requires adaptive management and sometimes lowering scientific-academic expectations. Political dynamics in the landscapes sometimes have effects on actors and decisions, which are not possible to control. These challenges need to be accounted for with flexibility, to find way to adapt and still achieve the desired outcomes.

In terms of interaction with the broad spectrum of actors in the landscapes, we learned that in some instances, the workshop format generated false expectations among participants, creating tensions in a project that is mainly focused on research. Although the workshops promote collective learning, there is a need to find other feedback channels that facilitate knowledge sharing without necessarily generating misleading expectations. For example, in the MFJ the team suggested shorter meetings among three or four actors, and the MFC is already implementing community transects and field trips as alternative ways to exchange knowledge.

Finally, this initial phase of the project was the first opportunity to generate interest around water resources in the landscapes. Social networks surrounding this topic (e.g. the *Grupo Impulsor* in the MFC) are slowly emerging as a result of this first phase of work. The next phases of the project will require even more interaction with these groups of actors (i.e. identified 'agents of change') and validation with the general public to work jointly in the generation of future scenarios and socially accepted adaptation strategies at the landscape-level.

8. Conclusions

The socio-institutional context analysis generated during the first phase of the project is the basis for a bottom-up approach for water resources adaptation supported by science-society engagement. The objectives of this analysis were achieved working in close collaboration with the MF teams and engaging a range of actors in each landscape. This helped build a legitimate socio-institutional analysis of water resources and gain a shared understanding about several entry points to improve collaboration in the landscapes, create interest, build capacity and support empowerment of local actors to design and plan for adaptation of water resources, all of which is essential for the next phases of the project. In addition, the process of co-construction facilitated continued learning between scientists and civil society organizations, which is at the core of the project's philosophy.

More specifically, this socio-institutional context analysis i) helped gain insights on the drivers affecting water resources in the landscapes and possible challenges in the future if current trends continue, and a shared understanding of the main issues perceived by local actors, which they are interested in addressing, ii) allowed identifying key actors in the information and governance networks around water resources planning and management in the landscapes, including insights on influence dynamics and relationships that can facilitate or obstruct the integrated management of water resources and adaption planning; iii) helped identify potential 'agents of change', generate interest about water resources and promote the emergence of new networks of actors working on ways to improve collaboration and the management of water resources in the landscapes; iv) contributed to understanding factors that may enable or constrain water resources adaptation planning in the landscapes by identifying existing strengths and barriers to this process; and v) helped explore and detect possible entry points to start working on adaptation strategies in the MFs using existing strengths as opportunity windows to overcome some of the barriers obstructing the water resources adaptation process.

Some challenges encountered along the way relate to i) time required to invest in the co-construction of knowledge working with MFs in each landscape; ii) unforeseen dynamics that influence the process such as political dynamics in the MFJ, which change the landscape of influential actors; iii) socio-institutional constrains specific to each site such as low levels of engagement of the private sector in the MFC or the public sector in the MFJ, which required adaptations in the method implementation and posterior validation of results; and iv) lack of existing studies and information on water resources, which calls for the development of further studies looking at biophysical dynamics linked to social dynamics in the Model Forests to inform the development of adaptation strategies for water resources in the landscapes.

Overall, the co-construction of knowledge with the MFs generated trust, ownership and interest to continue the process of exchange and co-learning between scientists, the Model Forests teams and multiple actors in the landscapes. This is fundamental for the next steps of the project because the action-research nature of Work Packages 3 and 4 (WPs 3&4) will require continuous interaction between the scientific team and the team of local actors in the Model Forests, i.e. MF teams, agents of change and the broader spectrum of actors in the landscapes. The findings of this socio-institutional context analysis inform the work in WPs 3&4 both in terms of provision of substantial information and key insights, and in terms of lessons learned about modes of interaction that are more conducive to participation and learning in each landscape. Work Packages 3 and 4 will use this as a basis to work on participatory scenario development, and the identification, evaluation and validation of adaptation strategies for water resources working closely with local actors to promote desired change in the landscapes in the context of local development and climate change.

