Strategic Adaptation Plan for Model Forest Araucarias del Alto Malleco (MFAAM) Landscape



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Climate Change and Water

EcoAdapt Project: Adaptation to climate change for local development

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Executive summary

1.3.31

Exasperated by climate change, many Latin American countries face critical water scarcity issues. Rural communities are particularly vulnerable because they directly rely on a limited freshwater supply to sustain their livelihoods. In addition to changes in weather and climate, other compounding factors such as demographic pressure, political dynamics, economic inequality, poor inter-sectorial cooperation and land use changes put stress on the environment as well as the way of life for many people. Communities are being compelled to develop adaptation strategies to address the foreseeable negative impacts of these drivers.

EcoAdapt offers a context-specific bottom-up approach to adaptation planning for water resource management focusing especially but not exclusively on landscape management. The adaptation planning process involves sharing and cogenerating knowledge with multiple stakeholders operating across different scales and policy areas through an iterative process of learning. For local development, this includes expanding on existing networks that link different spatial scales and knowledge domains. In Latin America, EcoAdapt has been working with three civil society organizations in Chile, Bolivia and Argentina that represent multi-stakeholder platforms called Model Forests (MFs).

This report is a synthesis of the information gathered through two years of studies and stakeholder engagement in the EcoAdapt process implemented in the Model Forest Araucarias de Alto Malleco, Chile (MFAAM). Based on these findings, this report presents a strategic plan with specific actions and priorities designed to address the main issues, as identified through the consultation and participatory planning process with the communities of Lonquimay and Curacautin.

In Chile, water availability is not only an ecological issue but also a legal one, given that under the Water Code (1981) water access rights are considered a tradable asset independent of the land where it is located and are designated for either consumptive (human consumption) or nonconsumptive (energy generation and irrigation). In the MFAAM, water rights for consumptive use are unavailable because they have all been purchased and/or assigned. Most of the nonconsumptive use water rights in the territory have been acquired by private enterprises with the focus of developing hydroelectric plants. Tension exists between the demand for increased energy production on a national scale and the competing demands for water at the local scale. Additionally, 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 seed production (e.g. Araucarian pinones), and presence of new invasive species and pests. In the context of both ecological and socio-political pressures, this plan addresses the question of how water availability and security can be insured for local development.

Through a series of interviews, network mapping and validation workshops, barriers and strengths have been identified that could enable or constrain water resources adaptation

processes in the territory. Key stakeholders identified through these knowledge co-construction efforts were part of the process of creating and validating the information used to create this report. Members of these various groups are also part of the strategic planning team and heavily involved in planning processes for their communities. With the help of the community, eight key objectives were developed to serve as a guide in identifying priority actions that support the vision. These eight objectives can be summarized in this plan's two core focus areas:

- Increase citizens resource management skills and advocacy abilities
- Improve livelihood

Plans for action were developed and rated according to priority perceptions regarding a set of criteria that includes: issue urgency, issue ripeness, implementation capacity, affected population, implementation duration and community building potential. Five priority actions were identified for each of the two main themes as well as 9 additional lower-priority actions to address improved livelihoods and 5 additional actions to improve management capacity. EcoAdapt identified four actions as critical to strengthening the organizational capacity of MFAAM thus providing a foundation from where to continue action over time. Two quick energizing actions have already commenced on a small scale to stimulate interest in the process and motivate participants with quick-yielding tangible outcomes. It is worth mentioning that most of the strategic lines prioritized have a direct or indirect link with the expected impacts of climate variability and change on the landscape. In this respect, the climate component has been considered as an envelope, a background knowledge motivating actions and based on which stakeholders aware of its observed and projected consequences (through the knowledge co-construction activities) thought of possible solutions together with technical experts.

Paragraph on monitoring and evaluation):

- Will the objectives be revisited in a few years to see if there are improvements or are things are getting worse?
- Who will take responsibility for reviewing success of actions and progress on objectives?

Although these actions may not be able to stop or reverse the effects of climate change, by adapting to the changing reality the community will be better able to cope with its effects. Using water more efficiently and making improvements to increase the retention of water within the ecosystem can help ensure water availability for all water users in the community.





Presentation

How to use this report? This report is a summary of the EcoAdapt process in the Model Forest Araucarias del Alto Malleco (MFAAM) and its main outputs. The main body of this document is organized in four sections.





1. Introduction



1.1. Adaptation planning process for BMAAM

The process undertaken to elaborate this landscape Adaptation Strategic Plan resulted from the EU-FP7 funded EcoAdapt project (www.ecoadapt.eu; 2012-2015). As an action-research initiative EcoAdapt focused on three Latin American landscapes (in Bolivia, Chile and Argentina) to influence water management processes that can contribute to local development while reducing vulnerability of human populations to climate change. The EcoAdapt adaptation planning process avoided the pitfalls of framing adaptation planning based on a strict analysis of climate change impacts which can lead to implementation deficit (Dupuis and Knoepfel 2013). Having acknowledged and systematized existing information on the impacts of climate change on water cycle, the project rather took a barrier and capacity-oriented focus to embed the adaptation planning and implementation efforts into priorities of the local economic development sought by landscape inhabitants. Under this approach, the project process in the landscape was led by the organization representing the Model Forest multi-stakeholders platform and involved the interaction among civil society organizations, researchers from international and National centers and policy makers. The process to elaborate this plan involved different phases (See Figure 1) along a period of three years. It started with a diagnostic of socioinstitutional, socio-ecological and socio-economic aspects related to water management and climate change elaborated in collaboration with stakeholders in the landscape with the objective to promote understanding of implications of climate change and water interactions with local economic development (Understanding Phase).

1.1



Figure 1. EcoAdapt process from promoting understanding through a participatory diagnostic phase to planning and implementation.

It combined the use of bio-physical and social science studies (to characterize the landscape water management context) with information generated through field learning activities with stakeholders intended to validate and complement information from these studies with local



understanding and knowledge. This knowledge co-production process served the goal of increasing the capacity of stakeholders to feel ownership, gain trust and effectively engage in the adaptation planning and implementation process.

In a second phase, this capacity was then key to engage stakeholders in the planning process (Planning Phase) which had two components (Figure 2), namely: a) planning and implementing energizing and prioritized actions; and b) planning and securing resources for other strategic actions in the landscape. The first component addressed the planning and implementation of one objective and its associated actions prioritized among many that were scrutinized using criteria tailored to the contextual need of the landscape (Managing Phase). The strategic goal of this energizing actions was to respond to both the urgency for action and the need to maintain momentum for stakeholders' engagement needed to secure resources for the implementation, monitoring and adjustment of the whole plan (i.e. comprehending the other objectives) as suggested by the yellow dotted line in Figure 2.



