Creating and Sharing New Knowledge Through Joint Learning on Water Governance and Climate Change Adaptation in Three Latin American Model Forests: The EcoAdapt Case

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Preface

The EcoAdapt Project (funded by the European Commission under its FP7 Research Programme) is a joint undertaking by four research and five civil society organizations from Europe and Latin America[1], aiming at action-research to enhance local communities' ownership and implementation of innovative solutions for adaptation of the landscape and people to climate change. Engaging with multi-stakeholder platforms in three Model Forests (**www.bosquesmodelo.net**) in Argentina, Bolivia and Chile, respectively, the project focuses on identification and implementation of measures that would enhance water security for long-term local development under the influence of climate change. This type of action-oriented research collaboration is being implemented in a challenging environment of competition between the urgency for improving livelihoods of local people and the need to generate new scientific knowledge.

The underlying principle in the EcoAdapt Project is that all knowledge is valuable, and that both researchers and local actors benefit from adopting a knowledge culture based on joint learning. Researchers learn how to tailor their scientific problem framing, methods, analysis and presentation of results to the context of their counterparts. On the other hand local actors learn about different ways to frame the problem and contribute to possible solutions that scientists can help design.

As the global network for forest science cooperation, IUFRO's role in the project is to facilitate joint learning among stakeholders and based thereon combining traditional knowledge with scientific findings so that new knowledge and insights into the complex realities of the socio-ecological systems related to water and climate change can be generated. This should eventually lead to new qualities in the relation among stakeholders and prepare the ground for joint action to resolve the various problems associated with water and climate change.

This IUFRO Occasional Working Paper provides insights into possible approaches that action-research projects may follow to promote learning among involved stakeholders. It proposes a framework to analyze how learning has taken place during the collaborative work developed in the EcoAdapt Project by participating organizations in the phase preceding adaptation planning in three model forests. A critical factor is to build trust from the beginning of the action-research process, to stimulate a fruitful dialogue and shared exploration and implementation of sustainable development pathways. Learning is also critical in the shaping of adaptive capacities, since multiple uncertainties are increasingly challenging the current state of our knowledge.

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[1] Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Stockholm Environmental Institute, Oxford SEI Ltd (SEI), International Union of Forest Research Organizations (IUFRO), Fundación Internacional para la promoción del Desarrollo sustentable Futuro de Latino América (FFLA), Asociación Civil Bosque Modelo Jujuy (ABMJ), Fundación para la Conservación del Bosque seco Chiquitano (FCBC), Servicio Evangélico para el Desarrollo (SEPADE) and Fundación Centro de Servicios y Promoción Forestal y de su industria (CESEFOR).

It is hoped that the examples and lessons learned as well as insights gained into this project as outlined in this document can help other organizations around the world build their collective adaptive capacity in the face of climate change.

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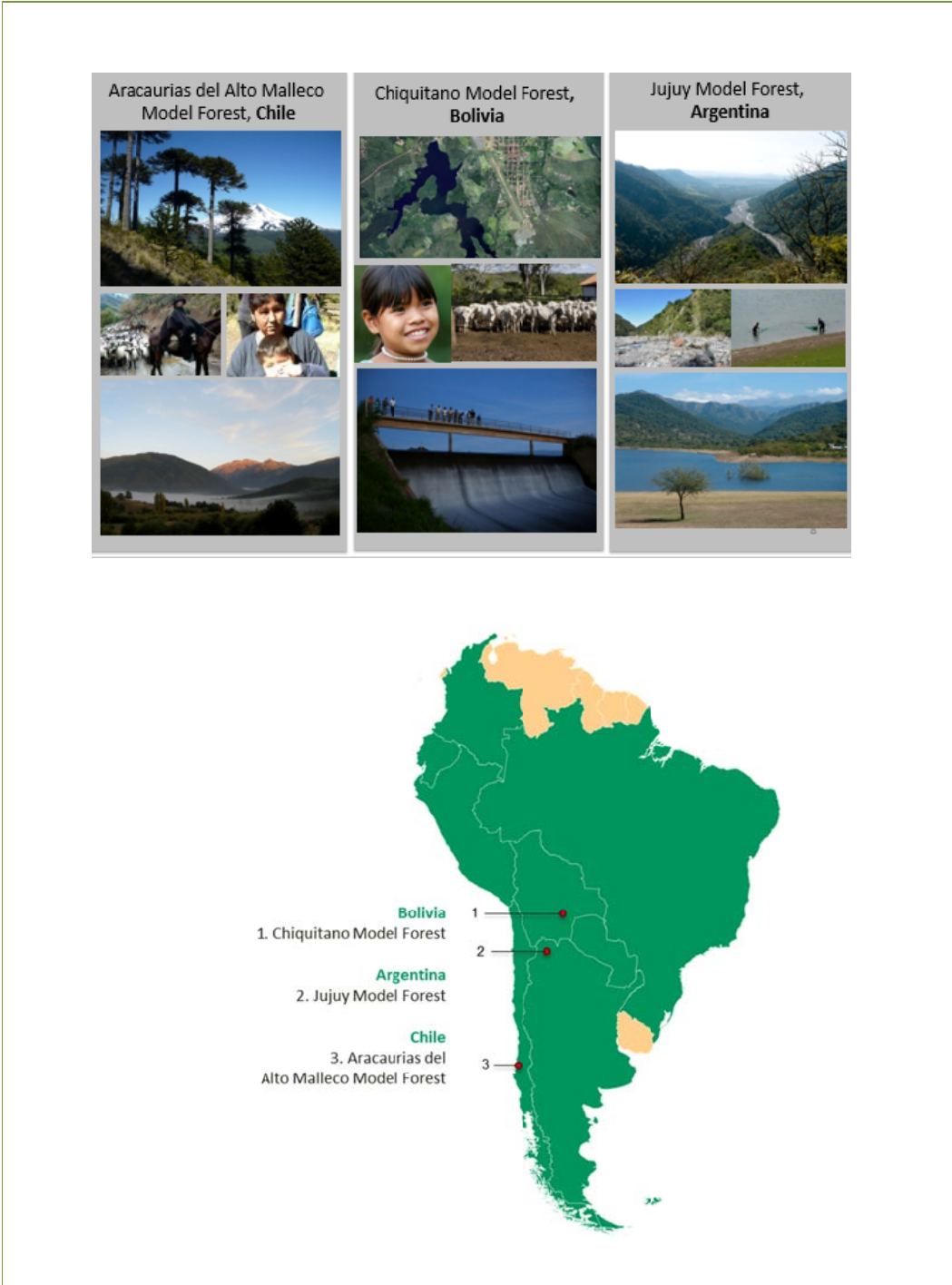
Acknowledgements

Executive Summary

Climate change adaptation is about risk management to secure water, food, fiber, timber and other means of livelihood. Although the management of climate risks is a long-term undertaking, recent climate change trends underline the urgency for active measures in order to improve the resilience of people and landscapes to adverse effects of a changing climate. Traditional knowledge and land management practices may provide a good basis for climate change adaptation, though new science-based information must be included into what people already know, in order to widen the horizon for change and alternative action, thereby creating a solid basis for developing viable climate change adaptation strategies. To this end, it is essential that the complex issue of climate change is made transparent and understandable to all actors involved, representing an enormous challenge in terms of scope, methods used, and required resources.

The EcoAdapt Project: "*Ecosystem-based strategies and innovations in water governance networks for adaptation to climate change in Latin American Landscapes*" aims to develop a viable, sustainable civil society response to environmental and climatic challenges, by combining diverse forms of knowledge and by promoting collective action. This endeavor requires a critical mass of motivated and informed local actors; therefore, joint knowledge development and shared learning from different sources and ways of knowing are strategically important aspects of the project. This paper presents the project's experiences in this respect and compares these with the relevant literature in order to propose a framework for knowledge management and learning.

Learning through the project was initiated through a dynamic process that is already showing positive results, including growing commitments and capacities among the local actors in the three EcoAdapt Model Forest areas in Argentina, Bolivia and Chile, respectively. Interestingly, and in contrast with the project's initial strategy to integrate climate change adaptation into local development, focusing on water security and local development turned out to be a better starting point for collective action and learning than climate change.

The multi-actor platforms were fundamental in generating a learning process which stimulated in turn further learning processes. First, a series of knowledge-sharing workshops were held which resulted in a permanent path of joint learning and engagement. These workshops highlighted the demand for more precise and accessible information which led in each Model Forest to the formation of platforms of multiple "change agents" helping to organize field learning activities. These activities generated some promising outcomes, for example, a common interest and understanding of water as a core component of the watershed ecosystem, and improved awareness of the importance of the community drinking water systems, particularly with regard to physical infrastructure, local management and governance.

Through a broad representation of local groups, these multi-actor platforms achieved a growing legitimacy in their respective local environments, filling a niche by addressing felt needs for local development around water issues. Other positive effects included the mobilization of human, institutional and financial opportunities and resources, an enhanced debate on dissemination of relevant information, and growing trust among actors through a common

language and vision. All this contributed to lowering the barriers between groups and institutions, and reducing future transaction costs. In the long run, this could decrease operational costs and help the community to be more effective in its actions around different issues related to water management.

In addition, the learning outcomes or lessons learned are converted gradually into inputs for strategic development, scaling up, outreach, policy debate, and policy implementation. Distances between the actors diminish; policy-makers get more involved; people become more knowledgeable concerning legal and policy matters and are willing to try to influence these policies or to make better use of them. Improved understanding of water issues and the need for joint action go hand in hand, while the levels of intervention can be better integrated, leading to increased impact.