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Annexes

Annex 1. Perceived roles and functions of actors in the water governance networks

Model Forest Jujuy

Table 1: Roles attributed (perceived) to the actors in the water governance network

ACTOR	ROLE
Agua de los Andes	Company responsible for the treatment of drinking water in the province of Jujuy. It is managed by the provincial government with public funds.
Model Forest Jujuy	Civil Society Organization that performs actions and executes projects with the purpose of contributing to an integrated natural resources management in Los Pericos - Manantiales water catchment in the province of Jujuy, North of Argentina.
Clubs	Private organisations that organize leisure activities in the ADP area (e.g. recreational fishing, nautical activities, etc.)
Communities	Communities that live in the surrounding area of 'Los Diques' and that are users of it. They are impacted by problems affecting the water catchment. In some places, communities have organized themselves to form neighbour groups or committees.
Consorcio de Riego Valle Los Pericos (CRVP)	Water user organization that is part of the private sector. It is mainly represented by the tobaco producers, which account for the 80% of the water users. Appointed by the provincial government (DPRH), the CRVP is responsible for the water distribution in the middle basin.
Dirección Nacional de Vialidad	National institution with provincal headquarters that plans and manages the national road infrastructure. They are also in charge of repairing national routes in situations of major natural disasters including floods, landslides, mudslides (among others) that result in blockages of routes and paths. Projects of bigger magnitude are decided at the national level, but decisions regarding road maintenance are taken at the local scale.
EJESA	Private company with international capital responsible for the electric energy supply in Jujuy. EJESA works under a concession contract with the provincial government. It was established to provide the public service of the generation, distribution, and commercialization of electric energy.
Hidrocuyo	Private company in charge of the production of hydroelectric generation for the interconnected system. Hidrocuyo is located in the area of the reserve, at 'Las Maderas' dam area.
Schools	Public education institution in charge of primary, secondary and tertiary education.
Prov Gov	Public administrative body commonly organized by Ministries or Secretariats.

Hospital	Institution providing medical and surgical treatment and nursing care for sick or injured people.
INTA	National Institute of agriculture and livestock that undertakes research on agriculture and livestock at the national level.
Intendencia de los Diques	Provincial body dependant on the Environmental Management Secretariat which is responsible for the management of the Natural reserve area called 'Los Diques' (ADP area). It is not in charge of the water management per se, only responsable for the land-use management of the area surrounding 'Los Diques'.
Municipality of El Carmen	Municipal government with both the legislative and executive mandates and administration of those issues that pertain to the administrative municipality of El Carmen.
Municipality of San Antonio	Municipal government with the legislative and executive mandates for the administration of those issues that pertain to the administrative municipality of San Antonio.
Local media	Private companies. Some of them with strong linkages with polititians at the provincial level. They include TV, radio, newsletter, and digital media.
Planning Ministry	Government body from the provincial level in charge of planning.
Health Ministry	Government body from the provincial level in charge of health issues, including preventive measures. It has a group of nurses (called APS -Agentes Primarios de Salud) that provide a door-to-door service to deal with health issues.
Rural communities	Communities that live on a permanent basis in 'Los Diques' area. Some of them live in the area since a long time ago, and others have established recently.
Residencial communities	Middle-high class inhabitants that have weekend houses in the residencial parts of the 'Area de los Diques y Perilagos' (ADP).
Lake police (or ADP police)	Provincial body dependant on the firemen. They are responsible for the security and safety of the 'Area de los Diques y Perilagos' and nautical rescue.
Agricultural producers	Water ursers from the CRVP, in its majority from the tobaco sector.
Dirección Provincial de Recursos Hídricos	Provincial body that manages the surface water and groundwater resource.
Restaurants	The restaurants are usually authorized concessions to clubs in order to promote tourism in the area of 'Los Diques'.

Secretaría de Gestión Ambiental	Provincial administrative body responsible for the environmental conservation and natural resources management.
Secretaría de Turismo provincial	Provincial public body in charge of promoting and controlling tourism in the province.
Tobacco sector	All those institutions of the sector, including the 'Camara de Tabaco', Cooperativa de los Tabacaleros, La Tabacalera, Latser, etc.
Tourism	Foreign tourists that are not from Jujuy or nearby areas.
Weekend visits	People who go to the ADP area over the weekends for recreational or tourism purposes. In general, these are local people from the area.
UNJU-Universidad de Jujuy	National public institution in charge of university education.