Figure 2: The two components of the strategic adaptation planning process in the landscape.

Through the EcoAdapt process it became apparent that the organizations (working on the challenges of designing and implementing an adaptation plan for water resources and taking into account local economic development needs) required to strengthen the base or foundation from where they act In this respect, the EcoAdapt project identified and worked to strengthen four main specific actions to promote the adaptation planning and implementing capacities of local organizations which is resumed by this plan, namely:



Produce new technical information through studies in the landscape

Improve the understanding of the governance structures in the landscapes.

Build organisational capacity and leadership

2

3

4

Increase existing capacity on natural resources management

- 1. Produce new technical information through studies on hydrological, ecological and climatological processes in the landscape. Both scientific data and social/historical memory surrounding water resources need to be collected and synthesised into information that is accessible to its target audiences. The purpose of this information is to inform decision and action and therefore it needs to be presented in formats that are relevant to different users of diverse knowledge backgrounds and interests. Currently the information gaps are a large limitation on many stakeholders ability to skilfully act.¹
- 2. Improve the understanding of the governance structures and public institutions in the landscapes. The lack of clarity about roles and functions has generated confusion and inaction. Clarifying roles and functions of different public institutions in relation to water resources can increase accountability.²
- 3. **Build organisational capacity and leadership.** Creating spaces for dialogue and local participation in decision-making is good way to building, strengthening and expanding social networks. Promoting existing networks such as territorial and the APR committees can be beneficial to developing stronger leadership and building grassroots capacity.³
- 4. Increase existing capacity on natural resources management. Technical capacities may 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 not sustainable in the long term, if the capacity to implement and maintain them in the long term does not accompany the process.⁴

⁴ Eco Adapt. Deliverable N^o 4.4.



¹ Eco Adapt. Deliverable N^o 4.4.

² Eco Adapt. Deliverable N^o 4.4.

³ Eco Adapt. Deliverable N^o 4.4.

1.2. Challenge

The Model Forest faces the dual challenge of protecting the natural resources found in the area, while simultaneously taking steps to improve the standard of living for the local population, who experience some of the highest levels of poverty in the country. This strategic plan focuses on the addressing the challenges of water scarcity, especially in the face of climate change, in the MFAAM territory, and aims to address the following question:

How can water availability be insured for local development in the short and medium term, within a context of increasing demand for the resource, changing hydrological dynamics, and restrictive legislation for the use and access of water?

⁵Water availability is generally determined by climatic variables (temperature, precipitation) that influence the hydrological cycle. However, in Chile, water availability is not only a biophysical issue but also a legal one, given that under the Water Code (1981) water access rights are considered a tradable asset independent of the land where it is located. Water rights, as defined by the Water Code, are designated for either consumptive or non-consumptive uses.

Different water sources in the Model Forest Araucarias de Alto Malleco (MFAAM) contribute to the human and economic development in the territory. Domestic water for the towns of Lonquimay and Curacautin comes mainly from 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.⁶ In rural areas, the main sources of water are rivers, wells, and estuaries. In general, the population in the MFAAM indicate that water quality is good, particularly in urban areas where waste water treatment facilities have been established in recent years. Agricultural, cattle ranching and forestry activities however can have negative impacts on surface water quality especially if water usage is unregulated and poor practices are being followed. Other activities such as aquaculture and stone extraction affect the physical structure of the streambed and habitat quality of the riparian zone.⁷

Thus far, little progress in implementing adaptation plans has been made both at national and sub-national levels due to one or a combination of factors. Challenges include: low awareness of climate change 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 social sectors, and poor integration of local knowledge and visions into adaptation planning.⁸

⁸ CEPAL. 2006



⁵ Eco Adapt. Deliverable N^o 2.5.

⁶Goberino de Chile. CASEN Survey 2009. Ministerio de Desarrollo Social. Available at: http://observatorio.ministeriodesarrollosocial.gob.cl/casen_obj.php

⁷ Eco Adapt. Deliverable N^o 2.4.

1.3. Context

The purpose of this project is to address the challenges faced by the Lonquimay and Curacautin communities and design a context appropriate adaptation plan. To gain a thorough understanding of the issue dynamics multiple studies were conducted to better understand the socio-institutional and socio-ecological context. This section is a summary of these studies.

1.2

1.3.1. Geography and demography of the territory

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 3). The MFAAM implements project activities across these two communes. The territory includes pre-Andean and Andean landscapes, comprising an area of 560,000 hectares. Almost half of the land use is forest, grassland and grazing accounts to just over a quarter of the land use, and annual crops to around a tenth of the land use in the territory (Table 1). The main land use is forest. Two important rivers cross the territory of the MFAAM: the Bio Bío River with a drainage area of 24,264 Km2 and the Cautín River, which forms part of the Imperial River Basin and has a drainage area of 12,763 km2 (Figure 4).



Figure 3: Geographical location of Model Forest Araucaria Alto Malleco, Chile (MFAAM). Source: Bosque Modelo Araucarias of Alto Malleco.



Figure 4: Maps of Imperial river watershed in Curacautín (left) and of Bio Bio river watershed in Lonquimay (right) Source: Vilugrón et al., 2013

The biggest changes to the landscape of the area occurred during the colonization of the region in the 20th century. In the first half of the twentieth century the subdivisions of land in both communes, the arrival of new residents, and the construction and extension of the railway line gave rise to the cutting and burning of large areas of dense forests. The forest was cleared to either provide wood for sawmills or to provide free land for agriculture and livestock. The area experienced an intense exploitation of native forest in the mid-twentieth century, which degraded the landscape and forest leading to the closure of many factories and sawmills in the second half of the twentieth century. To this day the impact of those early colonization activities remain as the productive structure of both communities is livestock and agriculture, and not forestry.⁹

In 2002, the population in the MFAAM was 27,207, with 37.6% living in Lonquimay and 62.4% in Curacautin (Table 2). For 2012, the National Statistics Institute (2002) had estimated a population growth of 12,8% in Lonquimay and a population decrease of 10.5% Curacautin, with an overall population growth of 0.3%. In 2009, over half of the population of MFAAM was living in urban areas (CASEN survey, National Ministry of Social Development, 2009). Of the two communes, Curacautin is predominantly urban (69.1%) while Lonquimay has a larger rural population (66.5%) (Table 3). There is also a significant presence of Mapuche-Pehuenche indigenous communities. The indigenous population accounts for 45% of the population in Lonquimay and 6% in Curacautín (Table 4).10 Indigenous land covers 141,929.76 ha, which represents 37% of the total area of the Model Forest.

