PERCEPTIONS' KEY DRIVERS IN A MULTI-PROPOSE CHILEAN SUB-BASIN: MOVING TOWARD SUSTAINABLE WATER GOVERNANCE AND CLIMATE CHANGE ADAPTATION. PRELIMINARY RESULTS

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ABSTRACT

Sustainability at a river-basin level includes the integration of actors, policies, knowledge and uncertainty. All these elements depend on human understandings of the relationships between the involved concepts. The perceptions of a multi-propose sub-basin were studied through a mixed methodology of: identifying strengths and weaknesses of Chilean water governance; designing and applying an in-depth interview of key stakeholders as well as a questionnaire to water-users and the public; and validating these through a participative workshop. The results show that the main strengths are the solid structure of Chilean water governance at the national and local scales, but participation and inclusion remain weak, and there is resistance to participation. There are at least six key stakeholder groups and perceptions. While industrial actors are more informed and aware of climate change adaptation, institutional actors maintain a skeptical and political discourse at national and local level.

KEYWORDS: participation and inclusion; equity and sustainability; decentralism

1. INTRODUCTION

Globally, water consumption has increased at an exponential rate and is directly related to population growth and economic development (Henrichsen and Tacio, 2002). For example, since the 20th century, population growth increased six times (WMO, 1997) and water extraction for agricultural uses, such as for irrigation, increased thirteen times, which became the world's principal water user, with 70% of the extractions, followed by the industrial and domestic users with 15% each, approximately (Vörösmarty et al, 2005). The increase in the quantity of water demanded ahead of a fixed quantity of water supply causes different problems in a watershed, which are characterized by limiting the compatibility of water uses in the same basin and water consumption rivals ecosystem integrity, which is that which allows for consumption. This reality is further threatened because of climate, economic, social and political uncertainty attributable to climate change.

According to Bates et al. (2008) one of the main problems introduced by climate change is the interaction with current water problems, likely intensifying them at levels the human system cannot adequately address. The changes in flow patterns and, consequently in the provision of water ecosystem services, could induce more social conflict not only inside the watershed eco-social dynamic, but also at higher levels of decision making. In order to cope with these current and future water problems new ways of governing the freshwater ecosystem (Kallis et al, 2009) through sustainable water governance are necessary.

Governance is a thriving debate, which has gained more clarity since the beginning of the 21st century, especially in terms of discerning the key elements for defining it (Adger and Jordan, 2009). First, governance integrates a wide range of stakeholders and relationships involved in the governing process (Pierre and Peters, 2000), from governmental actions and institutions, such as enterprises and NGOs (Lemos and Agrawal, 2006). Second, governance represents the regulation patterns that emerge from these diverse stakeholders, and these norms of behavior are considered valid (Barriga et al, 2007). Third, governance is not limited to a particular period or location. Instead, it regularly crosses these analytical categories. Therefore, governance consists of a structure and dynamics (Agrawal and Lemos, 2007) which is expressed at different geographical scales and decision making levels (Lebel et al, 2005, Brondizio et al, 2009).

Given the consensus on these elements, current governance theories have been identified: the theory of governance, the empirical phenomenon of governance and more recently, governance as a normative prescription (Adger and Jordan, 2009) For example, sustainability is a normative fundamental idea sought by governance (Meadowcroft, 2005). Independent of current research, the assessment of governance should avoid transforming it into a static phenomenon and should include both process and outcome (Adger and Jordan, 2009).

Incorporating these analytical elements this research defines water governance as, **the coordination and interactions between the political, social, economical and administrative systems to solve common problems in relation to water administration and management.** Consequently sustainable water governance is defined as the deliberate adjustment of water governance practices with the firmly propose to guarantee that society moves towards a sustainable trajectory. This is the ability of sharing power throughout the entirety of society (Lebel et al, 2006).

A preliminary question arises from this theoretical framework: what are the basic and more important criteria which guide water governance to an intentionally sustainable trajectory? Several principles and criteria have been developed toward this end, with many of them very difficult to assess, for example, equity (e.g. Theys 2002). Nevertheless there is consensus within water governance research that participation and inclusion as well as accountability and transparency are the basic assessment criteria for studying this sociopolitical phenomenon (Barriga et al., 2007). However, the preponderant element is participation, which leads to a decentralization of power.

While participation may simultaneously be considered a genuine transformative approach of development and a result of participatory governance, it should promote decentralization, inclusion, legitimacy, effectiveness, and equity (Hickey and Mohan, 2004). This is supported by a renewed participation concept by re-incorporating it into the political sphere (Gaventa and Valderrama, 1999) and recognizing that working with the intersection of new citizen participation spaces, receptivity and accountability by institutional stakeholders is a political issue (Gaventa, 2004). Thus, participation and governmental receptivity are expressed in different participation spaces wich are a reflection of different spatial scales and in which, in many cases, are undergirded with unequal power relations (Gaventa, 2004, Hickey and Mohan, 2004).

For the most part, closed and invited spaces are generated by existing institutions or the most powerful actors, and for this reason, unequal power relations prevail within those spaces (Cornwall, 2002). So, when assessing the level of participation, one must assess the level of inclusion within those participation spaces and the spaces that have been created outside the government domain; that is, non-institutional actors who are marginalized in other spaces, are in opposition to the empowered actors, or are granted greater autonomy (Cornwall, 2004; Gaventa, 2004, Mohan and Hickey, 2004).