Model Forest Araucarias de Alto Malleco

Table 2: Roles attributed (perceived) to the actors in the water governance network

ACTOR	ROLE
Dirección General de Aguas (DGA)	It provides water rights for its use. It implements water projects, rural potable water, it deals with water flow measurements, etc.
Municipalities (Lonquimay and Curacautín)	Linked to committees and rural potable water projects. It is unknown to what extent the municipal decrees relate to water resources. Some actors attribute the role of the municipality to issues particularly related to irrigation projects. Role in supporting the application process of getting water rights through the programme PRODESAL. They have a general role in facilitating information and consultative processes as well as decision-making (attributed by private actors, farmers, and other public institutions).
Instituto Nacional de Desarrollo Agropecuario (INDAP)	The general attributed role is to allocate resources for irrigation projects and regularization of water usage. It funds irrigation projects to small producers and work for the water rights and local development, but they have not conducted workshops. Further work is expected from this institution (vision of farmers and entrepreneurs from the agriculture/livestock sector). There is a perception in limited influence when it comes to the user's level and resolution of regularization matters.

Corporación Nacional Forestal (CONAF)	It is considered a key actor because it applies the law of forest development. Its role in the protection of natural resources, especially forests, is highly appreciated.
Environmental Ministry	Its role is mainly attributed to the assessment of environmental impacts of projects. It is perceived as an institution that is far away from the communities of the area of study, municipalities and other organizations.
Corporación Nacional de Desarrollo Indígena (CONADI)	They are involved in the regularisation of water rights to mapuche indigenous communities. They also lead irrigation projects at a small scale. CONADI is perceived as an intermediary funding institution.
Legislative power (polititians, senators, parliament members)	Responsible for the national legislation (e.g. Water code). They are considered as important actors because they are responsible for the legislation, but no dialogue and no listening is perceived from their side. They link with different actors but well connected with the municipalities.
Farmers	They are water users and require irrigation schemes in place. They are active and can strengthen the linkages with others to generate project proposals, encourage participation and work in a coordinated way with others.
Dirección de Obras Hidráulicas (DOH)	They are in charge of interventions that deal with water flow levels. Their role is also attributed to the installation of irrigation projects and irrigation improvements and the implementation of rural potable water projects. They provide funding support to projects.
Hydroelectric companies	It affects negatively because it has too many water rights. They are involved in projects such as dams or other power plants.
Comisión Nacional de riego (CNR)	They are involved in irrigation projects, irrigation efficiency and they encourage private investments. They encourage technification of irrigation schemes. They make investments in hydraulic infrastructure including irrigation, protection of river banks and rural potable water.

Model Forest Chiquitano

Table 3: Roles attributed (perceived) to the actors in the water governance network

ACTOR	ROLE (perceived)	ROLE (based on the PMOT 2009)
Municipal government	They respond to the communitie's needs, especially in relation to water access to areas in Concepcion that do not have access, and natural resources management, among others. The municipality also is perceived with a support role during emergency situations caused by droughts and floods. The municipality must look for alliances with the central government,	Plan for sustainable development in the urban and rural areas, promote productive development, comply and make comply national and municipal laws/by-laws (e.g. Forest Law). Regulate and manage the services of potable water, sewage system, streetlights, waste managment, transport, safety and security. Manage the services of land registry at both urban and rural areas.