¹⁰ INE. 2002.



⁹ Benavidez. 2014.



Table 1: Land use in the MFAAM territory. Source: MFAAM Strategic Plan 2009-2012

Land Use	Percentage (%)
Forest	46
Grassland and grazing área	28
Annual crops	11
Exotic species plantation	2
Infertile soils	13

 Table 2: Population by area and sex. Source: National Census 2002, 2012, Instituto Nacional de Estadísticas (INE).

	Year 2002 Male Female		Year 2012	
Commune			Male	Female
Curacautín Lonquimay	8,310 5,414	8,660 4,823	7,293 6,279	7,895 5,269
Total (BMAAM)	13,724	13,483	13,572	13,164

Table 3: Urban and rural population. Source: National Census 2002, 2012, Instituto Nacional de Estadísticas (INE)

Commune	Urban	Rural	Total
Curacautín	12,412 (73.1%)	4,558 (26.8%)	16,970
Lonquimay	3,435 (33.5%)	6,802 (66.4%)	10,237
Total (BMAAM)	15,847	11,360	27,207
	(58.2%)	(41.7%)	

Table 4: Population by ethnicity. Source: National Census 2002, 2012, Instituto Nacional de Estadísticas (INE)

Commune	Non indigenous population	Indigenous population	Total
Lonquimay	5,673 (55.4%)	4,564 (44.6%)	10,237
Curacautín	15,932 (94.7%)	1,038 (6.1%)	16,970
Total (BMAAM)	21,605 (79.4%)	5,602 (20.6%)	27,207

1.3.2. Social and ecological interaction

In the region the minimum temperature has increased by almost two degrees in the last decade compared to the average of 47 years of record. The increase in temperature has been coupled with a downward trend in average yearly rainfall, which has led to an increase in severe droughts in the area. The increase in draughts has been quite dramatic over the last 100 years. Both

winter and summer severe droughts have gone from occurring in average every twenty years to today's average of every six years.¹¹

Changes to temperature and precipitation have had impacts to the variability of river flows at different elevations. In areas of low and mid-elevation areas, water availability has declined sharply over the last sixty years, especially in summer, autumn and spring. At low elevations winter flows have also been reduced. However, the winter flows in areas of high elevations have increased during the last decades due to the increase in average freezing altitude, which leads to more precipitation occurring in liquid form instead of snow.¹²

In spite of these changes in river flows, in the region, water availability is primarily not an issue of biophysical limitation but is a legal issue, given that water belongs to the owner of water rights when legally registered. Water resources in the territory and in Chile in general, are legally regulated by the Water Code (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 (human consumption) are unavailable because they have all been purchased. Currently, it is only possible to acquire rights for non-consumptive use (energy generation and irrigation).

Given that Chile is facing energy shortages, most of the non-consumptive use of water rights in the territory are acquired by a small hand of private enterprises with the focus of developing hydroelectric plants. The national need for energy in combination with a supportive Water Law has the negative impact in the territory where water use is prioritized for energy generation and irrigation over water for human consumption.

Though not as predominant as the water law, there are two other drivers of water scarcity in the territory: Unsustainable land use practices (i.e. overgrazing and deforestation) and climate variability. 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.¹³ 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 pests. The introduction of new forest plantations using non-native species such as eucalyptus and pine

 $^{^{13}}$ Eco Adapt. Deliverable N° 2.5.



¹¹ Muñoz Navarro. 2013

¹² Idem





pose an additional burden on water resources.¹⁴ The effects of climate variability have already been noticed. Local actors have noticed diminishing water quantity due to a decrease of water volume at 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 temperatures particularly during the winter season.¹⁵

Finally, social-ecological systems are also affected by other drivers such as market fluctuations and changes in demographics.

Changes in the functioning of these relationships between society and the ecosystem can potentially put stress on the ecosystem or lead to socio-economic problems. In the case of the MFAAM, increasing markets demand for salmon as well as the moderate demographic growth in the region could potential further strain the water resource.¹⁶

1.3.3. Key stakeholders

Within the context of a strategic plan, the stakeholders in MFAAM can be grouped into two main categories, those that play important roles in the exchange of information, and those that are central in the decision-making process. Influential stakeholders for mobilizing change are generally perceived to be public entities, although there are other actors from civil society that have informal influence and therefore, are important in the decision-making process and the implementation of actions. Table 5 summarizes the main stakeholders in regards to water governance in the region.

The identified stakeholders were part of the process of creating and validating the information used to create this report. Members of these various groups are also part of the strategic planning team and are therefore heavily involved in planning processes for their communities.

¹⁶ Eco Adapt. Deliverable N^o 2.5.



¹⁴ Eco Adapt. Deliverable N^o 2.4

¹⁵ Eco Adapt. Deliverable N^o 2.4.



Table 5: Roles attributed (perceived) to the actors in the water governance network

Institution	Description
Corporación Nacional Forestal (CONAF)	CONAF is considered a key actor because it enforces the laws pertaining to forest development. Many stakeholders are highly appreciative of its role in the protection of natural resources.
Ministry of Environment	The Ministry of Environment's role is mainly to assess the environmental impacts of projects and proposed projects. Some stakeholders perceive the institution as distant and disconnected from the communities and local organizations
Corporación Nacional de Desarrollo Indígena (CONADI)	CONDI is involved in the regularisation of water rights to Mapuche indigenous communities. They also lead irrigation projects at a small scale. CONDI is also perceived as a potential funding institution.
Legislative power (politicians, senators, parliament members)	Members of the legislative branch of the government are considered important actors because of their responsibility in instating and upholding national legislation (e.g. Water code). They have a large network and are able to connect with different actors in a variety of sectors. Some stakeholders however find it difficult to engage with politicians because of what they perceive as a lack of dialogue and unwillingness to listening.
Farmers	Farmers have a high stake in water management issues due to their high demand for water and their need for effective irrigation systems. They are often actively involved and can strengthen the linkages with other stakeholders. Farmers have been known to contribute project proposals, encourage community participation and work cooperatively with other actors.
Dirección de Obras Hidráulicas (DOH)	DOH is 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 hold a large portion of the water rights, which limits the
Hydroelectric companies	availability of water rights for other users. These companies are often seen as negatively impacting the fairness and equality of water access in the region. The companies are involved in projects such as dams or other power plants.
Comisión Nacional de riego (CNR)	CNR is involved in irrigation and irrigation efficiency projects. They encourage private investment and the modernization of current irrigation systems. They invest in water infrastructure including irrigation, protection of riverbanks and rural potable water delivery systems.