The above-mentioned outcomes fit well within the conceptual framework for knowledge management and learning proposed by EcoAdapt. At the same time, the project results and framework suggest that there are still a few challenges ahead in order to complete the learning process and establish a sustainable learning cycle. One of these challenges is scaling up interventions at different levels of governance. This is of strategic importance because community-based environmental management has a limited effect and is meaningless if policy-makers do not respond adequately by revising existing policies and regulations.

Another challenge is to integrate policy objectives into ongoing local activities while integrating local interventions into a broader policy framework. The project has been developing interactive learning methods, improving the learning environment and applying different means of motivation. Up-scaling and cross-scale integration should lead to the implementation of improved land management and learning practices at a sufficient level of scale to achieve the desired changes in the socio-ecological systems studied. Generating and sharing new knowledge through joint learning may then set a solid basis for enhanced cooperation, social organization and governance in order to harness synergies and address trade-offs, rather than perpetuating old conflicts and demands around water scarcity and quality.

I   Introduction and Purpose

The EcoAdapt project "*Ecosystem-based strategies and innovations in water governance networks for adaptation to climate change in Latin American Landscapes*" aims to facilitate the development of a viable, sustainable, civil society based response to environmental and climatic challenges on water resources, based on the following three pillars:

1.   The conservation and restoration of Watershed Ecosystem Services (WES) for climate change adaptation and local development,

2.   Innovation in water governance processes, with regards to the access of water among users and uses, and conflict resolution to reconcile different interests and points of views, and

3.   The co-creation of knowledge and building of a critical mass of well-informed people who are committed to achieve the project's vision. The implementation strategy in Figure 1 illustrates that to move towards the project's vision, there is a clear philosophy and strategy in place with a defined sequence of stages and steps to be undertaken:
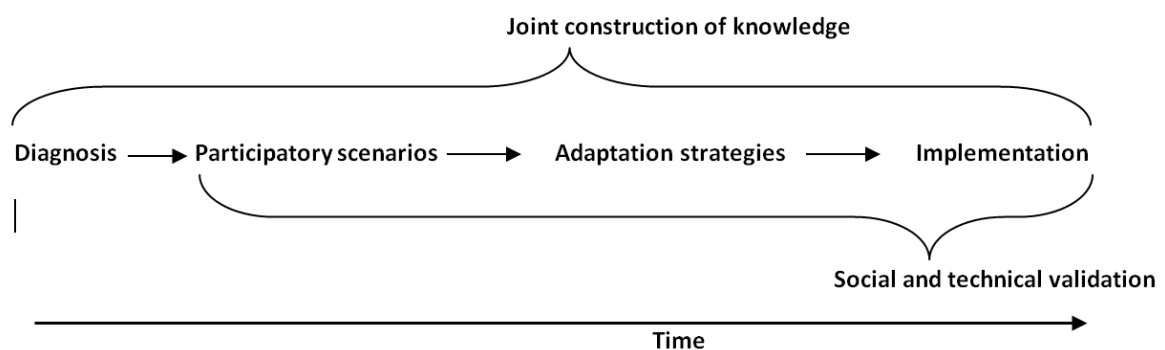
Figure 1. Philosophy and strategy of EcoAdapt

This diagram also shows that the joint construction of knowledge constitutes the backbone of the project.

The construction of shared knowledge involves the integration of diverse types and sources of knowledge in order to achieve the changes sought by the project. In line with this, knowledge is not "transferred" but "co-constructed". Within the project, multiple actors worked together to understand and interpret reality and development practices from various angles, disciplines and ways of knowing, thereby creating a critical mass of individuals that are committed to move forward in the same direction. This process represents the 'theory of change' or the roadmap for project implementation.

In the EcoAdapt philosophy and practice, **everyone learns and must learn**: the project designers and managers, the donor and evaluators, the various partners, teams and leaders of the three Model Forests (MF) and the locally relevant actors of these areas.

In this paper, the authors will discuss this process of joint learning with main focus on:

- how initially high transaction costs can pay off once benefits become more evident;
- how trust is established among parties with quality two-way communication channels;
- how all actors end up speaking a common language; and
- adopting a clear and shared vision about where they want to go and how to get there. In this context, the purpose of the paper is to:

1. Summarize and analyze the processes and outcomes of joint learning and knowledge development in which the associated partners of EcoAdapt engaged during the project; these processes concern the use and management of water resources by the different stakeholders in specific watersheds, in the context of climate change and local development.

2. Contribute to building a broad framework for knowledge management and learning, based on the experience with these processes.

The authors discuss how these experiences led the project team to adjust its original entry point, adaptation to climate change, in order to focus more specifically on the access to clean and sufficient water. In addition, drawing on the experiences during a series of workshops conducted in the first two years of the project, the authors describe how the process of joint knowledge building influenced the research methodology and thematic emphasis of the debate. This process is then being compared with the relevant literature and a broad conceptual framework for knowledge management and learning is being proposed.

Furthermore, this paper shows that the project, even though in an early stage of joint learning at the time of writing this paper, had already accumulated knowledge and that its outcomes were being used as valuable inputs for policy debate.

II   Theories and Concepts of Joint Learning and Knowledge Development

In this chapter, the different components of the project learning processes are outlined, compared with the literature and analyzed for their contribution to build a sustainable learning process.

a) What is Learning All About? The Wheel of Learning

Learning is considered a continuous process, where knowledge that was previously generated may lose its weight due to new information or to a new way of interpreting existing information (Kuhn 1962).

Kolb (1984) argues that learning occurs in a cycle of four phases: 1) the concrete experience (learning by doing and applying what we have learned from our own experience), 2) reflective observation (learning from observing and critically assessing the social and ecological response to actions), 3) abstract conceptualization (learning by determining underlying relationships, principles and rules), and 4) active experimentation (testing hypothesis derived from the abstract conceptualization). If this last phase is followed by new concrete experiences, the cycle is complete and starts all over again, while getting stronger by building on the previous learning experiences. This recurring process is called the learning wheel Senge (1990).

Despite its limited timeframe, EcoAdapt was designed to complete at least one of these cycles of learning (Figure 2) with all of its four phases and to strengthen local stakeholder platforms to such an extent that the learning wheel would keep moving beyond the project's life span. . Thus it was necessary to identify the conditions needed in order to ensure that the learning wheel would keep moving.
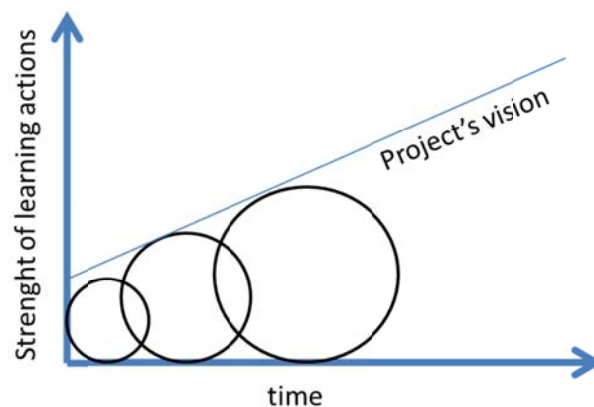
Figure 2. The wheel of learning, adapted from Senge, 1990

b) The Concept of Meaningful Learning

In EcoAdapt we concentrate on the concept of **meaningful learning** (Ausubel 2000). This means building on what people already know, but want to understand better, taking into account their interests and aims. This type of learning implies that the emphasis is not so much on teaching but on facilitating the learning process and the assimilation of new concepts, approaches and tools.

Values and attitudes of people should be incorporated into this learning process because people are generally motivated by their values, their interests and their aspirations. In addition, as history has shown, science without ethics can have very harmful effects.

Indigenous knowledge is a good example of knowledge in which the ethical dimension is not separated from the cognitive one, and is being expressed in values and behaviors such as respect and reciprocity between people and their environment, which we can find in the concepts of *Pachamama* (Mother Earth), *Apus* (sacred mountains) in Andean communities, and *Ichi* in the Chiquitanía[2] worldview. It is certainly not easy to integrate indigenous worldviews with science; however, these conceptions of the world are consistent with underlying values in science aimed at protecting our environment and planet (Parrotta *et al.* 2012, Nakashima *et al.* 2012). At the kick-off meeting of EcoAdapt held in Bolivia, the participants adopted a comprehensive meaning of knowledge as including "Knowledge, Skills, Behaviors and Values" (De Melo 2011). The importance of the motivations driving the learning process was stressed, and learning was conceived as an ongoing process, responding to new stimuli which constantly push away the "frontiers of knowledge" (such as opportunities, scarcity, threats, stress, see Figure 3). Hence, learning must be seen as an ongoing and evolving process taking place in an upward spiral-like process.

c) What Is The Motivation Behind Learning?

In contrast to the education of children, which focuses more on behaviors and on how to make good decisions in the future, the education of adults is meant to help them adopting new criteria and tools by receiving fresh new external information to make better decisions in a constantly changing world (Vorley *et al.* 2013). Hence, new knowledge must be inserted in what they already know and have learnt in their life and should prepare them for new challenges and opportunities. The EcoAdapt learning processes focus mainly on adult education[3] and group learning. The latter includes individual learning but also learning in networks and communities (Wenger 1998).

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[2] The *Apus* (Quechua Word for Grandparents) are sacred mountains with white heads because of the snow, to whom villagers pay tributes because they provide water. The *Ichi* in the Chiquitania region is an animal or other being that protects a lake or water reservoir, preventing it from drying. In both examples, there is an underlying concept of the value of protection and caretaking, and the need for a proper balance and reciprocity between human activities and nature, which has a soul in the indigenous worldview.

[3] This does not mean that there are no activities aimed at young people. In the Jujuy Model Forest there are many activities with local students promoting reforestation, which also involves the parents. In general, there are many communication channels between parents and children: the transmission from parents start at an early age and is mostly about traditional knowledge. In our globalized world, information and skills (such as technological) sometimes move the opposite way, from children to parents, as is the case of Facebook and other digital means of social communication.