	the sub-national government and the Cooperative of water as counter parties in relation to infrastructure and maintenance.	Strengthen the inter-institutional coordination, promote development and strengthen the institutions and social organizations that allow an improvement of management capacities and social control. Provide access to information to the population through media.
Sub-national government	Unknown role with regards to water, but it has a role in the support of infrastructure construction as well as routes, wells and paths. They also have a role in providing support to communities during drought periods or bushfires, and capacity building to communities in relation to waste management.	Representatives from the government, from its departments and they are in charge of the administration of the province Ñuflo de Chávez. It coordinates 6 municipalities of the province. It provides support in relation to natural resources management, water basins and protected areas. It does not manage resources, the construction work is done via the provincial council.
CICC	They safeguard communitie's interests making sure they all have water systems in place. They also coordinate with other institutions. They influence the Municpal government, surveillance committee and subnational government to make sure the projects benefit the communities. They also work with NGOs and provide support in the elaboration of forest management plans, assessments of bushfires, care of water sources and have a role in acknowledging communitie's rights. They support communities in the interaction with the municipality for the execution of the Annual Operations Plan (POA) and the elaboration of the TCO Monte Verde law.	CICC was established in 1985 and its main role is to improve the quantity and quality of agricultura/livestock production of communities. Search for markets for the produce generated by the communities. Work in coordination with the OICH. OICH was created in 1995 and its main function is to promote and strengthen the principles of unity and solidarity between its member organizations. It aims for sustainable development, taking into account the natural resources, cultural identity, community participation and gender equity to improve the conditons of the indigenous people in the Chiquitania.
Local communities	They organize themselves to know further and improve their natural resources and be counterparties of construction work and other projects.	The OTBs were created in 1995 and have the mandate to represent the civil society. Its role is described in the Law of popular participation and the Law of

	Receive capacity building, conserve the forest and protect water sources. The 'Organizaciones Territoriales de Base' (OTBs) coordinate with the committee of surveillance/monitoring for a proper implementation of the POA, take care of the good use of water pumps in the communities, influence to receive assessment in water management, keep good communication with communities. They also cooperate with the municipal government to create employment The civic committee controls the investments that the municipal government makes and follows-up the execution of projects. However, the committee lacks influence in the decision-making.	municipalities. The surveillance committee is formed in 1995 and has the role to practise the social control on behalf of the citizens regarding the resources of co-participation in relation to taxes. They also have to make sure there is an equitative investment of the resources in the rural and urban areas. Social control is understood as 'the CSO's right to know, supervise and evaluate results and impacts of public policies and participatory processes in relation to decision-making, as well as access to information and analysis of tools for social control (Law of National Dialogue, article 25) The civic committee has a role in deffending the interests and recognition of the third section of the province, as well as the deffense, rescue and promotion of cultural values.
Water cooperative	Its role is not well understood in the rural area. It benefits all those who receive water from the system and they work with the support from the municipal government. It provides water through the network, it maintains the functioning of the network, monitoring the quality of water, plan the extension of networks in Concepción. It creates awareness regarding the care of potable water. It (should) minimize the health risk caused by water borne diseases.	The 'Cooperativa de Agua' formally registered as 'Cooperativa de Servicios Públicos Concepción' (COSEPCO). It has a central role in managing the service of water distribution to homes in the urban area and communities from Porvenir and Altamira.
Plan International	Supports community project initiatives by transferring knowledge and information, capacity building or advice. Spokesperson of the communities'	Plan International was established in Concepción in 2000. Its role is to support the human development and the productive system and sustainable management of natural

	needs. Plan International has provided support to the communities in relation to water pumps, health improvements and capacity building to the communities. It provides economic resources to conduct work in coordination with the municipal government and supports communities to gain further access to water.	resources in coordination with the municipal government.
Vicariate	Recognized as one of the institutions that supports communities in relation to water supply. It provided great support to the communities in water systems and water pumps as well as capacity building for maintenance.	The catholic church has presence in the municipality since 1692 with the jesuites missions. Human development and support to the productive system and sustainable management of natural resources.
AGACON	They (should) support communities and take care of the water sources. They (should) comply with regulation that has to do with improved management of natural resources. They (should) work in coordination with the municipal government and the population and contribute with technical, and economic support.	AGACON is a non-profit association that provides services to cattle breeders with regards to sanitation as well as legislative and administrative issues. It also strengthens the livestock commercialization system.
FCBC	Counterpart in initiatives that support communities.. It provides capacity building, advice to communities, especially in relation to better water access in coordinated efforts with the municipal government. It has provided support in the maintenance of water pumps in the communities.	The FCBC is established in the municipality in 2007. The central role is in providing support in the sustainable management of natural resources and land-use planning in the municipality. It conducts research in relation to forest conservation in the Chiquitano forest.
ABT	It authorizes the execution of forest management plans to communities	It promotes and regularizes the control of the integral forest management by

	and private companies. It also controls the ilegal traffic of Wood.	involving social sectors and through dynamic processes that contribute to the socio-economic development of the country. It harmonizes citizen participation in relation to natural resources management.