1.4. Barriers and Strengths for Water Resources Adaptation

Through interviews, network mapping and validation workshops a number of barriers and strengths have been identified that could enable or constrain water resources adaptation processes in the territory. Barriers are considered obstacles to the adaptation process that can be overcome with concerted effort, creative management, changes in thinking, prioritization, and related shifts in resources, land uses, institutions, etc. Strengths, on the other hand, are existing capacities in the landscapes that can facilitate the adaptation process and help overcome barriers. Because of their alignment and overlap in priorities the results from both communities: Lonquimay and Curacautin were aggregated.

The barriers and strengths have been categorized in a 2x3 matrix that includes a progression from situational to structural challenges in the Y axis, and three phases of planning on X axis.



Situational challenges relate to current circumstances in the landscapes and are perceived to be proximate to the territory. On the other hand, structural challenges are part of a legacy and are embedded in structures that have been created over longer periods of time generally having remote origin (both in time and location).

The creation of a strategic plan involves three distinct phases:



Barriers may hinder progress from one phase to another, or result in problems or unintended consequences later. In general, structural barriers are more difficult to overcome. They require significantly more resources and long-term strategies, while situational barriers may be easier to address with locally based short-term actions. Strategies for addressing barriers will ultimately depend on the existing strengths in the landscapes.

Figure 5 summarizes the barriers and strengths in the MFAAM community. It is worth noting that the largest barriers MFAAM is facing, legal shortcomings and centralized planning, can also be seen as strengths. The strength of a centralized system is that changes in the law have the potential of creating wide reaching positive effects.





	Diagnosis	Planning	Manage	ment
Situ	Passive a farmers (de external in	attitude of Lack of clarity pendency on of managers terventions) specializ	about roles , and lack of ed staff	
lationa	water-soil-forest, and lack of monitoring	systematized m	anage water resources	management
-	dynamics	water resources is not col	nmunities to	to influence
	Fragmented knowl-	Social memory regard- Lack of	f organizational	Lack of processes and capabilities
	suit	table		
St	and its fo	rmat is not	not clea	arly articulated
ruc	on water i	s dispersed	oratior	n, and laws are
tu	Tochnical	nformation	little int	erest in collab-
ral	and decisions on		Public	
	regarding the rules	distribution of water rig	hts region	nal political power
	Little knowledge	legal framework and inequ	litable lit	tle presence of
		Legal Shortcomings: restr	ictive Cent	tral planning and

	Diagnosis	Pla	nning		Mar	nagement
Sit	Recognition of ecological changes in the territory	Recog pote impa	gnition of t ntial positiv cts of clima change	he ve ite		strengthening research
uatio	subject wat forest	er and s		manager natural re	nent of sources	advocacy: informa- tion, training,
na	Interest ir	n the		ences of su	stainable	empowerment for
_	view)			Successfu	l experi-	Mechanisms of
	(Mapuche world-		,			
	Holistic view of land	tion 1	(69)	sh	ip and organ	izational skills
5,	listic view of lowed	Indigenou	s Consul-	AAM	MF, Citizens N	Network), leader-
Stri			-	EXISTI	ng networks a tforms (board	and collaborative
Г П		Public Mar	nagement	F		
tu l		Participa	ation in		extractio	ons in times of drought
al	mat	Law of (Citizen		eratio	ons (reserve flows),
	for access	to infor-	DG	A and SEA	visory Boa	ards, ecological consid-
	Transpare	ency Law	funct	tions in the	Water Use	er Organizations, Super-
	T		Centi	alization of	Changes	in the legal framework:

Figure 5: Barriers and strengths in the MFAAM community



2. What matters



2.1. Vision

Through numerous workshops and community engagement events stakeholders within the MFAAM have identified the following vision:

1.2

Residents have the skills and tools to participate in local decision-making, and work together to promote local and regional development, while honouring our local identity. Our natural environment is recognized for its uniqueness, and communities are involved in conserving and managing it for present and future generations. The economy is diverse and innovative, based on local culture, and ensures a dignified standard of living for local community members

17

2.2. Objectives

Eight key means-objectives were developed to serve as a guide in identifying adaptation actions that support the vision. These eight objectives (identified through the diagnostic phase) can be summarized in this plan's two core focus areas¹⁸:



Although seemingly these objectives do not focus explicitly on addressing climate change or climate variability, they are inherently linked and address the concern of stakeholders regarding local economic development. By focusing on feasible actions that will help insure community resilience and water availability for local development in a short and medium term, the resulting outcomes will also be in line the goals of addressing climate change effects.

2.3. Focus area: Increase citizens resource management skills and advocacy abilities

The underlying goal for this focus area is to increase the capacity of resource management and advocacy of those negatively affected by the current legal and environmental water shortages. The following four objectives where identified:

¹⁸ Eco Adapt. Deliverable N^o 2.4.



¹⁷ Strategic Plan Araucarias del Alto Malleco Model Forest (AAMMF) for the years 2013-2016. Lonquimay 2012

Increase knowledge and wareness

Increase capacity to resolve conflicts

Increase social responsability

Increase social participation









Increase knowledge and awareness: An overall lack of environmental awareness and information about water related issues is a huge hindrance to developing good water resource management practices. Increased environmental education can facilitate more meaningful dialogue across different stakeholder groups is essential to ensure the best decisions are made.

1.10

Increase capacity to resolve conflicts: Multiple interests and sectors are competing for same resources, which can lead to a rise in conflicts. In order to resolve and prevent conflicts open channels of communication must exists between and among stakeholder groups, as well as the skills to engage in productive conversations.

Increase social responsibility: Increasing knowledge and awareness is not enough to affect change, citizens must also take responsibility over the problems they are facing. The territory suffers from a passive attitude and an overreliance on government authority to address the issues citizens face.

Increase social participation: Involving the public is decision-making is important to a sense of ownership and self-determination over one's own future. This includes meaningful intercultural involvement with an opportunity for all stakeholders to voice concerns and influence those with decision-making capabilities.