In his *liberation pedagogy*, Paulo Freire (Freire 1970), stresses the importance of learning to empower the poor and excluded groups of society, by promoting their inclusion and emancipation according to their rights, aspirations and potential. In the context of the livelihoods approach (e.g. Bebbington *et al*. 1999) and the community capitals framework (e.g. Emery and Flora 2006), learning contributes to the formation of social and human capital, seen as essential to strengthen access to the other capitals or resources, and therefore leading to improved well-being.

Learning is driven by motivations, interests and aspirations to achieve a desirable change, such as secured and improved livelihoods, maximized use of assets, cost-effective and environmentally-friendly production, conservation and restoration of natural resources, risk management, adaptation to climate change, and so on. The primary motivation to acquire new knowledge and skills is to guide our decisions and actions towards a desired change. Therefore, poor people tend to be driven mostly by their immediate need to secure food, water and livelihoods under circumstances of environmental and climatic uncertainty (or other factors of stress such as fluctuations of market prices).

There is a clear relationship between learning and decision-making. To transform reality and solve problems, informed decisions must be made and appropriate and timely actions have to be taken, and these require a solid base of knowledge and skills. This is expressed among others in the theory of Keeney (1996) that decisions rely on already existing knowledge combined with new aspirations.

Feedback is crucial to learning. Feedback gives a signal about the adequacy of actions taken and decisions made to enact the types of changes desired. Thus, critical reflection on the actions carried out is key. To get more out of it, **the process of learning and acting must be iterative**.

d) Responding to Threats and Opportunities

The combination of stress (i.e. problems to solve or barriers to overcome) and the occurrence of new opportunities is "fertile soil" for experimentation and innovation, in particular when outside facilitation and support are available. Problems lead to curiosity, fact finding and solutions to reduce situations of stress and secure livelihoods. If people are able to find effective and practical solutions to specific problems, they increase their adaptability and become more proactive and resilient. Situations of stress and scarcity within a farm community may be: impoverished soils, insufficient water retention, lack of forage for the animals in the summer. Opportunities may be: new Information on alternative agricultural practices; participation in farmer field schools; developing farm-ordainment plans. These situations of stress, scarcity or opportunities may generate new aspirations or a desire for change. If well channeled, supported by a continuous and meaningful learning process and coupled with the necessary resources, these can lead to innovation, improved practices, including modifications required to reduce climate risks and more secure livelihoods. See conceptual map in figure 3.
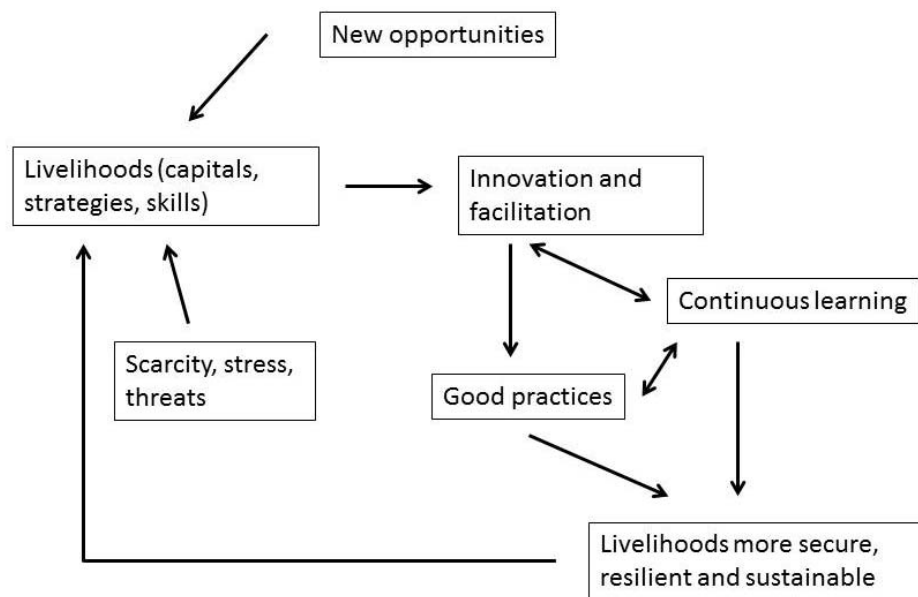
Figure 3. The interaction of stress and opportunities that trigger innovation and may lead to continuous adaptation (adapted from Prins *et al*. 1999).

e) The Constructivist Approach to Learning

Learning is essential for society's adaptation to climate risks. As mentioned above, the concept of meaningful learning is used as a basis for the development of the learning process. The starting point is to recognize and integrate different types of knowledge, since what one already knows can be combined with new sources of information. Both the climate risks and the effects of learning outcomes on responding to these climate risks are uncertain. Thus, action and reflection also need to be integral parts of the learning process (see for ex. Kolbe, 1984). In the practical context of EcoAdapt, this process is similar to the "situated learning process" proposed by Lave and Wenger (1991), where knowledge is co-constructed in the same context where it is being applied. In this section, the authors describe this and other aspects of the learning process as applied in the Eco Adapt Project.

The theory of meaningful learning indicates that what a person already knows and wants to understand better is the "*most important single factor influencing learning*" (Ausubel 2000). This embodies the constructivist approach to learning and it builds largely on the theory of Jean Piaget - the great scholar of cognitive development -, who states that people learn by assimilation and accommodation (for ex. Bodner 1986). Learning by accommodation implies adapting old knowledge to new information and ideas. This is a more difficult process than assimilation and sometimes even traumatic because it implies unlearning rooted ideas which sometimes may go against common

wisdom.[4] It is well known that often people filter new information so that this will be in line with established old ideas, which can be a barrier to widen the 'frontier' of knowledge[5].

Adaptation in life and also to climate change, conceived as a process of meaningful learning, implies assimilation and accommodation, i.e. to combine various sources of information: integrating what we know, based on observations and own experiences and adding to it fresh information from other sources, to widen and deepen understanding. This process is further enhanced if adjustments are made continuously, according to what is learned through reflecting on the activities, similar to the previously described learning wheel or spiral (Figure 2).

This form of planning, implementation, monitoring, feedback and adjustment fits well with the spirit of action-research, which is to test new ideas, strategies, methods and tools to improve the effectiveness of the actions taken in order to solve concrete and complex problems. This was demonstrated for example in the CATIE FOCUENCAS II watershed program (Kammerbauer *et a*l 2011; Leon and Prins 2010). By defining concrete goals, questions to be investigated and work hypothesis to be validated, and by regular reflection and adjustment of activities, good results were achieved, both tangible (e.g. protection of water recharge zones, environmental sound production technologies, management by watershed committees) and intangible ones, i.e. with respect to joint learning and knowledge development. Lessons from other programs at the watershed and landscape scale point to the same. Research results about forest management governance emphasize the importance of building experience through taking concrete steps around specific problems in order to accumulate experience and prepare the ground for addressing larger and more complex issues (Rayner *et al.* 2010). Cashore, Galloway *et al*. (2001) postulate the same incremental approach of adaptive management.

A similar way of thinking is expressed in the SLIM framework (*Social Learning for the Integrated Management and Sustainable Use of Water*)[6], as displayed in Figure 4, where changes in practices and changes in understanding together bring about transformation and concerted action. In addition to assimilating completely new issues, learning occurs when people change their understanding of an issue, change their practices (accommodate) accordingly and thus transform their reality.

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[4] The most famous example in history comes from Galileo. His reasoning about the Earth spinning around the Sun (and not the other way around) caused his imprisonment.

[5] This explains the resistance of a number of politicians and citizens to accept the scientific evidence of climate change.

[6] The SLIM program is a systematization of a series of projects and experiences in water and watershed management in several European Union countries, see also https://sites.google.com/site/slimsociallearningforiwm/.
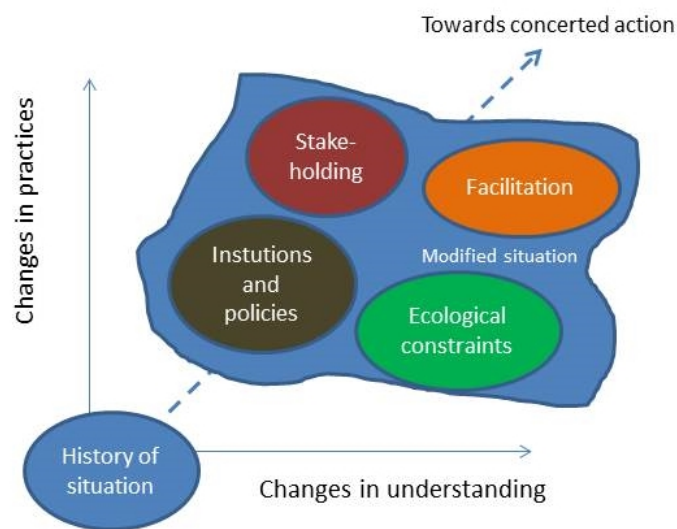
Figure 4. The development of shared understanding among relevant stakeholders and changes in practices must go hand in hand, so that reflection and action will strengthen each other and contribute to the desired change and concerted action at a watershed scale (adapted from The SLIM Project 2004).

The EcoAdapt Project integrates this adaptive management and action research approach in design and implementation. A good example of both the need for adaptive management and the effect of it arose right at the beginning of the project. During the first planning workshop (see project timeline, Figure 7), in which the eight project partners participated, the project's learning methods and research strategy were discussed. After an initial summary of current practices and understandings of methods and concepts, it turned out that there were significant differences among partners in methods, definitions, priorities and interpretations of what it means to co-generate knowledge. All of them were, to some extent, entering into a new territory, either in terms of learning methods or in terms of thematic areas: of the local partners, only the Jujuy Model Forest had worked with water governance and security issues in the past, although all partners agreed on the importance of this issue.