Annex 2: Potential agents of change identified in the Model Forests

Model Forest Jujuy

Table 1: List of potential agents of change identified by the MFJ team by mid-2013

POTENTIAL AGENT OF CHANGE	ROLE ORGANISATION	OBSERVATIONS
Víctor Navarro (Secretaría de Turismo) Adrian Mendieta (Mayor)	Municipality of El Carmen	Víctor Navarro works in the área surrounding the water dams and he is interested in the tourism development of the area. Adrian, the mayor, has a good working relationship with the Model Forest Jujuy. In addition, the Mayor has influence on the national and provincial politics. He is a bridging actor to the clubs and the Intendencia de los Diques.
TBD	Direccion provincial de recursos hídricos	The Jujuy Model Forest has a good relationship with the head of the Direccion Provincial de Recursos Hídricos but he cannot commit to the project activities at the moment.
TBD	Intendencia de diques	There are political conflicts that cause tensions between the current head of the Intendencia de los Diques and the Model Forest Jujuy. These tensions may be resolved with further interaction.
Ernesto Quintana	Consorcio de riego valle de los Pericos	Advisor to the CRVP. He has collaborated with the Model Forest Jujuy for a long time and he has credibility among other actors in the network. He is interested in the conservation of the ADP area. He was part of the CRVP and he is currently an advisor. He is very committed to water issues and the good management of the ADP area.
TBD	Agriculture/livestock producers	Producers are only interested in production. They are receptive to proposals for change but they are not good initiators of change. They are linked to the Camara de Tabaco, which often provides training. Both institutions are very related to the INTA.
TBD	Hidrocuyo	Hidrocuyo deals with its own issues without taking into account the rest of actors. It only links strategically to those who have

		political power in relation to water resources management (DPRH) and energy production (i.e. Planning Ministry).
Alejandro Snopek	Cámara Tabaco	He actively collaborates with the Model Forest Jujuy. He is currently the president of the Model Forest Jujuy Directory, and a member of Parliament with good relationship with diverse actors such as the tobacco sector, and the Secretariat for Environmental Management. He is part of the environmental commission and one of his objectives is to protect the upper basin area. Alejandro can help strengthening relationships with the CRVP.
TBD	ABMJ	They do not have political influence, but they have influence on key actors and the agents of change.
Mario Martiarena	Clubs and restaurants	Vice-president of the Nautical Club. Political person, with good relationships with other actors and is interested in participating.
Ernesto Regazzoni Rafael Hurtado	Schools, hospital, INTA, UNJU	There is a good relationship with Ernesto, who is interested in cooperation, but there are doubts whether he can really commit as he deals with multiple activities (e.g. INTA, UNJU). Rafael is the new Head Lecturer in Climatology at UNJU, and he has done research on climate change. At present, he has not interacted with the Model Forest Jujuy.

Model Forest Araucarias de Alto Malleco

Table 2: List of potential agents of change identified by the MFAAM team by mid-2013

POTENCIAL AGENT OF CHANGE	ROLE ORGANIZATION	OBSERVATIONS
Uta Hashagen	Empresaria Turística	She has a strong interest for natural resources and sustainability of productive activities and develops actions geared towards awareness creation and natural resources conservation. She has time and interest to work together.
Paulo Palma	DAS	DAS is an organization working for the promotion of economic development in Lonquimay, with small producers and with linkages from farmer's organizations in the area. He might not be able to engage due to limited time availability.
Jorge Vera	CONAF	He has linkages with local institutions, as well as forest assessment bodies. He cares about local development. His role in CONAF varies and it is unknown whether he will be in a position to engage in the EcoAdapt process.
María Isabel	INDAP	She has a holistic vision of the landscape development, has knowledge on the forest sector and has linkages with local actors (livestock and forest sectors). She is the head of INDAP, so she has high influence and networks that facilitate the development of proposals. She has interest in the development of the