2.4. Focus area: Improve livelihood

The underlying goal of this focus area is to improve livelihood, which is intimately connected with the ability to access good quality water. The following four objectives where identified:

1.1



Improve water security and availability: Water availability is determined by climatic factors such as temperature and precipitation, which have an impact on water balance in the watershed. Water resources in Chile are legally regulated under the Water Code (1981), which promotes the privatization and trade of water rights. Competing demands for water usage and unequal opportunity to access water rights have made water availability more of social-political issue rather than a biophysical one. Nonetheless, changes to the biophysical availability of water through land use change and climatic variability have exasperated the issue. Thus sustainable water management is critical to insuring water availability for all users.



Improve water quality: Water quality is affected by the various activities carried out in the watershed. Forestry plantations, agriculture and livestock grazing are consumptive activities that are also potential sources of water contamination through changes to the natural nutrient and sediment-loading regime. Stone extraction, aquaculture and hydroelectricity production divert surface water and return it downstream with unmeasured impacts to the water quality. Controlling and mitigating pollution sources will improve water quality for all users in the watershed.





Develop local economy: Developing and promoting a local economy can improve community resilience. There is opportunity to develop supply-chains for sustainable wood and non-wood forest products from the region as well as an opportunity for growth in the tourism sector. Institutional coordination of sustainable best practices and certification processes could be instrumental in the marketing of value-added products, promoting tourism and improving the sustainability-based economy.



Improve natural habitats: Healthy wetlands and forested area help to purify and retain water within the watershed and improve water quality and availability downstream. The model forest area includes a high concentration of Araucaira, or monkey-puzzle trees as well as other native forest ecosystems of significance for their biodiversity and importance to the indigenous peoples. The introduction of new forest plantations using species such as eucalyptus and pine has introduced additional burdens on water resources in the watershed. The conservation of critical water sources for drinking water and the protection of sacred wetland will ensure ecological integrity of the region, which supports humans and well as numerous species of flora and fauna.



3. Mobilizing progress

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3.1. Critical success factors

Planning and implementing adaptation strategies for water resource management involves participation from an entire network of actors. The Araucarias del Alto Malleco Model Forest organization has a leadership role on this project and will act as the main facilitator for intersectoral cooperation.19 Voluntary participation from various stakeholders as well as the trust and informal authority the model forest has built over the years will be crucial in augmenting the model forest's capacity to mobilize coordinated efforts and implement the actions identified in this plan.

MFAAM is well aware that the ability to successfully address an issue or problem depends on many socio-political factors. The way in which an issue is perceived, both by individuals and institutions, is arguably the most important factor in determining whether mitigation/adaptation strategies and action will be embraced or dismissed. To increase the opportunities of successful implementation and assist in the process of prioritization of actions six factors were used to determine the contextual feasibility in MFAAM of each action (Table 6).

¹⁹ Eco Adapt. Deliverable N^o 2.4.



Table 6: Six factors were used to determine the contextual feasibility in MFAAM

	High	Low
URGENCY	The situation presents a sense of urgency that necessitates immediate action. If not addressed, the problem may quickly worsen or exasperate other issues. Meaningful action must be taken within the year.	The implementation of this action can begin within the next five years without any detrimental consequences. The problem is not very urgent.
ISSUE RIPENESS	The issue is in the forefront of the socio-political arena. It is a priority for both the public and politicians. Existing legislation and public policy priority for this issue makes seeking funding opportunities easier.	There is a general sentiment of disinterest or repulsion from the issue. There are no existing policies on addressing the issue and funding sources are lacking or unavailable.
IMPLEMENTATION CAPACITY	There is sufficient knowledge, skill and resources within the community to adequately address the issue in question.	The implementation of this action is precluded by lack of knowledge, skills and/or availably of materials.
AFFECTED POPULATION	The implementation of an action to address this issue will have a positive effect on many citizens in different sectors of society.	Positive impact of this action will only affect the immediate benefactors. No other sector is affected by the action.
IMPLEMENTATION DURATION	Action can be implemented in less than one year.	The action will require a time commitment of 5 years or more. The impacts of the actions will not be apparent for a long time.
COMMUNITY BUILDING	Action has the potential to strengthen joint efforts and generate interest in community collaboration for future action.	Action will not generate interest in the common good.

3.2. Strategic Actions

The actions described below where initially identified through research and community workshops.^{20, 21} The identified actions were further refined in collaboration with the BMAAM and then presented back to the community for validation and prioritization.²² The process of community prioritization was as follows. First the participants evaluated and scored each action in regards to how well they met the objectives (described in section 3.2) of the community, and the critical success factors factors (described in section 4.1). This was an insightful process as participants were able to discuss each action from with the context of its feasibility and expected impact on what the community cared about. The scoring for the objectives and factors where then combined into one score from zero to five, with 5 being the highest ranked and top priority actions. Below are the results of the prioritized strategic actions.

3.2.1. Focus area: Increase citizens resource management skills and advocacy abilities

1.1-1

The top five actions to address this focus area are the following:



 Design and implementation of training and educational workshops aimed at key stakeholders and decision makers (5*). The importance of knowledge and understanding of both the ecological and political factors at play when it comes to water resource management is paramount. It is essential for key stakeholders and



Photo 15. Meeting with key actors to generate proposals.



²⁰ Eco Adapt. Deliverable N^o 2.4.

²¹ Eco Adapt. Deliverable N^o 2.5.

²² Eco Adapt. Deliverable N^o 4.4.

decision makers (refer to Section 1.3.3) to be well informed and feel confident in their understanding of the various integrated factors at play. These workshops would be designed to fill knowledge gaps or introduce training on water law and rights as well as advocacy communication which would help provide participants with the tools to integrate this understanding into their decision-making processes. Participants will also come away with increased capacity to transfer knowledge to others.^{23, 24}



2. Increase cooperation between relevant authorities and public actors in regional and local action (4*). Building a strong partnership between authorities (government at various levels) and the civil society actors directly affected by water governance issues is key to increasing intersectoral cooperation. A cooperative partnership involves an exchange of information and resources, which leads to mutually desired outcomes. These types of working

partnership, however, are often difficult to establish and maintain requiring on-going open communication between sectors. Fostering this relationship will involve partners getting to know one another and developing a sense of trust through a series of formal and informal meetings and through the act of collaborating on small-scale projects. Recent Laws on Citizen Participation and on Transparency of Public Information (Law 20.285) are an opportunity to increase cooperation for joint actions and to design solutions that are environmentally and socially sustainable as well as improve access to information for citizens.^{25, 26, 27}

3. Effectively manage human resources for cooperative action (4*). With the large diversity of actors and stakeholders involved in managing water resources it is important to consider the most effective use of human resources. Each action described in this Strategic Plan will require a combination of workforce with different possibly competencies, including: workmen, technicians, engineers and specifically qualified or experienced



people. As far as no additional resources are guaranteed, the Model Forest relies on the voluntary work of members from many sectors, including agricultural producers, local

²⁷ Eco Adapt. Deliverable N^o 2.4.