As a result of these discussions, adjustments were made at the very beginning of the project lifecycle, redefining responsibilities and budget allocations. A bigger part of the implementation activities were assigned to the local partners and an attempt was made to re-define the general issue from local perspectives. This was done by integrating indicators into the project's monitoring system to address changes in perceptions of these issues by the different groups of actors. In addition, a steering committee was formed with representatives of all partners to ensure frequent reflection and reaction on the changing conditions within project areas, and promoting joint learning among the different project partners.

At that point, the project was no longer "about" learning as it became a "learning project" itself. As a matter of fact, the exchange of experiences, skills and knowledge occurred at multiple levels, from the practitioners in the field and the technicians in the study areas to the external facilitators, with consequences for the project as a whole.

f) A Fruitful Interface and Environment as Crucial Ingredients of Joint Learning

In general terms, joint understanding and action requires carefully managing the interface between specialists, technicians and producers, with regards to interests, points of views and skills. The English sociologist Norman Long focused on this interface and analyzed it as part of his theory of rural development (Long 2001). He conceived reality as an arena in which a variety of actors share objectives and particular projects. The government (national and local) seeks to apply its policies in society, while civil society seeks to influence government policy. A development agency seeks to promote change e.g. with farming families according to the agency's mission, through their technicians or facilitators. At the same time, families and the community have their own aspirations and projects (non-written), to which they expect the agency and technician to contribute. The facilitator is the interface in this example.[7] Long refers to these situations as *''encounters at the interface''*.

The concept of "interface" is quite similar to the concepts of ''bridging actors'' and "boundary organizations", which also point to the need to close the gap in perspectives, knowledge and actions of different actors around a specific problem. Vignola *et al*. (2013) analyzed the case of a project operating at the scale of a sub-watershed in Costa Rica, which sought to reduce the impact of erosion on soil fertility by the producers in the upper part and increase the timespan and functioning of a Hydropower company in the lower part of the watershed. This study highlighted the important role played by an organization which provides technical assistance to producers. Their technicians are "bridges" for facilitating two-way information, joining forces and achieving a shared understanding of the problem and of the interventions needed, for being accepted and trusted by the producers and communities, for speaking a common language and for acting as an interface between local people, policy-makers and scientists. Trust and the quality of communication between institutions and local actors in a project is a key to successful implementation. In the process of generating conditions for joint action towards resolving a common problem, partners involved have to negotiate a common agenda, define different points of view, complement different skills and roles, and get the right balance of costs and benefits. Therefore, the successful implementation of the learning processes requires an environment that stimulates attitudes and conditions such as: curiosity, empathy, assertiveness, respect, trust, shared language, common interests (Roux *et al*. 2007). All this is expressed in the notion of constructivism, appreciative inquiry and the joint creation of knowledge. Moreover, it is also to be considered that actors have different perspectives and interests, so that the challenge in natural resources management is to find a common ground and goals despite varying interests and views. The challenge is to convert initial divergence into convergence of understanding and purpose. This is also a major challenge in the participating Model Forests and among the project team as a whole. While in the Model Forests this is addressed in a general way and in relation to the management of natural resources through the creation of the Model Forest platforms and Boards, for the purpose of project implementation, more local platforms were created to serve as agents of change, enriching the learning environment.

A practical stepping stone for the creation of these platforms for joint action and joint understanding of climate change adaptation is to invert negative phenomena into positive ones. Common '*bads*' such as fire, droughts, floods and other threats are good entry points for building common *goods*: platforms for collective action to reduce the risks.

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[7] Interface has different meanings: being understood, being compatible; enabling common ground to reach an agreement for mutual benefit.

g) Summing It All Up: The Flow Chart of Knowledge Management

The concepts of joint learning and knowledge development used by the EcoAdapt Project and which have been explained above, can be summarized and visualized in the flowchart presented in Figure 5. This flowchart will be used as a reference in Chapter IV, in order to describe and discuss the learning processes and their outcomes in the project.
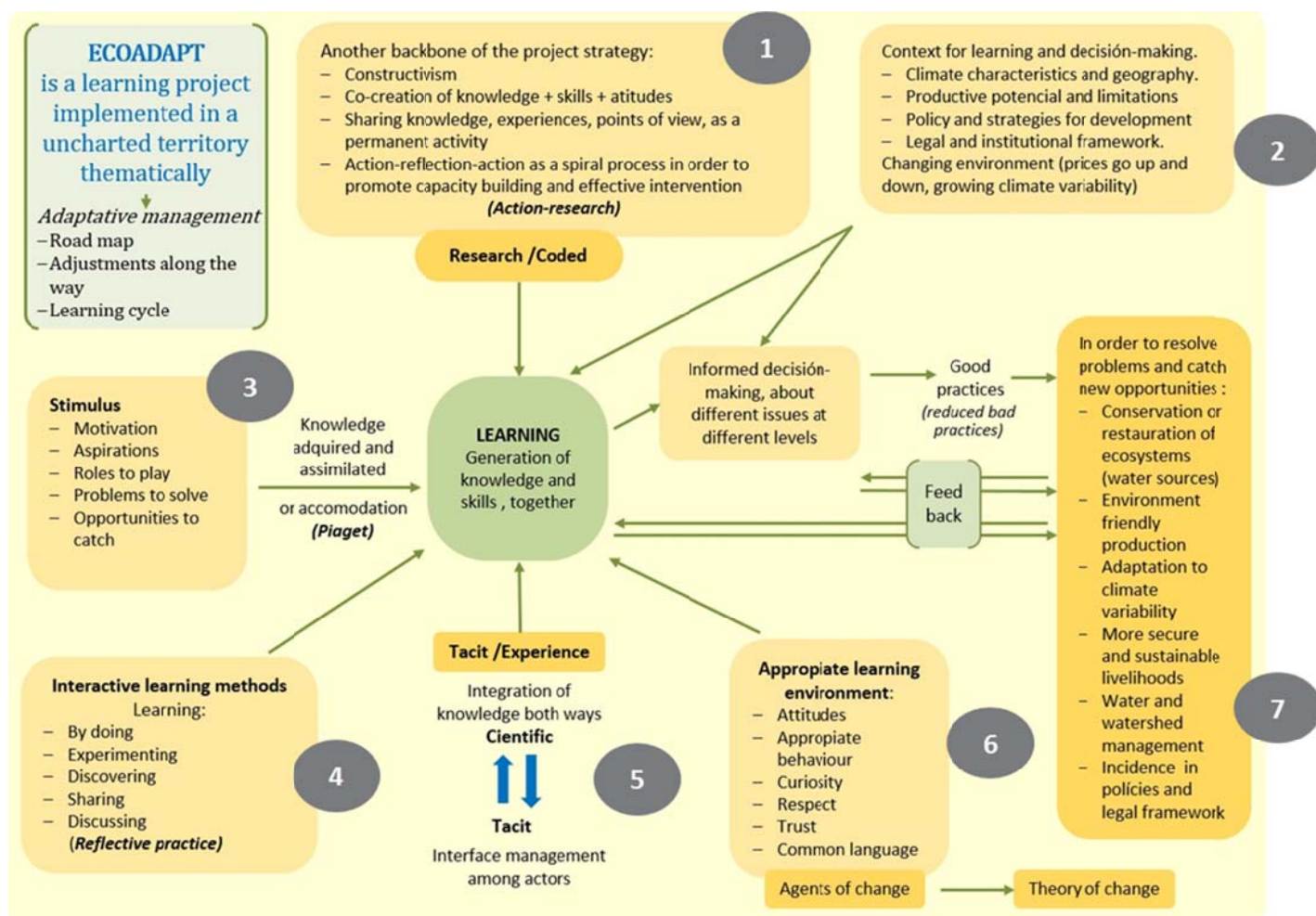
Figure 5. Flowchart of learning for adaptive management in the context of climate change.

[1] Project strategy; [2] Context for learning and decision making; [3] Stimulus; [4] Interactive learning methods; [5] Explicit/tacit knowledge integration; [6] Appropriate learning environment; [7] Problem understanding and decision making.

III   The Case of EcoAdapt: Learning for Adapting to Climate Risks and Improving Water Governance in three Model Forests.

Adaptation is a process of constant learning. Improved understanding on how people learn under particular conditions can help design appropriate adaptation strategies. The EcoAdapt Project was envisioned as an ecosystem-based adaptation project, centered on improving water conservation and governance and on reducing the risk of conflicts around the management and use of natural resources, in relation with climate change. Even-though the project did not specifically focus on forests and trees, its learning experiences are still extremely valid for projects where forest management is the core issue. Indeed, Model Forest themselves are not only about forest management, but about all the interconnected issues surrounding a large landscape.

How did this learning process happen in EcoAdapt?

After introducing the project's timeline, we will first review the context for learning and decision-making and present some of the interactive learning methods employed, as well as the methodology to integrate existing types of knowledge. We will then examine the main learning and discussion outcomes which took place during the mini-workshops and some of the findings gathered during the synthesis workshops. Finally, we will describe the process of meaningful learning in which the project engaged after completion of all these learning activities.

Figure 6. EcoAdapt in action: Participatory workshops were conducted at all stages of project implementation. The very first planning workshop helped to define the project's vision and theory of change.