When the inclusive participation process at local level is evident, horizontal integration is achieved (Lafferty and Hoviden, 2003, Brown, 2009). However, this success does not ensure the development of new forms of governance, because if the participation is framed only at local level, without reaching deeper avenues in which local actors can influence policies that ultimately affect their lives (Fung and Wright, 2003), it does not meet its transformative target. Therefore, participation must achieve a vertical integration (Adger et al, 2003, Lafferty and Hovden, 2003, Brown, 2009; Young, 2006), in which there is an scaling-up of local participation to higher decision making levels (Hickey and Mohan 2004, Mohan and Hickey, 2004).

In that sense, the first element to evaluate in a watershed management system is participation through created spaces and scaling-up. Therefore, new questions emerge. First, is the Chilean water management system promoting participation as a transformative instrument? Second, are both horizontal and vertical integrations at watershed level considered to be strengths of the Chilean water management system? In order to answer these questions, it is necessary to identify whether the Chilean water management system possesses these basic criteria for sustainable water governance as strengths, and consequently, to identify the weakness as well as challenges the system bears.

The last emergent question involves the uncertain future, especially considering climate change impact to water flows and consequently to water provision for different sectors. Have the actual strengths of Chilean water management system considered the likely impacts of climate change over water, water resources and social welfare? In order to answer this, it is necessary to primarily study whether climate change is perceived as a risk, how many stakeholders, citizen and water managers know about climate change, and if they are willing to cope with the climate change impacts.

Understanding the climate change perceptions of diverse stakeholders within a watershed relies on psychological (Taner *et al.,* 1989; Grothman and Pat, 2005) and socioeconomic factors (Smit and Pilifisova, 2003; Adger *et al.,* 2005; Smit et Wandel, 2006). In brief, psychological factors explain the valuation of risk, in terms of the likelihood of occurrence, severity, past experience of coping, and how effective adaptive strategies implemented are to deal with past climate variability were. The socioeconomic factors explain the degree of trust that stakeholders, water managers and citizens have in their own adaptive capacity and the effectiveness of the response that can be applied to reduce risk. Logically, one expects to find different levels of perception, both to risk and adaptive capacity inside a multi-purpose basin, due to the diversity of actors involved in them.

1.1 A case study: The Vergara River sub-basin

A case study approach was selected for three reasons. First, it is recognized that hydro-social conflicts are a contemporary environmental phenomenon. Secondly, the holistic nature of this case study allows the maintenance of openness in order to avoid reductionist views concerning the object of study: adaptive water governance. At the watershed scale, by analyzing the whole context of the case, problems are better understood by all stakeholders. At the micro-watershed scale, by looking at specific issues, such as the rural water supply and irrigated agricultural associations, the collaborative process focuses on the specific areas of conflict already perceived to exist between local stakeholders. Thirdly, the Vergara River sub-basin is a multi-propose watershed that is typical of many Chilean watersheds belong to the South-Central region, because many of the water problems faced at the local scale are the same as those that other longer watershed face.

The Biobío River basin (24,371 km^2), to which the study area belongs, constitutes the country's most important hydrological system, due to the amount of watershed ecosystem services provided: hydroelectricity, water for industries like the pulp mills associated with the largest forestry activities, water for irrigation, and water supply at rural and urban scale, among others. It is influenced by the temperate climates of the South as well as by the Mediterranean climate of Central Chile. Therefore, the Biobío basin is located in a climatic transition zone between 36°45' - 38°49' S and 71º00' - 73º20' W. It stretches from the continental divide in the east (Chilean-Argentinean border) to the Pacific Ocean in the west (Fig. 1A) and comprises three main geomorphologic units: the Andes, Central Valley and Coastal Mountain Range. Over the past decades, important land use conversions have taken place, transforming the Biobío basin -with ~1.000.000 ha of plantations- into the centre of exotic species forestry in Chile. Agricultural activities remain important in many parts of the Central Valley.

Vergara River sub-basin is located between 37°29' - 38°14' S and 71º36' - 73º20' W (Fig. 1B) and it is one of the main four sub-basin of Biobío basin; covering an area of 4.265 km^2. Minimum and maximum mean monthly discharges occur during the months of July and February-March, respectively. The major land uses are for agricultural crops (32%) and shrubs (8%) in the lower part, forest plantations (38%) in the middle and native vegetation (22%) in the upper (Aguayo et al, 2008).