²³ Eco Adapt. Deliverable N^o 2.4.

²⁴ Eco Adapt. Deliverable N^o 4.4.

²⁵ Eco Adapt. Deliverable N^o 2.4.

²⁶ Eco Adapt. Deliverable N^o 4.4.

government organizations, entrepreneurs, leaders of indigenous communities, researchers and civil society organizations. All labour should be utilized efficiently, whether it is given freely or at a charged rate. Additionally, this action involves analyzing the local and national labour market situation to determine the projected cost of ongoing and future projects.^{28, 29}



4. Transfer knowledge of water legislation to local and regional level actors (3*). Improved access to legal information and understanding of the framework under which water usage in Chile is governed will allow for more just allocation of water at the local and regional scale. This information will be presented using accessible language though a variety of media including workshops, printed and web material. Regional and local stakeholders who

have gained knowledge of how the system works can assist others in finding this information and filling out water access applications.^{30, 31}

5. Enhance access to information regarding water access for citizens (3*). The information available to citizens about their rights to water access is either non-existent or inaccessible. Literacy levels and ability to access information may be prohibitive for many who don't own computers and/or understand cannot complicated terminology. Simplified and pertinent information for water users will be developed and distributed widely in the



form of printed material. This action would involve the cooperation of institutions to lead occasional workshops, run events and distribute material to ensure the broader population is reached with information about water access.^{32, 33}

The five actions that follow received lower scoring from the stakeholders and are not, at the moment, deemed to be either important and/or feasible to implement. However, as progress is made on the above-prioritized actions it is very likely that the actions identified below will be given greater priority.

- ²⁹ Eco Adapt. Deliverable N^o 4.4.
- ³⁰ Eco Adapt. Deliverable N^o 2.4.
- ³¹ Eco Adapt. Deliverable N^o 4.4.
- ³² Eco Adapt. Deliverable N^o 2.4.
- ³³ Eco Adapt. Deliverable N^o 4.4.



²⁸ Eco Adapt. Deliverable N^o 2.4.

Create strategic alliances between cooperation and research

Promote network building among stakeholder groups and APR (Agua Potable Rural)

1.3.

Effectively manage human resources for cooperative action

Transfer knowledge of water legislation to local and regional level actors

Enhance access to information regarding water access for citizens

 Create strategic alliances between cooperation and research (2**). There is an opportunity to develop a partnership between MFAAM and researcher and students at the nearby Austral University of Chile in Valdivia. Creating this type of strategic alliance would be beneficial to both the community and the institution. The university would use the model forest as a case study on water management problems and their relevance for adaptation to climate change and provide guidance on how change



could be best implemented. Researchers can also provide competencies for an economic analysis of market opportunity of forest products. $^{\rm 34,\ 35}$



2. Promote network building among stakeholder groups and APR (Agua Potable Rural) (1*). Local APR committees formed by inhabitants of the rural communities are responsible of the local water distribution network. In many cases, local communities lack legal rights for water use, and hence water consumption is not regularized. Remote areas with dispersed populations may lack any type regularization and distribution networks. Network building through seminars and events is important in

the process of establishing good working relationships between Agua Potable Rural representatives and other stakeholder groups. This action involves reaching out to key

³⁵ Eco Adapt. Deliverable N^o 4.4.



³⁴ Eco Adapt. Deliverable N^o 2.4.

representative members of stakeholder groups and inviting the opportunity to meet with members of APR and discuss water management issues. After establishing this contact, APR members will be better able to collaborate with other organizations and ultimately provide better water distribution services

to the rural population.^{36, 37}

 Leverage funding for projects (1*). Several potential sources of funding in the form of loans and donations have been identified. Assessing this funding for projects requires investigation and often rigorous application processes. Two governmental institutions offer loans at interest rates ranging from 16% to 19%: INDAP (national institute for agricultural development) and CORFO (corporation for the promotion of



production). Seven other governmental bodies offer donations through a competitive process or subsidies: FIA (foundation for the agrarian innovation), CONAF (national forest corporation); DOH (directorate of hydraulic constructions); FNDR (regional development national fund); CONADI (indigenous development national corporation); FOSIS (Solidarity and social investment fund) and SERCOTEC (technical cooperation service).^{38, 39}



4. Workshops with traditional authorities (Mapuche / settler) (0*). Mutual understanding and cooperation between Indigenous and non-Indigenous groups and authorities will lead to better management of resources and fewer conflicts. This action will entail facilitating planning workshop with participants such as representative of indigenous Mapuche communities (Asociación Indígena Trawün Longko and Asociación Indígena Quimquewentru), tourist operators (Association of Tourist

Operators), local municipality (Council members), and representative of Community Aqueduct Associations and directors of the Board of the Model Forest. These workshops will also serve as a platform for network building and knowledge sharing, which will facilitate communication between various stakeholders in the future.^{40, 41}

⁴¹ Eco Adapt. Deliverable N° 4.4.



³⁶ Eco Adapt. Deliverable N^o 2.4.

³⁷ Eco Adapt. Deliverable N^o 4.4.

³⁸ Eco Adapt. Deliverable N^o 3.4.

³⁹ Eco Adapt. Deliverable N^o 4.4.

⁴⁰ Eco Adapt. Deliverable N° 2.4.

5. Creating a Water Table multi-stakeholder advisory council for improved mediation between groups (0*). A formal multistakeholder platform for open discussion and planning of water management related issues would increase transparency in the decision making process and allow for increased local participation. Creating an effective *Water Table* would require the involvement of a diverse set of actors including authorities from government, business and civil society. This would be a platform for MFAAM to engage



Photo 24. Meeting with FM Chile to find out more about their EcoAdapt experience.

with water resources management professionals to promote a grassroots action approach to promote local capacities for an effective and efficient water adaptation planning.^{42, 43}

3.2.2. Focus area: Improve livelihood

The top five actions to address this focus area are the following:



1. Springs and wetland protection (5*). Springs, wetlands and riparian areas provide ecosystem services and are critical to the functioning of a healthy ecosystem. These sensitivity areas must be protected both physically and with legislation. Regulations that prevent grazing, clearing or otherwise destroying a spring and wetland areas need to be put in place. Corporación Nacional Forestal (CONAF) plays a key role in enforcing laws and protecting the forest. Ecologically important areas for water resources will be physically protected by the addition of fencing, the incorporation of native vegetation and the installation of drinking water dispenser for animals. Priority will be given to

⁴³ Eco Adapt. Deliverable N^o 4.4.