The EcoAdapt project is based on a clearly defined theory of change. During the first planning workshop with all partners, the general aspects of the project's theory of change were agreed upon (Figure 6). The project strategy and phases of the change process were then outlined to support project implementation. Knowledge gaps were identified, and research methods were adopted in response to these gaps and in order to establish a benchmark for further actions. This initial phase concluded with a series of mini-workshops and synthesis workshops which in turn conduced to the planning and implementation of a great quantity and variety of awareness and training events and methods (processes, visualized in the timeline of Figure 7).
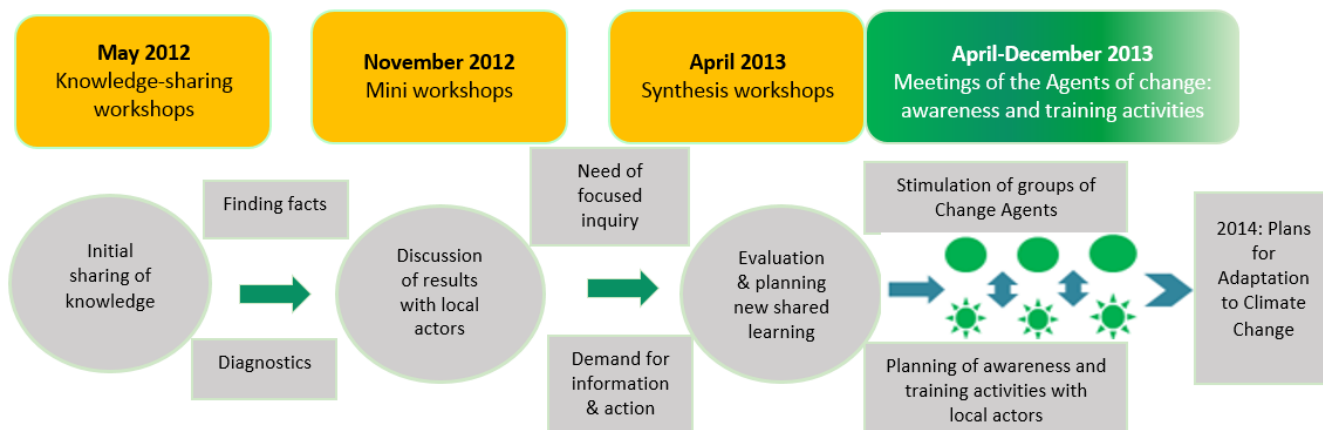
Figure 7. Timeline of EcoAdapt activities

This time line is linear, but as described in the previous chapter, learning is a continuous process that evolves in loops (i.e. learning wheel). For instance, after the initial diagnostic phase and in relation to awareness and training activities, the inquiry process continued concerning local climate change knowledge and practices, water resources, and forms of local cooperation. The information collected was enriched, concretized and made available to the local stakeholders through more interactive ways described further in this document. At that stage, the project methodology started to involve more and more action-research, incorporating action, reflection and adjustments to project activities (backbone of project strategy, see number 1 in Figure 5) and adaptation plans (part of the feedback in Figure 5). Following more or less these same processes and field learning activities in the different project sites helped the partners to come up with locally appropriate solutions for the different socio-ecological contexts.

a) Context for Learning and Decision-Making

During the first workshop in May 2012, in which only project partners participated, a wide range of topics and methodologies were addressed. It was during this workshop that the existing knowledge about the reality and problems of the three Model Forests was captured and mapped. It turned out that the Jujuy Model Forest team knew more about water and watershed issues because they had worked on irrigation issues, while people from the Araucarias del Alto Malleco Model Forest had more of a legal perspective on water issues while in the Chiquitano Model Forest, this was a whole new topic because they had more experience in other issues such as land use planning and processing of non-timber forest products. With regards to climate change, the level of understanding was similar in all Model Forests as people seemed to know well the anthropogenic causes of environmental problems related to climate change, but had not really analyzed local impacts and adaptation issues, although there was a common feeling that tensions might arise in the future as a consequence of climate change and increasing water scarcity.

In addition, it was mentioned that in all three Model Forests a large number of existing environmental laws are not being applied and that it would be necessary to improve environmental governance.

b) Interactive Learning Methods

Since project partners didn't know each other, the initial knowledge-sharing workshop was useful to exchange about the different methods they used for interactive learning. These included addressing problems and defining concepts through brainstorming; walking with a partner to share concerns and ideas; performing a forum theater to debate situations that could emerge during the project; organizing a knowledge "fair" to exchange information and negotiate mutual support; setting up a role play (e.g. a trial about ecosystem services) and others. The knowledge fair was one of the most effective and stimulating methods to get stakeholders on the same page and to link knowledge demand and supply. Other methodologies were considered useful for different situations and publics, and all were considered relevant to the project. Experts were identified to strengthen the partners' capacity in relation with the use of these learning methods.

Further in the process, during the "mini" workshops, issues related to water governance and climate change were discussed in working groups, composed of representatives from various sectors, employing a variety of participatory tools such as posters with qualitative data tables and pie charts with quantitative data summaries, generating questions to encourage discussion, use of cards, among others. The variety of resources was useful for communication and the exchange of ideas, and allowed the expression of ideas from different perspectives and in different formats, orally and in writing, enabling different types of participation. Visual and oral information was more easily absorbed than written data. The participants from the Jujuy Model Forest used metaphors to express the idea of cooperation, such as the image of mountains and ships to express the idea of barriers to and opportunities for cooperation.

Regardless of the learning method used, it turned out that people felt more comfortable to express their ideas when they were in their group of peers (i.e. farmers or indigenous people) while a mixed composition of sectors contributes to the exchange of thoughts and information beyond the group of peers (importance of the learning environment). In our experience, the best approach is to combine both and organize first a discussion in the group of peers as preparation for the discussion in mixed groups. This also helps to prevent that only well-informed people dominate the debate.

Interestingly, two CIRAD researchers introduced the method of participant observation in order to properly register and interpret the attitudes, behaviors and interactions between individuals and groups in the mini-workshops (Jankowsky and Sabourin, 2013). The method implies a series of indicators and procedures that should be observed by an interested outsider, based on guiding questions during the knowledge exchange and debate in the workshops such as: *Is the information clear? Do you agree with it? Does it bring something new? What are the topics that generate most discussion? Who are most outspoken? Who are close or distant in their way of thinking?*

Experience in the field has shown that the method of external observation must be complemented with a "reflective participation" by the local actors themselves. This is where local stakeholders become directly involved in knowledge generation by sharing their own experience with peers and interested third parties (via storytelling, field days and in situ exchange of experiences). This kind of exercise sharpens their observational capacity and enriches the interpretation of their own reality with new points of view. It also improves their self-esteem and decision-making skills.

Valuing tacit knowledge (i.e. knowledge that is transferred from generation to generation, learned in practice and through social interactions) is instrumental to reflective participation: this knowledge can be integrated with scientific knowledge via interactive methods such as testimonies, in-situ exchanges, designing and discussing maps and transects, and acting out local situations (role play, theater). It is less extractive and more proactive than carrying out interviews (such as in the diagnosis phase), and therefore consistent with the philosophy of co-creating knowledge. It involves gathering new and useful external information in a friendly manner, and the systematization and documentation of local experiences. A good illustration of this is the 2013 training plan of Aracaurías del Alto Malleco Model Forest which included presentations about the National Water Code in combination with field visits and case studies to reveal possible paths for the regulation of water rights.

During the learning process, the EcoAdapt team also concluded that there was an overuse of the "workshop" format for debate and formation of opinions. Therefore, in the following project phase, the methodology and didactics were enriched with instruments such as focus groups and field trips, among others.

c) Integration of the Existing Knowledge and Visions

Before the project even started, it was clear that even among project partners it would be necessary to integrate the existing knowledge. The first workshop was thus oriented towards knowledge-sharing about each of the project sites (Model Forests). The researchers explained key concepts, as well as approaches for mitigation and adaptation to climate change and how these relate to human factors. These concepts and approaches were then discussed from the different experiences and perspectives of the project partners, matching tacit with scientific knowledge, to even out the information among participants. This integration of knowledge supported the development of the project's theory of change.

The vision defined as part of the theory of change was the formal stimulus for learning, although individual partner organizations and beneficiaries may have had their own implicit motivations to join the project. Some sought greater academic status or were interested in solving very specific problems, while others were more interested in the opportunities that working with project partners could create in the future. One of the great challenges of the project has been to merge these different aspirations and motivations to find an efficient road towards the project's vision.

The integration of existing knowledge was accomplished throughout the project. At the beginning, partners mutually agreed on data collection methods and on the prioritization of research activities. According to the different learning contexts, data collection methods varied slightly, although the research objectives remained the same. The partners had to play an important role in the design to ensure that, in spite of local differences, there was a minimum body of information comparable between the study sites. This was not an easy task. It took quite some time, for example, to communicate and agree on the content and procedures for the interviews, including the organization of the information gathering and analysis.

Knowledge integration includes incorporating new ideas and information into what people and groups already know so that they can be fully absorbed (for instance integrating new information into existing practices related to fire management conservation or climate change adaptation). It also entails discarding old ideas that do not match the new information received. An example of this is the relationship between forests and water. There is a widespread

view that more forestation means more water production. However, it is unclear to what extent this is true and if this applies in the project sites, or what are the critical parameters for water retention, restoration and regulation of the water cycle, and to what extent it contributes to climate change adaptation. In this respect, project partners are asking the scientific community to inform the debate by making available existing information or generating new, locally relevant information in collaboration with the local partners.

Building cooperation among project partners is a proven strength of EcoAdapt, but this comes with a price. Transaction costs tend to be high at the beginning, particularly because so many different partners were involved, that a certain amount of time was needed to learn to cooperate and to develop a common vision and language, discovering a road to walk together and walking the talk. There were fruitful interactions as well as some stressful situations. Trust, chemistry, mutual appreciation, a common language and understanding are essential ingredients for building successful cooperation (as part of an appropriate learning environment, see Figure 5, number 6). The co-construction of knowledge in EcoAdapt is instrumental, but joint learning can be slow and tedious since learning also implies a lot of un-learning and readjusting of previously acquired knowledge. However, in the end, not investing in it is considered to be more costly because it can prevent the achievement of the desired changes.