		landscape.
Karin Campos	Red Comunitaria de Turismo Rural	She was identified during the feedback and validation workshop. She has linkages with local entrepreneurs.
Carlos Montes	Unidad de Desarrollo Económico Local (UDEL) Curacautín	As leader of UDEL, he has linkages with local actors and he is a visible and credible agent in issues related to the local productive development. He is also very close to the Mayor.
Washington Alvarado	BMAAM	He is well positioned in the landscape and he has a strong linkages with other actors and credibility among local actors. He works in the EcoADAPT project and has a strong committment for the local development and sustainable natural resources management
Luis Parra	Comunidad campesina de Río Blanco	He is interested in water resources issues and he is a local leader. He has interest in water management, he has credibility and willingness to work in these issues.
Guillermo Vásquez	Ex Mayor of Lonquimay	As ex mayor, he is known enough in the landscape, he is interested in the topic and has credibility. He can also be a bridging actor with the policy makers. However, he left the mayor's office and it is unclear which path he will follow next
Carlos Alegría	Mesa Territorial de Campesinos de Montaña	He has a historical role in the organizational leadership of the mountain farmers. He has a lot of linkages with other organizations, good will and interest in the topic.
Claudio Sandoval	SEPADE	He is well positioned among the social organizations of the landscape and has high credibility in the area. He has worked with farming communities for the last 10 years. He works in the EcoAdapt project and has committment for local development and the sustainable management of natural resources.

Model Forest Chiquitano

Table 3: List of potential agents of change identified by the MFC team by mid-2013

POTENTIAL AGENTS OF CHANGE	ROLE AND ORGANIZATION	JUSTIFICATION
Marco Urey Laurenz Romero	Dirección de Desarrollo Productivo y Medio Ambiente in the Municipality	The Municipallity is a central and bridging institution in the network and it has legitimacy and credibility in the basin. There is an agreement signed between the Model Forest Chiquitano and the Municipality to implement the EcoAdapt Project in the basin. The contact persons are very knowledgeable and aware of the problems in the territory.

Guadalupe Antelo	ASCULTUR and Water Cooperative COSEPCO	She is the president of a tourism group called Ascultur and member of the committee of surveillance of the water cooperative. She is considered a leader in Concepcion. She has many connections with different actors from the society in Concepción. She has shown committment since the beginning of the project.
Carlos Peña	Ex mayor and ex president of the Municipal Council. He is also a cattle ranger.	He has shown personal interest in the project. He is an environmentally friendly cattle ranger and he is open to try new techniques for livestock production. He has technical knowledge, and good relationships with many actors in the basin, including the private sector.
Tizziano Barutto	Manager of three livestock farms in Concpecion.	He is very innovative and proactive in trying new techniques in the livestock sector. He is a link to the private sector.
Rubén Suárez	Ex-mayor of the municipality of Lomerío, indigenous leader and current president of the OTB in Santísima Trinidad.	He is an indigenous leader in the Chiquitania with very good relationships with local organisations (e.g. OICH and CICC) and with the Municipal Government. He is recognized as a leader by the local communities.
TBD	Cooperativa de Servicios Públicos (COSEPCO)	It is identified as an important institution in relation to water management in the Zapocó basin. At the moment there is no clear person who could represent the Cooperative, but there is a lot of interest shown in participating as a technical reference for information and assessment.
Community of San Andrés	Water committee at the community of San Andres.	It is a good community example given that it has a water committee with its own regulations. Yet the agent of change (the main person) has not been identified yet, but will be done in the medium term. A drawback could be the need for transportation from the community to Concepción.
TBD	Asociación de Ganaderos de Concepción (AGACON)	Livestock is one of the most influencing sectors affecting the water resources in Zapocó. AGACON tends to be reluctant to engage in participatory processes. There is a need to develop a strategy to reach cattle rangers through agents of change.
TBD	Subgobernación de la Provincia	It is considered an important actor given the number of policies that need to be implemented in the territory.

	Ñuflo de Chávez	However, there is a lot of rotation of personnel within the institution, which makes difficult to find a committed person.
TBD	Central Indígena de Comunidades de Concepción (CICC)	It represents the indigenous communities in the Zapoco basin. The person that will be representing the sector has not been identified yet. It is important to take advantage of the current good relationship that the Municipality has with indigenous communities and the CICC.

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