⁴² Eco Adapt. Deliverable N^o 2.4.

taking action in protecting sacred areas of wetland called *menokos*. This action is planned to start at four sites within the first year.^{44, 45}





Photo 26. Riverside and watershed after protection program.

2. Promote restoration of natural resources to enhance tourism (5*). Pristine and well-managed natural areas attract visitor and increase the reputation of the region as a tourist destination. Expanding the tourism sector in MFAAM will have two-fold benefits: increased revenue for the local economy and increased awareness of maintaining natural assets that attract visitors. This type of promotion can be done through workshops for local business and farmers who wish to open themselves up to the market opportunities of the tourism sector.⁴⁶





Photo 28. Restored natural area with tourism potential.

3. Reforestation with native vegetation (4*). Reforestation involves an initial investment of labour, materials (soil, saplings) and water but it provides long-term benefits to the community. This action will consist of establishing a reforestation demonstration area where best practices for maintenance and animal protection can be developed. This demonstration area will be in operation for 5 years and will serve as a location to promote reforestation of ecologically important areas that have been degraded. Youth volunteers and community members will be engaged in planting and caring for a variety of native species of trees, such as monkey puzzles, Rauli beech and Coigue. From the

⁴⁶ Eco Adapt. Deliverable N^o 4.4.



⁴⁴ Eco Adapt. Deliverable N^o 3.4.

⁴⁵ Eco Adapt. Deliverable N^o 4.4.

practical experience gained from maintaining a demonstration plot, these volunteers can then take on a leadership role in passing on this knowledge. This action will have benefits both for the functioning of the water cycle and for building knowledge and capacity within the community.^{47, 48}





4. Prevent surface soil erosion and degradation of the native forest habitats (4*). Soil erosion is the excessive loss of fertile topsoil due to natural, animal or human activities. The soils found in MFAAM are considered to be of poor quality, fragile and prone to erosion. The loss of surface soil negatively affects farmers because it decreases the fertility of the soil and it can lead to devastating floods. Areas without vegetative cover and where the soil has been compacted through overgrazing, mechanized farming or clearing, are at high risk. Preventative measures to control surface soil erosion and against native forest degradation include improving and regulating animal grazing practices as well as restoring and protecting forested areas. The Comisión Nacional de Riego (CNR) is already involved in irrigation efficiency projects and can be a key actor in fostering land stewardship among rural community members.^{49, 50}





⁵⁰ Eco Adapt. Deliverable N^o 4.4.



⁴⁷ Eco Adapt. Deliverable N^o 2.5.

⁴⁸ Eco Adapt. Deliverable N^o 4.4.

⁴⁹ Eco Adapt. Deliverable N^o 2.5.

5. Establish legally enforced enclosures in critical areas - water pool reserves and upstream from catchment points (3*). Legally formalizing the protection of riparian areas around the water sources that provide water to residence of urban areas is critical to ensuring a clean and abundant supply. The cost associated with creating reserves upstream of catchment points will include fees for environmental and legal competencies.^{51, 52}



The nine actions that follow received lower scoring from the stakeholders and are not, at the moment, deemed to be either important and/or feasible to implement. However, as progress is made on the above prioritized actions it is very likely that the actions identified below will become a greater priority.



⁵¹ Eco Adapt. Deliverable N^o 3.4.

⁵² Eco Adapt. Deliverable N^o 4.4.







1. Promoting alternative uses of native forests (2*). Promoting alternative uses of native forests involves developing supplychains for the main non-wood forest products of the territory: the seed fruit of the monkey puzzle tree (*piñón*), the morchella or morel mushroom and the eglantine or rosehip fruit. This action includes promoting good collection practices and an in-depth analysis of market development opportunities. A market for nonwood forest products would increase incentive to maintain a healthy forest and decrease the

reliance on logging and the lumber industry. A more diversified economy would also improve the economic resilience of the community. $^{\rm 53,\ 54}$

2. Construct storage shed for rainwater (2*). Rainwater harvesting can provide water for agriculture and individual household usage. This action involves investigating and promoting water storage and piping in areas prone to droughts. Potential benefits of rainwater capture include flood mitigation in low-lying areas, reduced reliance on current water delivery system as well as increased availability of potable water for drinking or irrigation.^{55 56}





Photo 36. Construction of infrastructure for storing rainwater.

3. Promote regional identity in the development of tourism perspective (2*). MFAAM region is home to significant population of Mapuche-Pehuenche indigenous people who hold a holistic view of the landscape rooted in their belief system which recognizes the linkages between water, forests, land and climate. This value of managing and protecting their land can be extended to the non-indigenous population as well. The connection to land and place is a part of the regional identify. Strengthening

territorial identity in relation to water resources will encourage citizens to value their water resources, being mindful of their contribution to local development, such as the growth of the tourisms sector. A strong regional identity also increases the opportunity

⁵⁶ Eco Adapt. Deliverable N^o 4.4.



⁵³ Eco Adapt. Deliverable N^o 3.4.

⁵⁴ Eco Adapt. Deliverable N^o 4.4.

⁵⁵ Eco Adapt. Deliverable N^o 3.4.

for community members to express these values through conservation, art, spiritual practice and traditional living, all which may lead to increased attractions for tourism.⁵⁷

1.2

- 4. Waste management at municipal level (1*). This action involves the design and implementation of a waste management system for the two urban areas, Lonquimay and Curacautin. The cooperation of government is needed to approve the funding for such as project.⁵⁸
- 5. Encourage the establishment of polyculture or permaculture plantations (0*). This action will involve encouraging farmers to diversify their fields and adapt a polyculture or permaculture system through educational workshops that outline their benefits and provide farmers with the resources to assist in the transition. By growing a multitude of crops together farmers will become more resilient to factors beyond their control such as the outbreak of a pest, unfavorable weather or changes in market price for a



establishing polyculture.

specific product. At the same time multi-crop system better mimic the natural ecosystem and create habitat for beneficial insects such as bees and other pollinators as well as help increase water residence time. An additional benefit is the increase of agro-tourism opportunities.⁵⁹



6. Develop a recycling system for agricultural water (0*). Recycling grey water is an efficient use of water resources at it conserves water and reduces the load of wastewater treatment facilities. A Recycling system involves separating water used for washing and re-using it before it returns to the drainage system. Initially this action involves designing and implementing demonstrative systems in select households. Then, based on an evaluation of the effectiveness of the

system begin promoting wide spread implementation.^{60, 61}

7. Increase awareness of the importance of water to tourism (0*). Distribution and sharing of finite water resources is the key issue in the Bio Bío and Cautín watersheds located within MFAAM region. Water security and availability is important to attracting tourism

⁶¹ Eco Adapt. Deliverable N° 4.4.