New knowledge was also co-constructed with local stakeholders. About halfway through this process, a restitution of the findings took place in all three sites; this was partially done through local "mini" workshops and later through broader synthesis workshops which encouraged cross-learning between Model Forests. The central aim of the mini-workshops was to share, validate and enrich the knowledge generated in the first phase and to lay a foundation for the next ones. The main objective of these workshops was *the creation of shared knowledge as a basis for developing joint actions in line with the vision of Model Forests and EcoAdap*t, while the central issues were climate change, cooperation and governance (see the example in Boxes 1 and 2). An important lesson learned of these mini workshops was that one can pique interest and create curiosity during a workshop but hardly reach a minimum level of understanding and commitment, especially if the issue is complex and new, so the best approach (which was adopted later) is to generate curiosity and a desire to continue the process through both entertaining and instructive activities (strengthening both the stimulus and the learning environment, see the flowchart in Figure 5).

A common point of discussion in the workshops was the need to build more trust between stakeholders to improve collaboration. This lack of trust might explain the absence of certain stakeholder groups in the meetings (for ex. the cattle ranchers in the Chiquitano Model Forest, Box 1), and was mentioned as an obstacle in the Jujuy Model Forest for collaboration between local stakeholders and public authorities (weak presence and involvement of the latter).

During the workshops, in general, participants asked for more precise or wider information on certain topics, leading to a systematic (re)planning and implementation of field learning activities, channeled through the newly formed multi-actor platforms.

Box 1. Learning through mini-workshops in the Chiquitano Model Forest, Bolivia

In the Chiquitano Model Forest, the mini-workshops triggered an interesting learning process

- *The paramount importance of the conservation and restoration of water resources was unanimously recognized. It is interesting to note that this recognition was made from different perspectives and interests: on one hand, urban groups and municipal authorities are interested in maintaining and restoring the dam that supplies water to the urban population of the municipality of Concepción and the Zapoco watershed, while on the other hand the rural communities are not interested in it because they do not benefit from the dam, they do not have access to water in sufficient quantity and quality and the rural drinking water infrastructure is in poor condition. Therefore, building bridges was essential to bring together diverging perspectives and interests and enable a shared watershed management approach.*
- *Another characteristic of the area is that communities are scattered and have relatively little contact with one another. Therefore, one of the first tasks has been to shorten this distance by creating a common vision where the different interests and perspectives could be shared and developed.*
- *A new municipal land use plan aroused quite some interest, although its implementation remains to be desired.*
- *A crucial issue which was nearly absent from the discussions, was the role of livestock in water issues and watershed management. The person who put this into discussion was a progressive cattle rancher and former mayor of Concepción.*
- *The issue of climate change proved to be incipient and still poorly internalized. Therefore, it must be linked with problems which are already being perceived by the communities, such as deforestation, drought and fires.*

The strengths and weaknesses of the mini workshops were analyzed afterwards and the lessons which emerged from this analysis were assimilated and used to improve further events, such as the synthesis workshop and a series of successful awareness raising activities among stakeholders.

d) Learning from the Mini-Workshops: Convergence and Divergence in the Understanding of Key Topics Among Local Actors

Key Learnings about Climate Change

The views on climate change were mostly related to visible and felt problems, such as droughts, fires, floods, late arrival of the rain for crops or more intense precipitation in less time. The views were based on direct observations or acquired through other means (television, radio, newspaper, training events).

There is a widely shared feeling among the local actors of the three Model Forests that the weather has become more erratic and unpredictable, making it more difficult to plan production based on past experiences and knowledge. In other words, the risks have increased and the livelihoods of farming families have become less secure.

People agreed that climate change exacerbates problems of anthropogenic nature. During the initial workshop, climate change was correlated with the increased occurrence and frequency of drought, wind and fire. Fires are the events that most successfully mobilize government institutions, producers and communities for joint action[8].

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[8] In April 2013, there was a well-attended activity in Santa Cruz around the implementation of a defense platform against Wildfires (Source: FCBC bulletin)

In Aracaurias del Alto Malleco Model Forest, people imagined the consequences of climate change with a more distant future in mind, mainly because water scarcity due to climate change is not yet very visible or being felt. During the group discussion, the emphasis was mostly on land use change, on the increased demand of water for more uses, as well as on the lack of equity in the access to water and in policy-making (called "legal stress"). The Aracaurias del Alto Malleco Model Forest was the one to coin the expression of *winners and losers of climate change* (Box 2).

In general, there was more debate on which steps should be taken in the future than on what was already being done in terms of mitigation and adaptation. There was little discussion on traditional strategies of farmers and communities to manage risks of climatic events in the interest of food security. The literature, however, highlights the value of capitalizing more on traditional knowledge and practices. For instance, in the Aracaurias del Alto Malleco community of Lonquimay, the Mapuche communities move their cattle in the summer to the Andean highlands for grazing, which is a traditional practice to secure the forage of their animals, and a way of managing

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Box 2. Learning about water in Aracaurias del Alto Malleco Model Forest, Chile

In Aracaurias del Alto Malleco Model Forest, there was a comprehensive and precise reconstruction of the changes in water use over the past 30 years, including the production of electricity, changes in land use and patterns; irrigation projects (for agriculture, cattle, fisheries, forestry) and rural projects to provide drinking water.

What generated the most debate and coincidence of opinion was the problem of unequal access to water among different types of uses and users, illustrated by the case of the APR project (Rural Drinking Water) in the micro-basin of Rio Blanco. A village leader exposed the issue: 200 families need 4 liters per second to enable the water project, but their aspirations are being frustrated because a single person has monopolized 1,000 liters per second for a possible electrical dam project.

Many different opinions were expressed about the relationship between land uses and production methods, with conservation efforts on one side and water use on the other side. Another issue was the impact of agricultural activity on the water cycle, a fertile topic for further inquiry.

There was a lot of interest in climate change because of the novelty of the topic, although it is still hard to visualize, because its manifestations and effects are less visible than in dry, arid areas. Discussion focused on evidence already captured and on anticipating what might happen in the immediate future or in the longer term in order to take timely and adequate actions.

In the debate it came up that there are losers and winners of climate change. The gradual increase of temperature in cold areas could enable agriculture where this was not possible before, with consequences such as increased migration, expansion of irrigation projects, effects on drinking water availability, etc.

climate risks[9]. Still there are also some flaws in the management of the tundra type of pastures in the Mapuche communities[10].

With respect to the sources of understanding, representatives from the farming communities based their opinions mostly on direct observations, while perceptions of the representatives from urban settings and institutions were based on what they read and heard in the media and what they learned in training events.

Generally, there is a need to reflect more thoroughly on the best didactics and tactics to put climate change into discussion, given the complexity of the issue. The EcoAdapt experience shows that what seems to work best is to draw on what people already know and perceive before digging deeper into issues they want to understand. This involves, to start with concrete facts before moving on to the abstract concepts, to go from observable situations to less tangible matters and to teach on the basis of experience and decision-making, while expanding horizons by bringing to the debate new science-based evidence. This process allows to link the known and the unknown, the past, the present and the future, and to combine tacit and traditional knowledge with scientific knowledge to reduce vulnerability and increase the resilience of people and resources (agro-ecosystems).

Key learnings about Cooperation and Governance

During the debates, it was recognized that weak governance is a critical obstacle to implement effective water protection and restoration and climate change adaptation measures.

Figure 8. Perico-Manatiales watershed, Jujuy Model Forest, Argentina

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[9] In the discussion about climate change adaptation it is often forgotten that climate risk management is not a new need and phenomenon, but an old and well established practice of farmers and communities to ensure their livelihoods through a varied repertoire of technologies and previsions.

[10] For instance, there is a need for adopting new animal husbandry practices such as the division of pastures and animal rotation as well as the production of forage such as alfalfa which is a new and well-accepted innovation in the Mapuche communities. Moreover, we should stimulate synergies between animal husbandry and forestry to prevent roaming animals from browsing on natural regeneration.

Figure 9. The dam, Zapocó watershed, municipality of Concepción, Bolivia

Good examples are the dams in the Perico-Manantiales watershed (Jujuy Model Forest, Argentina, Figure 8) and in the Zapocó watershed (Chiquitano Model Forest, Bolivia, Figure 9). Although provincial and municipal legislation requires the protection of the area surrounding the dam, the respective regulations are s not implemented because of a lack of monitoring and follow up, and leadership and support by civil society. This seems to indicate that improving governance and ensuring the effective implementation of environmental regulations is an important first step.

According to both Model Forest teams, the conservation of the water dams depends largely on the watershed management capacity to restore the environmental system: however, this idea deserves further thought. In Concepción (Bolivia), the stakeholders had the idea of creating a watershed management platform to enable the water production and conservation in the Zapóco watershed. Different sectors of the local population as well as local institutions would have to support this idea and platform to make it reality. Other challenges are to link policymakers and the actors of the territory in order to create a shared understanding of the issues, and to reduce the gap between farmers and livestock owners and between rural and urban groups.

In the Jujuy Model Forest, all regional actors agreed during a workshop that the problems in the middle and lower part of the watershed are largely generated in the upper part of the watershed, and that concrete actions need to be taken in this regard. One weakness is the low population density in the upper part and the lack of communication between the 30 families living there (plus one large landowner) and the 100,000 families in the middle and lower basin. It is not clear yet which agency has sufficient authority and capacity to take the lead in order to solve the problems in that area of the dam.. Political dynamics and envy represent challenges, particularly in the public sector.