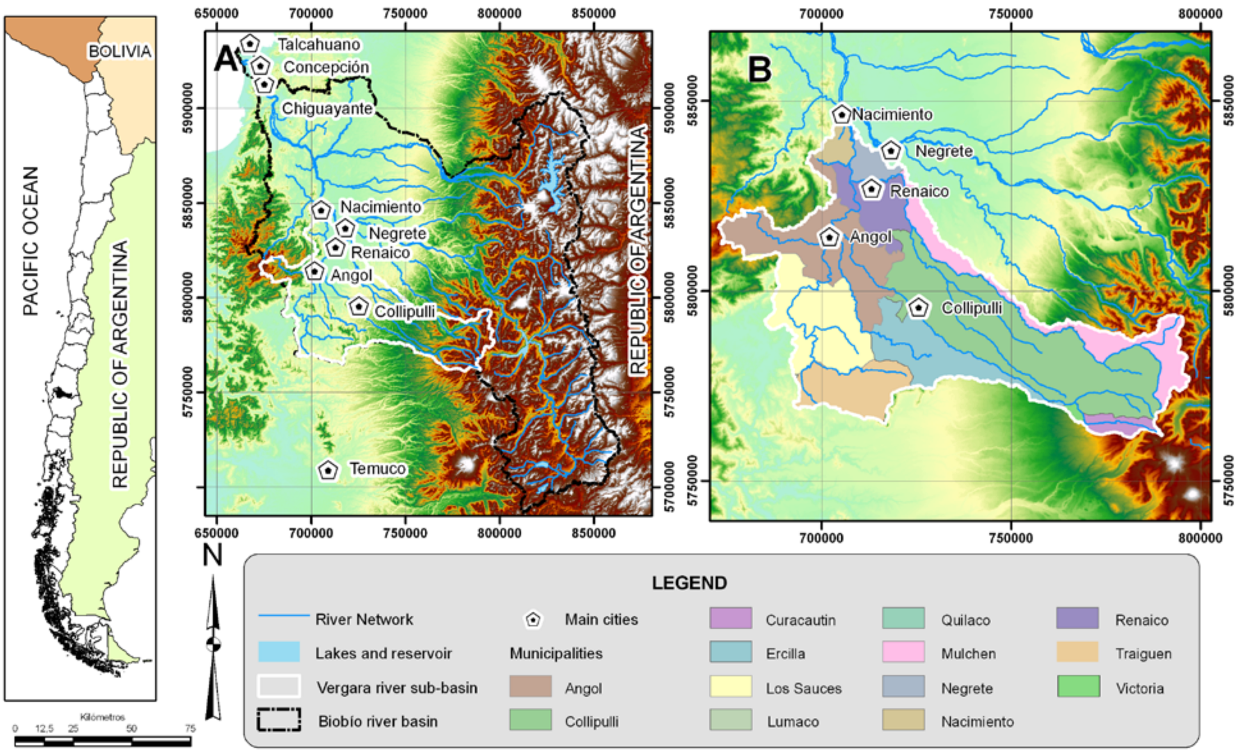

Figure 1 Localization, limits, hydrography and topography of (A) the Biobío River basin and (B) Vergara River sub-basin and the administrative boundaries involved.

1.1.1 Socio-environmental characterization of Vergara River sub-basin

The Vergara River sub-basin is shared by the Biobío and La Araucanía Regions (Fig. 1C). Thirteen communities are in their area of influence (Table 1, Figure 1C), however, three of them retain less than 5% of the area within the watershed, so these communities are not considered in the study.

According to the latest national census, 72.26% (177,820) of the population lives in urban areas and 27.74% (68,264) lives in rural ones. Compared with national statistics, the study case population inhabits is less urban (14.34%). The literacy rate in the whole sub-basin is 89.02%; in urban areas it is 91.44%, and in rural areas it is 84.83%. Both figures are lower than the national averages: 96.8% for urban areas and 89.16% for rural areas . The Human Development Index (HDI) for the sub-basin is medium (0.64), with the town of Los Sauces having the lowest level of development (0.6) and the with the town of Angol having the largest (0.71). However, the socio-economic scenario for 2006 was less encouraging, when the sub-basin showed an increase of poverty, which reached 35% of the population, first detected in the town of Los Sauces. For 2009 the situation got worse, and there was a 7 percent increase in the poverty rate.

The Biobío and La Araucanía Regions concentrates 20% of the Chilean territory dedicated to agricultural use, with 9.9% of the national irrigated area. The most common type of irrigation system in Chile is gravitational (76.3%). In the Vergara River sub-basin the gravitational irrigation system reaches 75.6% of irrigated areas, and 92% of it is by surface irrigation, followed by mechanical irrigation (15.4%) and micro-irrigation (9%) (INE, 2007). The main agricultural products cultivated by irrigation are pasture for cattle and cheese production, traditional crops (wheat and beans) and "*chacarería"* (tomatoes, vegetables). There are also berry crops for exportation (ACCBBN, 2006).

There are two pulp mills and one for newsprint, which use on average between 30 and 50 m^3 of water for the generation of 1 ton of cellulose, which has an estimated annual consumption of 56.1 million m^3. It discharges about 25m^3 of industrial waste to produce 1 ton of cellulose, which has an estimated annual discharge of 40,880 m^3 with a high organic load.

The supply of urban drinking water is controlled by two companies, each one supply the cities of one region. According to MINVU (2008), the home drinking water coverage of the communities in the area of influence of the sub-basin, varies between 74% to 90% coverage. In rural areas, water supply is controlled by rural organizations named Rural Drinking Water (RDW) and in the sub-basin exits 38 RDW with 94% coverage of the sub-basin (CITA, 2007).

1.1.2 Main hydro-social problems in the Vergara River sub-basin

The literature review helped to identify two different types of actors involved in the water problems and hydro-social conflicts, those who recognize / experience water problems and those, related to the institutional or social involvement which promotes conflict resolution. The actual main water problems are two and both hydro-social conflicts consider the temporal scale.

The most evident problem is related to water supply during summer time, due to the regulation and water extraction for agricultural proposes and the hydrological effects of historical land use change. Additionally, there have been years with much more water scarcity than others due El Niño phenomenon. Basically, the literature reviewed shows the main stakeholders affected are irrigation farmers, because they use water for irrigation form October until March - April, and the amount of water available is related to the base flow and the irrigation system used is the less efficient.