⁵⁷ Eco Adapt. Deliverable N^o 4.4.

⁵⁸ Eco Adapt. Deliverable N^o 4.4.

⁵⁹ Eco Adapt. Deliverable N^o 4.4.

⁶⁰ Eco Adapt. Deliverable N^o 3.4.

as visitors need to have adequate access to the resource for personal consumption as well as for recreational activites such as swimming, boating or fishing. Additional people visiting the area throughout the year may put stress on the availability and quality of water as well as energy demands. Therefore, including water for tourism usage in water management planning is important in ensuring the growth in this sector.⁶²





Photo 40. Promoting awareness of the importance of water for tourism.

8. Water regulation in developing tourism (0*). Developing water regulation in context of tourism will require the cooperation from several groups to decide how these water rights for use will be distributed. Dirección General de Aguas (DGA) will play a role, as it is responsible for implementing water projects, delivering rural potable water as well as distributing water usage licenses. This action requires negotiating with water right owners for fair distribution of water rights and will be

necessary when water demand related to tourism activities begins to increase.⁶³

9. Promoting agro-tourism (0*). Agro-tourism involves hosting visitors in rural homesteads or farms and showcasing the production, harvest and processing of agricultural goods. The hosts must demonstrate a high standard in ethical and sustainable agricultural practices in order to create a draw for tourist. Promoting agro-tourism as a means of additional income generation has the added benefit of improving practices to meet the tourism industry's demands. Eco and eco-agro tourism have been on the rise in recent



years, as visitors are not only looking to site-see but to experience local culture and way of life. A set of resources will be developed to assist farmers in creating a viable business plan and preparing their farm for visitors. These resources can be presented in a workshop that also promotes natural area restoration as a means of attracting tourism.⁶⁴

⁶⁴ Eco Adapt. Deliverable N^o 4.4.



⁶² Eco Adapt. Deliverable N^o 4.4.

⁶³ Eco Adapt. Deliverable N^o 4.4.

3.3. Energizing actions

Finally, through the participatory decision making process two actions were selected as quick steps that would help energize and inspire citizens to engage with the EcoAdapt process. These actions are being performed at a small scale, to both invigorate the process and to test hypotheses. The plan is to scale up these actions when further funding has been secured.

1. Springs and wetland protection. MFAAM in conjunction with SEPADE and local communes in Curacautin and Longuimay have started a pilot project called "Waters for development". This pilot project involves working alongside local communes to fence in two springs and surrounding wetlands, and reforest parts of it with native species. The objective of the pilot project is to better understand the effectiveness of these actions in promoting the protection of sensitive hydrological areas, as well as engage and build capacity with the local communes.^{65, 66}



1.2.

The cost for each fencing is approximately €2,800 (EU). Currently the plan is to enclose a total of three springs, two in Longuimay and one in Curacautin.⁶⁷



called Roraco

2. Reforestation with native vegetation. MFAAM is working in conjunction with CONAF and local schools in Curacautin and Longuimay to reforest recreational areas near school playgrounds. The purpose of this pilot project is both educational, to support student better understanding their local ecology, and for research purposes to better understand reforested species survival rates. The species planted are chosen to recreate a forest ecology called Roraco, which is a combination of oak, raulí, and coigüe. This

forest ecology should improve soil organic matter, create nesting habitat for birds, provide with firewood, create wind curtains, and provide shade in the summer months.^{68, 69} The cost of per school is approximately of €6,500 (EU), which represent a reforestation of about 1000m² per school. Currently the plan is to work with two schools one in each town.⁷⁰

- ⁶⁸ Eco Adapt. Deliverable N^o 3.4.
- ⁶⁹ Eco Adapt. Deliverable N^o 3.5.
- ⁷⁰ Mardones Burgos. 2015



⁶⁵ Eco Adapt. Deliverable N^o 3.4.

⁶⁶ Eco Adapt. Deliverable N^o 3.5.

⁶⁷ Mardones Burgos. 2015

4. Monitoring and evaluation

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Glossary of terms⁷¹

Adaptation

Adjustment or preparation of natural or human systems to a new or changing environment that moderates harm or exploits beneficial opportunities.

1.3.3

Adaptive Capacity

The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Climate Change

Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer.

Deforestation

Those practices or processes that result in the conversion of forested lands for non-forest uses. Deforestation contributes to increasing carbon dioxide concentrations for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present.

Ecosystem

Any natural unit or entity including living and non-living parts that interact to produce a stable system through cyclic exchange of materials.

Hydrologic Cycle

The process of evaporation, vertical and horizontal transport of vapor, condensation, precipitation, and the flow of water from continents to oceans. It is a major factor in determining climate through its influence on surface vegetation, the clouds, snow and ice, and soil moisture. The hydrologic cycle is responsible for 25 to 30 percent of the mid-latitudes' heat transport from the equatorial to Polar Regions

Non-timber forest products

Products of biological origin other than wood derived from forests, other wooded land and trees outside forests. They may be gathered from the wild, or produced in forest plantations and agroforestry schemes.

Reforestation

Planting of forests on lands that have previously contained forests but that have been converted to some other use.

⁷¹Adapted from: EPA. "Glossary of climate change terms," EPA.gov, last modified September 9, 2013, http://www.epa.gov/climatechange/glossary.html



Resilience

A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

1 . The

Vulnerability

The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed; its sensitivity; and its adaptive capacity.

Wastewater

Water that has been used and contains dissolved or suspended waste materials.

Weather

Atmospheric condition at any given time or place. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour-to-hour, day-to-day, and season-to-season. A simple way of remembering the difference between climate and weather is that climate is what you expect (e.g. cold winters) and 'weather' is what you get (e.g. a blizzard)





 Information about the organization that publicizes.



Direction and contact information