On the other hand, in the Aracaurias del Alto Malleco Model Forest, there was full agreement on the inequitable distribution of water rights. The communities of Curaucatin and Lonquimay are located in the upper parts of the Curaucatin and Bio-Bio rivers, respectively. There is a shared sense of inequity that much of the water generated goes to large irrigation projects and hydroelectric plants in the middle part of the basin, while the populations in the upper part have little priority and say over water use, particularly groups of settlers and Mapuche indigenous communities. It is neither fair nor effective to ask the local population of the upper watershed to make efforts in terms of water conservation without proper compensation and without recognition of their water needs.

Key learnings about the relationships between water, forest, land use and productive activities

On this issue, there were many different opinions and assumptions that need to be investigated further. In the three Model Forests, the common way of thinking was: if more forestation takes places, then an increased water supply will follow. How true is this? As mentioned before, this will be the subject of future research.

e) Reflections and Adjustments from the Synthesis Workshops

The three synthesis workshops (in April 2013) were another occasion to share knowledge and decide about the focus of the next phase. It was also intended to encourage cross-learning between Model Forests (with the participation of a representative from each Model Forest) and engage agents of change/key players in the participation of the next project phases.

The synthesis workshops were a bridge between the benchmark results of the first phase and the development of scenarios and instances for intervention in the three model forests. Findings of this workshop were synthetized, including entry points, barriers to overcome, opportunities to grasp, creation of panels and scenarios; the procedures were explained in detail during the workshops and revised in the first meetings with change agents of the three territories. This was done in line with the "*Structured Decision Analysis*" from Keeney (1982), a participatory decision-making methodology based on values, which involves a sequence of the following five steps:

1) Analysis of the context of the decisions to be taken and the time horizon of these decisions and actions: When? What? How?
2) *Objectives to be defined from the questions: What do we want to change? What do we not want to change? What are the barriers and opportunities for this?*
3) Discussion of scenarios, alternatives and means to achieve the objectives
4) Consequences and evaluation of the alternatives (costs, benefits, effectiveness, equity)
5) Selection of the alternative (decision) to put together in a climate change adaptation plan

Definition of the central problem and goal

In each of the synthesis workshops and territories, a central problem was defined and taken as a common goal with outcomes expected to be similar for the three sites. This helps to focus the project vision in a comprehensive, operational and understandable way and to compare the results and lessons learnt. In each Model Forest, the central research and development question was collectively defined as follows:

Chiquitano Model Forest, Zapocó watershed (Bolivia)	Jujuy Model Forest, Perico river basin (Argentina)	Aracaurías del Alto Malleco Model Forest, Lonquimay and Caracautin communes (Chile)
How can we ensure the quality and availability of water for human consumption and production in the short and long term? This is in a context of institutional weakness in water management, expansion of agricultural activity and population pressure, whereas dry periods are becoming longer and more intense	*How can we manage water and related natural resources?* This is in order to achieve current and future availability (in quality and quantity), equally for different uses (avoiding conflicts) in equilibrium with the environment and local development as well as to minimize the risk of damage and loss from extreme events (people, economic activities, infrastructure) in a context of increased climate variability and uncertainty (shortage, surplus, seasonal change and overlapping laws, institutional disarticulation and "lack of awareness" at the Perico river basin? (With differentiated sub-problems in upper, middle and lower watershed).	*How can we ensure water availability for local development in the short and medium term?* This is in a context of increased demand for resources, decreased precipitation of water and snow, as well as restrictive legislation for uses and accesses to water.

Identification and Organization of the Agents of Change

The synthesis workshops were an excellent opportunity to put into practice the concept of agents of change. The attributes required for the recognition of an agent of change as understood by EcoAdapt were defined as follows:

Be proactive and thoughtful/be fully integrated in the own environment/be able to mobilize the own group/be linked with key stakeholders of the territory/be able to connect different worldviews, knowledge and visions/have time and commitment.

With this definition in mind, appropriate candidates were identified through workshops, and multi-actor platforms were formed; these were given the name of "panels" or "hybrid forums". During the synthesis workshop, side meetings were organized with potential agents of change.

In Concepción (Chiquitano MF) potential change agents were already approached by the project team before the synthesis workshop, which resulted in a dynamic side meeting with a diverse group of actors. They proclaimed themselves as a *Grupo Impulsor* ("driving group") which expresses well the purpose of the group, and is in line with the project strategy. It was a lucky marriage between an endogenous aspiration and a project strategy. In the other two sites, the process was somewhat slower. There were some trials and errors to connect project vision and strategy, scenarios, panels, and hybrid forums with the creations and operation of the agents of change group. Since then, the process had started to take direction, shape, and pace (see next section).

It should be noted that the rhythms and patterns of change differ according to the specific territorial conditions in the three Model Forests, but they act roughly in the same direction and on a similar path, which enables comparison among territories and an overall project impact. The more the actions and tactics were geared towards specific

territorial needs and opportunities, the better the chance that EcoAdapt (or other similar projects) will reach its overall goals.

f) Meaningful Learning After the Synthesis Workshops: Entering the Spiral of Learning

In each Model Forest, this learning process led to interesting results.

In the **Chiquitano Model Forest**, interactive methods such as visits to water sources, on-site observation and discussion and inter-communal exchanges were used in order to refine the information and recognize the value of the personal experience and capacity of the actors. A multi-actor platform was set up to link the project team and representatives of different social groups and institutions. Moreover, the learning events strengthened the relation and cooperation between rural and urban actors as well as with government agencies[11].

In the **Aracaurias del Alto Malleco Model Forest**, an awareness and training plan was established after the mini-workshops. The plan had several components: water and land management information would be communicated in an user-friendly manner to the general public, talks would be given about climate change and water legislation, field days would be organized to exchange experiences, guidance would be given on how to regulate water use rights and analyze conditions for success, stories and testimonies would be prepared. This is a hybrid plan of activities to capture information and experiences of local actors, generate a human and social capital of knowledge, and stimulate new commitments and forms of cooperation and joint action. Two groups of agents of change were formed in the municipalities of Lonquimay and Caracautin. These groups will play a key role in forging capabilities and commitments, as they are a node within their social group or institution, and a bridge between project team members and the sectors they represent. This corresponds to the idea of a learning network and the profile of agents of change, which integrate groups, worldviews and aspirations.

One of the main conclusions from the learning experiences in the Aracaurías del Alto Malleco Model Forest in Chile was that when one is strategically situated at the interface of science, society and policy-making, one can provide informed guidelines for concrete changes and actions on real-world issues.

In the **Jujuy Model Forest in Argentina**, a round table was set up with a variety of local representatives to gradually develop a climate change adaptation plan. Six work meetings were conducted in relation with how climate change exacerbates problems of anthropogenic origin. One of these meetings was particularly interesting, giving rise to a joint interpretation of the problems around the 'Los Diques' water dam and reservoir. The idea was to observe and interpret the problems together by walking through the scene, to stimulate shared teaching and learning, to

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[11] For instance, a program of the Ministry of Environment channeled through the Municipality to improve the drinking water infrastructure and management in the rural areas in the watershed called *Mi Agua* was linked to a new program by the Ministry of Health to improve the environmental health in the same areas, in such way that the one gives an added value to the other. As stated before, EcoAdapt makes an optimal use of its limited funds by enabling contacts and information of relevant local actors.

generate a common language and vision, to reduce institutional envy, to increase trust and confidence in each other, to generate an appropriate learning environment and to stimulate future commitments and actions.[12]

At the end of these meetings, participants agreed on a concrete action plan as follows: use environmental tourism as a springboard to improve and secure water quality of the dams, implement technological devices; promote a more solid social and institutional support for the implementation of provincial regulations related to the protected area around the dams; combine economic and ecological incentives; make an optimal use of capacities and of human and institutional resources through improved communication and trust and confidence-building measures..

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[12] It is noteworthy that in the mini workshop reflections of November 2012, some didactic weaknesses were revealed such as the overuse of the workshop methodology, where certain individuals tend to dominate and where participants do not listen enough to each other – a flaw which was overcome with this well-conceived new field learning activity.

IV   Lessons Learned for Strategy Development and Policy Debate

Based on the work of the EcoAdapt Project in the three model forests, some preliminary insights and lessons learned for strategic development, policy debate and policy-making can be extracted from the results as described here..

- *The strategic importance of articulating actors and scales of intervention*

Policies and laws which are not rooted in local participation and do not have the support of civil society are typically not effective; conversely, on the ground actions without proper legal and policy backing also has limited impact. It is therefore necessary, and feasible, to shorten the distance between state agencies and civil society, by inviting policy-makers to participate in dialogues and multi-actor meetings and platforms.

The same is true when it comes to promoting more articulation among government bodies and civil society organizations in order to make better use of scarce human, institutional and financial resources for addressing environmental, climatic and development issues. Equally important is to enable articulation between geographical scales and different levels of governance. This process is starting to slowly and gradually take place.

EcoAdapt has already given promising results in enabling actor cooperation and articulation in the three Model Forests through a shared vision, joint commitments and a functional division of tasks, which also reduce the suboptimal use of resources due to poorly coordinated actions.

- *The strategic and economic value of platforms and agents of change*

Cooperation and articulation through institution building is of strategic importance on the road to territorial and community-based management of environmental and climatic challenges. There are indications that there is good progress in this direction, and there is now (more) clarity on how to get there.

Economically-speaking, efforts invested in building multi-actor platforms and creating conditions for actor cooperation and articulation are cost-effective in the end because they help to establish trust and a common language and vision, to define the roles and functional division of tasks, and to reduce future transaction costs, while increasing the impact of the resources allocated, within the perspective of desired visions and objectives. The multi-actor platforms derived from the project emerged through bottom-up processes, empowering landscape actors and ensuring, to a certain extent, the influence and long-term impacts of the process they facilitate.