The second actual water problem and hydro-social conflict is the diminished water quality, especially in the main river, Vergara river, which is evaluated as bad to very bad water quality due to the industrial and domestic effluents.This water problem became in a hydro-social conflict also during summer time when the community wants to enjoy the recreational water services provided by the Vergara River sub-basin. Secondly, there have been punctual events of industrial waste water discharges in the effluents of Vergara River which are used for rural water supply and recreational proposes. Unfortunately, they only have been reported at local scale. For example, one of the Irrigation farmers associations identifies the bad water of quality as a problem, especially high levels of *E.choli*, which produces negative impact over their productive system, the tourism and water supply (ACCBBN, 2006).

1.1.3 Actual climate variability in the Vergara River sub-basin

Understanding the behavior of the current climate variability of the Vergara River sub-basin allows one to know to what the actors have been exposed to in terms of the influences of climatic variability. It has a positive trend in thermal regime, but not so in rainfall. Since 1970, Aceituno et al. (1992) and Rosenbluth et al. (1997) have observed an increase in the average annual maximum temperature (0.05ºC/decade) and minimum (0.18ºC/decade) in the basin of the Vergara River. In relation to the rainfall pattern, since 1970 the sub-basin has been characterized by a clear and strong decrease in annual average precipitation (DGF-CONAMA, 2006; Stehr 2007).

1.1.4 Expected climate change impact in the Vergara River sub-basin

Regarding the thermal regime, it has an estimated increase in annual average temperature of 2.0°C, the month with the largest increase is April, with 2.9°C (DGF-CONAMA, 2006). For its part, the annual average precipitation of the Vergara River sub-basin is estimated to decline by 21.9%, and the month with the greatest decrease is expected to be February (63.9%; DGF-CONAMA, 2006).

In the Vergara River sub-basin, Stehr (2007) estimated river hydrological variability and demonstrated that the average annual flow is expected to be reduced on average by 28%. By incorporating the results from the study of climate change estimations made by CONAMA-DGF (2006) into the SWAT hydrological model, an annual average flow decrease of 32% as well as a decrease in average monthly flow of 15% in August and 55% in December were obtained. The last results are extremely important because they pertain to the dry period when all the water users compete for the existing water resources.

2. METHODS

This study of water managers, urban and rural water suppliers, and organized rural water users perceptions to watershed management and climate change in the Vergara sub-basin (Fig. 1) complements studies on impacts over flow pattern due to historical and future land use changes and estimated climate change, as well as the interaction of these two drivers of change, conducted by the FONDECYT Project (Fondo Nacional de Desarrollo Científico y Tecnológico) "Land use change and climate change effects over water resources: New factors for integrated watershed management" (Stehr et al, 2010). This study adds sociological and political inputs in order to delineate clear recommendations for implementing integrated watershed management in Chile, which faces climate change uncertainty, so as to move towards sustainable water governance.

2.1 Actual strengths and challenges of the Chilean watershed management system and climate change

Through a literature review, four basic criteria of Integrated Watershed Management were defined, considering sustainable water governance and adaptation to climate change:

1. Recognizing the eco-social dynamic that characterizes, especially, multi-propose watersheds and defining Integrated Watershed Management.
2. Integration of different types and sources of knowledge towards sustainable decision making and integration of different types of uncertainty.
3. Integration of different interests, perceptions and stakeholders at the local level.
4. Vertical integration or participatory scaling-up.

These four criteria were used to revise literature that evaluates the Chilean administration and regulation of the water system with regard to sustainability and adaptation. This is especially important, because the Chilean system has become the world's leading example of the free-market approach to water law and water resources management. The predominant view outside of Chile is that the Chilean water market system is economically successful. Also, the Chilean water management system is widely recognized as a model that has produced positive impacts in terms of the administration and regulation of water resources.

For example, water-rights assurance, the efficiency of water resources use, and the water market operate independently of other resources and other watershed components. Through the privatization of Chilean sanitary systems, urban coverage and waste-water treatment have increased to almost 98% and 91%, respectively. After the 2005 modifications of the main legal instrument which regulates water in Chile, an official register of water-rights has begun, especially because the agricultural reform gave water-rights to land users' properties, but they were not registered, which did not promote the creation of water markets.

Three distinctive stages have been identified in the Chilean water management system, that allow us to observe and understand how the basic criteria used in this research has evolved through the last 30 years and how global environmental governance has impacted the Chilean model. In addition, the historical characterization has allowed for the identification of the actual and intrinsic strengths of the Chilean water management system as well as its weaknesses and challenges regarding sustainability and adaptation to climate change.

Ultimately, the key stakeholders were identified at different geographical scales—considering the Vergara River sub-basin as the local scale—and at different decision levels. Finally, an interaction framework of the institutional landscape was drawn between the key identified stakeholders.

2.2 Stakeholders perceptions' to watershed management facing climate change

2.2.1 In-depth interviews and key stakeholders' selection

The preliminary data presented in this article were collected through a series of in-depth, semi-structured interviews with 47 key stakeholders during the dry season (January to May 2011). This time period was characterized by a water crisis in the Chilean rural sector, because of periodic drought that affected several areas. Each in-depth interview was first evaluated through several rounds of pretests, and the final protocol of the in-depth interview covered five topics:

1. Personal information and work background.
2. Defining watershed, integrated watershed management (IWM) and valuing the watershed ecosystem services provided by Biobío River basin and the Vergara River sub-basin.
3. Actual and future hydro-social water problems in the Biobío River basin and the Vergara river sub-basin.
4. Level of knowledge and consciousness of climate change impacts in the Vergara sub-basin.
5. Watershed governance mode and participation issues.

The interviews among rural water-users also looked at the relationship between their water-user organizations and the coordination and integration to others stakeholders at local and national levels. The interview questions were both structured and open-ended and included probes to elicit complete responses. The interviews averaged about 2 hrs and were recorded using a digital audio recorder.

The respondents represented a diversity of experiences, responsibilities, and nexuses to water. They were selected using stratified purposive sampling (Patton 1990; Strauss and Corbin 1998). This process began by identifying the key stakeholders and then defining which ones represent different geographical scales and decisions levels related to water management. Respondents were selected form three type of decision levels: national, regional and local, and three types of relationship to water management: institutional stakeholders in charge of regulation and solving water problems; private water users whose main objective is to improve their income; and social stakeholders, such as conservation NGOs, the academy, and indirect water users, who represent society and special interests in terms of sustainable watershed governance (Table 2). Respondents belong to eight different types, with the majority being institutional stakeholders and the minority being private water users. At the local level it was possible to find different types of stakeholders.

Table 2 Different types of respondents.

		Decision level		
		National	**Regional**	**Local**
Type of stakeholder	**Institutional**	Environmental Ministry (1) CNR (2)	Environmental Ministry (4) DGA - MOP (4) DOH - MOP(4) SISS (2) INDAP (2) CNR (1)	INDAP (2) CNR (1) DOH (1)
	Private	Pull and mill industries (2)	Water suppliers (2)	Associations of Irrigation Channel Users (3) Agriculture industries (2)
	Social	–	Researchers (3)	ONG (2) Municipalities (7) Civil organizations (2)

DGA – MOP: General Water Administration of the Ministry of Public Works (Dirección General de Aguas del Ministerio de Obras Públicas)
DOH – MOP: Administration of Hydraulic Works of the Ministry of Public Works (Dirección de Obras Hidraúlicas-Ministerio de Obras Públicas)
SISS: Superintendency of Sanitary Services (Super Intentendencia de Servicios Sanitarios)
INDAP: National Institute of Agricultural and Livestock Development (Instituto Nacional de Desarrollo Agropecuario)
CNR: Irrigation National Commission (Comisión Nacional de Riego)

2.2.2 Data analysis

The qualitative analysis was adapted to be worked by a single researcher, following the procedures outlined by White et al. (2008). Thus, a codebook was developed to guide the analysis. First, the main strengths and weaknesses as challenges to the Chilean water management system that were identified by literature review were used as a provisional list of start codes, so the start codes reflect broad categories. From each broad code, the answers were deeply analyzed for identifying the secondary codes and sometimes tertiary codes emerging from the secondary ones. The new coding system was presented to an interdisciplinary research team for discussion and discovery of discrepancies and differing interpretations. The integrated team was comprised of a biologist, a sociologist, an agriculture engineer and a hydrologist.

3. FINDINGS AND DISCUSSION

3.1 Actual strengths of Chilean watershed management system and climate change

The main legal textbook which regulates, administrates and manages water in Chile is the Water Code “*Código Nacional de Aguas*”. In it, water is considered to be a public good, but its use is created by private user through water rights, which are not merely private property but also a fully marketable commodity. General Water Directorate (DGA) is in charge of administrate the water resource in Chile.

In this way, the Chilean law and water management system is unique in its kind, since water is recognized as a fully marketable commodity (Bauer 2004, 2005, 2009, Hearne and Donoso, 2005, Larraín, 2010), as the water use rights are given to individuals for free, in perpetuity, without having to justify their intended use and can be traded like any other property. And the essence of the Water Code was to create the basic conditions for the emergence of spontaneous water markets due to private initiative.

According with this and in line with neoliberal ideology, the state's role was reduced in the regulation and management of water and it was assumed that water markets will distribute the benefits equitably and externalities would be resolved by the water user organizations (WUO) that are created by the Water Code: water communities, associations of irrigation channel users, and water boards.

Three distinctive stages have been identified in the Chilean water management system during the last 30 years, which allow us understand the evolution of the four basic criteria identified that characterized sustainable water governance.

3.1.1 Stage I (1981-1989): Water Code essential nature

This stage begins with the conceptualization of the Water Code and ends with the return to democracy, thereby describing the essential nature of the code. Since the essence of the code is the promotion of free water-markets independently of the other resources and components of the basin, it exploits a system that deepens the sectoral management of all of them, disassociating the socio-cultural and environmental dynamics of water from the economic ones (Siles and Soares, 2003).

Thus, marine waters were legally separated from surface waters. Fresh water and groundwater were managed independently, despite their close hydrogeological interconnection. In addition, the rivers were administered at the level of sections and not in terms of drainage area. Water quality is managed independently of the quantity and availability and administered on a sectoral water quality for human health, drinking water quality and controlling the discharge of industrial liquid waste and agricultural pollution control.

Likewise, it was disaffection between the priority water uses form all the real and potential uses as well as the perceptions related to them, which are socially constructed and valued. Peña (2004a) commented on the inapplicability of individual water rights in cultures whose worldviews conceive water as a community element that is, at the same time, inseparable from the land. Bauer (2004, 2005), Bravo et al, (2004) and Peña (2004b) point out that *in situ* uses like fishing are not legally explicit, nor are the cultural and recreational ecosystem services that are provided, nor was the minimum ecological flows that is required to maintain biodiversity.