- *Ways and means of articulating local development and climate change adaptation*

The project name in Spanish, agreed upon by the local project partners, is *Climate change adaptation for local development,* but experience shows that the relation is also the other way around: *Local development for climate change*. As a matter of fact, the main driving force for local concerted action has been so far to resolve immediate felt and shared local development needs such as securing access to water, food, health and livelihoods. These, however, also contribute to strengthening local capacity to adapt to future changes. Hence, the relationship between the goals of climate change adaptation and local development is not linear but interactive, in tactical and practical terms. This needs to be a central approach in the overall climate change plan (and pilot action) to be elaborated in every Model Forest.

- *Scaling up initial local action for policy debate and impact*

When initiating collective action around perceived needs, people want to be successful and tend to deepen their understanding and widen their horizons, which helps tackling more complex matters, and motivates and enables people to fully participate in political debate and engage in advocacy.

We find a clear example of this in the Aracaurias del Alto Malleco Model Forest, where political influence was a strong driver of the local team to take part in EcoAdapt in the first place, and where this desired effect can be clearly observed today: actors in the two communities are more knowledgeable on water affairs, locally and nationally, they get in touch with political representatives and join the movement to bring about some desired changes in the water policies and legal framework. This is entirely in line with the Chilean Laws of Transparency and Citizens Participation in Public Affairs.

- *The challenges of improving water governance and managing conflicting interests and views*

It is essential to improve water governance and create more effective and fairer rules of the game with regards to access, use and the distribution of increasingly scarce water resources. Our final analysis indicates that good governance and watershed management are critical for sustainable climate change adaptation (*Innovation in water governance* is a project goal and part of its title).

Water (scarcity) can be both a source of conflict and cooperation depending on the institutional arrangements and rules of the game[13]. This is crucial to consider in view of increasing water demands by different users and uses and diminishing water supply caused by climate change. The fear of future conflicts around water was one of the reasons to select water and watershed ecosystem service (WES) as the central topic of the EcoAdapt Project. Still, conflict is not necessarily an outcome of climate change. Conflict around water could actually arise due to a myriad of other stressors that converge in the Model Forest landscapes, such as increased water demand and pollution. It is therefore important to consider multiple drivers of change and analyze in which conditions and how the outcome could lead to cooperation rather than conflict intensification. In this regard, EcoAdapt finds inspiration from the groundbreaking EU-Project CLICO financed under the 7th Framework Programme *Climate Change, Hydro-conflicts and Human Security* (CLICO project flyer 2010 and Policy Brief no 2, 2012).

To enable fruitful debate and decision-making on burning issues such as governance, rules of the game and channeling conflicts of interest and views about water use, it is advisable to create first a sound basis of trust and cooperation around joint action in less conflictive matters. To this end, stakeholder mapping and analysis is useful to identify synergies or conflicting interests, and identify entry points for action[14].

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[13] To date there are still well-functioning millenariy water management systems like in the oasis of Arab desert countries or at a larger scale of cooperation and governance, the s*awahs* of irrigated terraces of rice production in East Asian countries which show the historical potential of cooperation in conditions of water scarcity and its use for food security.

[14] This was carried out in another EcoAdapt study on *Social and Institutional Relations* in the three territories

- *Looking backward and forward on the path towards the project vision*

One of the challenges of connecting local development, political debate and policy-making is to reconcile the immediate goal of satisfying the felt needs of local actors with advancing towards more complex and demanding changes, at higher levels of social aggregation. According to our experience, this is possible through an adaptive strategy. The original roadmap needs to be consulted and updated constantly in light of new findings and reflections and links must be established with the communities and policy-makers from different levels of government – these links are currently starting to take shape.

The final EcoAdapt objective of guaranteeing access to water in sufficient quality and quantity in spite of drought and other climatic events cannot and does not need to be reached within the project four-year time span. However, during the project's lifespan, it is fundamental to lay down the groundwork in terms of motivated, informed, committed and collective cooperation and organization within the three Model Forest areas.

It is also essential to start addressing and tackling some burning issues such as governance, regulations and conflict management around water access and use, which are fundamental for achieving sustainable climate change adaptation. This can be achieved through promoting clear thinking and informed action.

Full clarity and certainty on certain issues does not necessarily have to be reached in order to start acting, because this would lead to a state of paralysis. Clarity and certainty can be achieved through a process of acting-learning-readjusting, as shown by the literature and experiences in adaptive management.

In such circumstances, the goals of change must be clearly defined, as well as the objectives of learning and inquiry, if possible with a working hypothesis and small-scale pilot actions which will shed light on the road ahead. This is the essence of adaptive management, of the wheel of learning and of action-research. This approach is even more important when one enters into a new, unknown thematic area, to be further explored and discovered.

V   Conclusion

As we have seen, knowledge is permanent, transversal and evolves constantly. It belongs, indeed, to a wheel of learning in which it develops in a sequential, cyclical and repetitive manner, encouraged and pushed by the desire to change certain aspects of reality. Throughout this process, a variety of pieces of information and knowledge are being assembled like in a puzzle.

The creation and exchange of knowledge is at the heart of the EcoAdapt Project, with the knowledge-sharing process taking off   at the May 2012 workshop in Concepción, Bolivia. At the time, this knowledge exchange only took place between selected teams from the three Model Forests and the researchers.

The project entered an *uncharted territory* concerning water security issues; this term is a metaphor to express the need to explore all options and find the right path. It does not refer to the unknown biophysical and geographical aspects of a landscape but more to approaching a relatively new topic (watershed management)[15], which was the case for many members of the project team.

All in all, EcoAdapt is a learning project[16], a real journey through learning. In this journey, adaptive management and learning go hand in hand. The newly formed multi-actor platforms ("motivational groups") have become crucial agents of change. They constitute nodes in the network of contacts between the project team and the groups and institutions which they represent or are linked to. They have a great potential to socialize, democratize and reconcile information, enhance capacities, debate issues and action to be undertaken, mediate conflicting views, articulate different competences and roles to enhance effectiveness and economy in assigning scarce and precious human, institutional and financial resources. As they are getting more informed, these agents of change also become reflective practitioners.

The initial transaction costs of joint leaning and planning may seem high. However, not investing in it would be more costly in the end because it would hamper achieving the desired and needed changes.

The concept of good practices within the project is not limited to the production at the farm level, nor to a more conservation-friendly way of production; it also implies the strategies in conservation and restoration of forest and water resources at the watershed or landscape level. It refers to the approach and joint action related to risks such as fire, flood, drought and climate change, and last but not least, it requires improved conditions of governance, including the effective and equitable implementation of environmental regulations. In fact, there are still too many environmental standards that lack a solid support from civil society and cannot therefore be properly implemented. Without a substantial improvement in governance, other desired changes will be difficult to achieve.

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[15] Jujuy MF had experienc**e** in watershed management, which was not the case with the other two MF. For the Chiquitano and Aracaurias del Alto Malleco MF, the topic was relatively new, but they had more experience working with indigenous groups, forestry and the production of non-timber forest products.

[16] Projects that adapt their strategies along the way according to what they discover and learn tend to be more successful in the accomplishment of their vision and goals than more rigid projects. (Prins 2005).

In that regard, it is important to make a clear distinction between different levels of learning, decisions and actions according to the type of problems to be addressed. For example, decisions or actions that need to be taken at the micro-watershed level require more time and efforts than working only at the farm level. The challenge is to articulate those different levels of intervention to obtain a greater impact.

Actions at the landscape level (watersheds, forests) have a greater chance of success when supported by environmentally-friendly production activities in the farms and communities. One must therefore act at different scales simultaneously and articulate these interventions. Policies and Laws without roots in and support from civil society are not very effective, and actions on the ground without legal and policy backing also have limited impact. Keywords about this include articulation, interface and bridges between actors, sectors and scales.

The project and process are complex and for that reason we need to make them clear, simple, easy to understand and easy to manage. Otherwise, people will feel overwhelmed and paralyzed by their complexity. The process of learning is as important as the content. Uncover problems does not mean complicating matters, but rather to make a complex reality easier to understand. This applies also to raising awareness on climate change. People observe certain phenomena and feel the effects upon their lives (directly or indirectly). It is wise to base our methods on what is already felt and observed empirically such as droughts, fires, extreme short rains out of season, changes of dates for planting and harvesting. New information and evidence can be added to this existing knowledge to make people become more knowledgeable, proactive and resilient.

In that sense, we need to capitalize on risk management responses and practices. Adaptation to climate change is about reducing vulnerability and increasing resilience of both individuals and groups and their biophysical ecosystems. Agricultural practices need to promote conservation of soil and water to prevent runoff and increase retention of soil moisture. This will reduce the occurrence of floods and drought. At the same time, agriculture should remain economically attractive and contribute to climate change mitigation as well. The FAO called this process *climate-smart agriculture* and there is a growing emphasis on it. Trees may play an important role, particularly when taking into account their potential role in managing water resources and strengthening the capacity of local actors to jointly govern these resources.

On the other hand, many problems are not caused only by climate stress, but also by other factors such as legal stress (Chile). Therefore, it is necessary to create adequate conditions of governance, and promote advocacy within the legal and policy framework, which is not only a matter of effectiveness but also of equity and legitimacy. This will not be achieved overnight. In the meantime, it is possible to take advantage of the positive aspects of water legislation and start negotiating improvements. This is an important lesson learned from the project, as highlighted in the case of the potable water association in the Aracaurias del Alto Malleco Model Forest.

In this respect, the concept of *climate-smart territories*[17] is emerging as a new concept which encompasses all of the different aspects of natural resources management under climate and other stresses. The three Model Forest areas within EcoAdapt are beginning to show characteristics that fit well with this concept and could become interesting examples of its application.

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[17] See for example Louman *et al*. 2015.

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