The non-valuation of recreational and *in situ* water uses as well as the biological demand rely on the Water Code to, primarily, define priority water uses: agricultural water for export proposes and water supply for the population (Peña et al, 2004), and then strongly promotes this types of water uses over the all water uses, downplaying perceptions of water not based on agricultural scarcity value.

All this is explained in that the Water Code primarily promotes water use in agriculture and water supply for the population; both uses are predominantly located in Central Chile (Peña et al, 2004), discounting other perceptions of water, not based on agricultural scarcity value. This result indicates that the implementation of one efficient tool to promote a specific water use does not assure efficiency in situations of multi-propose water uses. Therefore, around the world is being promoted to design and implement of a set of management tools that allows the integration of users, perceptions and conceptualizations of water as a common good.

The predominantly sectoral conceptualization of water is a common problem in ecosystem goods and services management, because it is not considered the system being managed is complex, unpredictable and characterized by unexpected responses when it is intervening (Mostert et al, 2007, Pahl-Wostl, 2007). This well-known weakness is intensified when it does not consider the uncertainty arising from the interaction of the water cycle with the economic, social and cultural system (Pahl-Wost et al, 2007, White et al, 2008). Decreasing this uncertainty requires the integration of different types of knowledge (hydrological, social, economic, etc.) that are responsive to the changing social and economic dynamic that strengthens the adaptive water management (Pahl-Wost et al, 2008).

The conceptualization of the Water Code does not include adaptive water management nor the social learning at its conception. Therefore, it is expected to be based on strong hydrologic knowledge about the water cycle. Nevertheless, the Chilean water management system, based on solid information is a reduced characteristic during this stage. For example, Dourojeanni and Jouravlev (1999) agree that there is insufficient scientific and technical information to define the rules, such as continuity and variability of the hydrological cycle. This situation is intensified even more, because the Water Code does not consider the uncertainty arising from the interaction of the water cycle with the economic, social and cultural systems (Pahl Wost et al, 2007, White et al, 2008). That feature is not an integrative tool of knowledge types that can respond to changing socio-economic dynamics or can favor the application of adaptive approach (Pahl-Wost et al, 2008). Despite, this disadvantage, DGA has another function besides giving water-rights to whomever ask for it, it is in charge of promoting and spreading the information generated in its hydro-meteorological network, which has permitted developing multi-disciplinary research.

All this allows the code to position water as an economic commodity over cultural and environmental values, and as a result, such perceptions are not legally articulated, and participation starts with just water users. The Water Users Organization (WUO) is independent from the state, which is an essential pre-condition for legitimizing the existent political system, however these participation spaces were created by the government, it means that their dynamic was conceived and ruled by the government, and who could have participated effectively is only the water-users with water rights, whose speech lies in the private interest, so it restricts the participation of other actors. Consequently, the lack of the representation of actors as the ecosystem, the citizens and future generations are threatened. Since participation spaces are not inclusive and are closed, plus the *laissez-faire* economic philosophy of the Water Code, the textbook does not have the goal of ensuring the sustainability of eco-social system, and participation depends on the activation of water markets (Bauer 2004, 2005, 2009). Nevertheless, participation has disincentives inside of WUO.

Consequently, at this stage the basic elements needed to promote the integration of different actors and interests at the horizontal level were not generated, and what's more, the norms which govern the creation of WUOs do not encourage integration within this space. For example, in the water boards the vote quota is established legally and it water becomes an element of inequity and an impediment to effective participation, because there is no difference in voting between the consumptive and non-consumptive users, the permanent or sporadic rights and the number of votes depends on the amount of water rights that the individual has. Thus canal associations do not want to work within water boards because there may be a hydroelectric dam upstream that has equal or more rights than many irrigators put together. For its part, the hydropower that does not want to participate as a user with more rights, because it wll have more financial responsibilities (Brown, 2005). For example, in the Laja River basin there is an emblematic case of this situation between ENDESA and canal associations.

Unfortunately, very few vertical integration initiatives exist at this stage of water management system, and the results are as expected from a weak system when dealing with complex, hierarchical systems: fragmented and perpetuating the typical disenfranchisement of social-ecological systems (O'Brien and Leinchenko, 2003).

3.1.2 Stage II (1989-2005): Starting debate about climate change and integrated watershed management

This stage begins with the opening of debate on the environment, integrated water resource management (IWRM), and environmental requirements imposed by global environmental governance and ends with changes to the Water Code along with environmental recommendations made by the Organization for Economic Cooperation and Development (OECD).

The return to democracy allows political leaders to focus their speech on the pursuit of sustainability, through participation, transparency, accountability and efficiency; key criteria for the sustainable governance of water (Ashton et al, 2005, King, 2007). At this stage there are Chilean environmental institutions and the discussion of the code fails to send two packages of amendments to Congress and the definition of a National Policy on Water (DGA, 1999)

The first package is sent to Congress in 1992 and proposes four amendments (1) to justify the application of rights, a five-year deadline to use them, otherwise the DGA may withdraw the rights and awarded to another applicant with more specific and immediate needs; (2) to enable the DGA to cancel and re-distribute granted-but-unused water rights; (3) to create river basin organizations, and (4) to incorporate water quality and minimum flows prior to authorizing new rights.

The third and fourth amendments proposed were in direct relation to the criteria of this research. The proposed creation of watershed organizations held the recognition of the interdependent and interconnected relationships of all components of the basin, incorporating the society. Second, the regulation makes clear that sectoral management is not capable of solving the negative externalities of use and exploitation of water, so only through effective and inclusive participation of all stakeholders might sustainable water governance be ensured. Thus the proposed basin organization differs substantially in composition with the WUO (Peña 2003) through attempts to include more actors in decision-making. The last change recognizes the need to incorporate criteria to understand and assess the ecological dynamics of the basin, considering that there are many basins in the country with little or no information on their natural capital.

The first two proposed amendments support the need to increase participation in the WUO through the creation of basin organizations, where the state's role is to safeguard social well-being by requiring justification for the application of rights, which matches with the socio-economic and environmental impacts of the basin. The second also is closely linked with the most controversial result of the implementation of the Water Code, the monopoly of rights and, consequently speculation and legal rights scarcity, (e.g. Bauer 2004, 2005, 2009, Peña 2003, Peña et al, 2004).

Despite the incorporation of sustainability criteria and integrated watershed management framework in this proposal, there was not a legal breakthrough as in the case of environmental institutions creation in the country. Bauer (2005) describes this proposal as being quickly withdrawn from the congress, since it was considered very rude and aggressive.

A second proposal is submitted to Congress in 1996. This one is more cautious, limited, and pragmatic, and it is debated for eight years. It also proposes watershed organizations and channel protection areas and solutions to the monopoly of non-consumptive rights. The first, although discussed, is finally displaced by a type of payment that will be charged to users with rights, but with no water use. In 2005

Congress made the first modifications of the Water Code, which some authors suggest as peripheral since the core of the code retains its essence. Nevertheless, the main change in terms of recognizing the interdependency of watershed components is related to surface and groundwater, which are legally re-defined as one system and their management is re-joined.

However, the system could incorporate ecological minimum flow requests as new rights, since it was able to use a piece of legal subterfuge to determine them. Law 19,300 defined an environmental management tool – Environmental Impact Assessment and the norms that support it – which is applied for determining environmental flows for new projects to be carried out and that will significantly impact natural resources like water. However, its application is very restricted, because the flow of most of the basins of northern and central Chile had been fully granted during the first stage. Thus, the application of environmental flows could be performed only in watersheds that had not been declared exhausted (Brown, 2005).

Since most of the proposals were not incorporated into the centerpiece of water management in Chile, in 1999, the DGA defines the National Water Resources Policy (Estrategia Nacional de Recursos Hídricos) which contains the proposals of previous years (DGA, 1999). This combined with local initiatives to manage watersheds show there are a different actors, stakeholders at different scales that are interested in the possibility of management the water resources through an integrated framework. For example, the Administrative Coordinator of the Biobío River basin (Coordinadora-Administradora de la Cuenca del río Biobío; Larraín et al, 1988) is an important initiative that tries to coordinate governmental institutions with the WOU, but it relies on the existing legal framework, which is characterized by its dispersion. Ultimately, this initiative did not succeed, perhaps because of the involved actors, stakeholders and researchers did not have enough power to reshape the debate, because the participatory spaces were exclusionary (Carruthers, 2001); the reflection of a political system that is vertical, elitist, and centralist limiting the participation of civil society (Carruthers and Rodriguez, 2009).

Paradoxically, at the end of this stage, the OECD makes fifty two recommendations in its report of environmental performance, including six belonging to the water sector, and one of them promoting the development of an integrated watershed approach (OECD and ECLAC, 2005). This milestone marks a new stage in water governance in Chile, one in which global environmental governance mobilizes national governance.

Around Climate Change, Chile advanced in the definition of a regulatory framework, through the ratification of the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol in 1994 and 2005, respectively. Therefore, establishing in 1996 the National Advisory Committee on Global Change (NACGC), this is constituted mainly by institutional actors, ministries, and organizations that generate scientific and technical information. This type of organism approaches the subject of participatory water governance but it suffers from a lack of citizen participation.

Since the Kyoto Protocol does not establish greenhouse gas emission reductions for Chile, the issue is addressed through both mitigation and adaptation to climate change with the same intensity. According to Claro (2007), this period of adaptation in Chile is in its infancy, as no concrete initiatives have been shaped and systematized, but rather is distinguished by a gap between official speeches presented in the international arena and the concrete actions in the nation However, its strength lies in its vast experience in exporting its natural resources, which is highly consistent with Chile's policy of economic openness. So, again it is possible to argue that global governance sets national policy and national sustainability is reactive and based on improving the foreign trade of resources.

3.1.3 Stage III (2005 to the present): A turning point in environmental governance in Chile

This stage is characterized as a turning point in the environmental governance of the nation, since it is a critical stage that exhibits the influence of global governance on the national environment and creates innovative-but-invisible re-adjustments of local water governance. Therefore, the critical element that is identified here is that continuance of the *status quo* will not lead to sustainability. For example, one of the greatest sign of this stage is that the appointment of the first Minister of Environment in January 2007, in 2010 the introduction of the redesign of environmental institutions, including the creation of the Ministry of Environment (Law 20,417, published 26/01/2010). This moves from horizontal to vertical ministerial coordination, but requires a immense financial capital investment to ensure the accomplishment of sustainability and a qualitative cultural change in all the society sectors.

Previously, in January 2006 NACGC developed the Climate Change National Strategy on (CCNE, CONAMA, 2006). A year later the National Strategy for Integrated Watershed Management was developed (NSIWM, CONAMA, 2007), basically, in response to recommendations made by the OECD.

Regarding the theoretical conceptualization of eco-social dynamics in the basin, an advance is identified that could not be expressed in the previous stage, despite the extensive discussion. The NSIWM in its conceptualization explicitly recognizes the interdependency and interconnections of all the watershed components with the culture in the territory of the basin. The NSCC in recognition of the transversality climate change incorporates all society sectors, considering both threats and opportunities and that action must be applied in the water sector in an integral approach.

However, there is a disparity in the planning process. In 2008 the NACGC developed the National Action Plan on Climate Change (NACPCC, CONAMA 2008), which defines the objectives of each of the strategy lines— adaptation, mitigation and capacity building and promoting — and activities, the agencies responsible for them and their deadlines. While the NSIWM is primarily responsible for creating the institutions in charge of IRBM in the country, the Basin Ministerial Council (BMC), which consists of ten ministries, further creates a Technical Secretariat, including at least DGA and ex-CONAMA, which provides technical support to the BMC and technical and financial support to watershed organizations to be created. However, in his sixth goal the NSIWM points out that the implementation of watershed organizations will be gradual and in a first stage by pilot watersheds, who served as an exercise test to evaluate the design of the institutions. Baker, Rapel and Copiapo River basins are the pilot watersheds in Chile.

This conceptual progress is not equal in terms of horizontal participation, as both NAGCC as BMC are mainly composed of ministries, reflecting the verticality and centrality of national politics. Moreover, in the case of NSIWM, although it establishes an agency in charge, the document does not enforce the creation of watersheds organizations. With regard to vertical participation, both documents emphasize coordination, in NAPCC between government, business and citizenship, and in NSIWM through public-private partnerships at the watershed level. In both cases the definition of participation that will allow such coordination, especially considering the level of intervention in decision-making by citizens, is unclear.

The NSIWM emphasizes coordination through public-private partnerships in watershed organizations. However, it is unclear about the definition of civil or citizen or social participation that will allow such coordination. Otherwise, municipal participation is not emphasized, considering that local government is voted for by citizens. On the contrary, governmental institutions at national and regional level are designated by the Chilean President. Either citizen or social participation is encouraged, in contrast, those who would like to be included in this agency must be part of an organization, so public participation occurs through civil society representatives and is merely voluntary. Thus, people are invited to participate in a space in which the disparities of power, and therefore inclusion, is still too large to be classified as transformative, since it may be absent of key stakeholders, such as the ecosystem and future generations.

In addition, the objective of this type of watershed management Chilean arrangement is the efficient management of the priority water “resources,” and it should be based on the actual legal framework. Therefore, *in situ* uses, recreational ecosystem services and biological demands continue without legal recognition and consequently, their representation might be part of others interests. This creates more complexity, because the NSIWM emphasizes the use of the existing sectoral legal framework as an efficient tool for integrated resource-based management (IRBM), and participation which leads to inclusion and decentralization is not a legal goal, so, the informal agreement emerged into a watershed organization, would remain outside the law, since it was characterized during a previous stage (e.g. see Brown, 2005).

For all above, I emphasize that allowing the participation of civil society to his will, it does not assure it, specially, given Chilean society is culturally leadership and it increases the gap between the rhetoric of participation and the promotion of effective participation among all stakeholders, which could lead to of de-legitimization of the state's role in water governance. I suggest that the state should regulate the shapes, mechanisms, and alternative forms of organizations emerging in the local area, such as water boards.

Likewise, progress is evident in relation to improving the quality and quantity of systemic information, integrated and linked between the government and academia. In the NSIWM, through the component tools and information, one would want to advance the incorporation of environmental criteria and the implementation of minimum flows and ecological and biological indicators in order to improve the information base and knowledge of the relationships and dynamics of ecosystems. However, I note that NSIWM does not strongly recognize the watershed as an area marked by integrated eco-social dynamics, even that it promotes research and definition of sustainability criteria that integrate economic, social and environmental issues; there is still a lack of integration of different types of knowledge, like traditional one. Additionally, NSIWM even promotes adaptive approaches, does not provide a definition or minimum elements that must incorporate this approach, even though it can be applied very technically, nor does it include social learning processes in the basin, which need not be explained with quantitative indicators. In this sense, assessing the contribution of qualitative methods is needed to collect the perceptions of the various actors in a basin aside from the implementation of actions within it.

There is no concrete progress in the vertical integration of water through a multitude of applications, but rather through persistent sectoral initiatives. For example, there are initiatives which integrate local and national stakeholders, like the association between DGA, INDAP and CNR for improving irrigation efficiency as the goal of sustainability and diversification of activities to reduce the impact of climate change. It should be noted that these institutions provide technical and financial support to poor agricultural players. Then, through them, it links horizontal integration with vertical institutional levels, from local to national, but still requires an integration of multiple water users and nonusers.

3.2 Chilean institutional landscape and key stakeholders

Usually, water governance structure is characterized by norms and relations among users with water-rights and the institutions that regulate their use. However, integrated watershed management leading to sustainable governance includes more visions and, consequently, more users, who may or may not have secure water tenure. Since this approach and the previous results, three components are identified in the institutional landscape: (1) goods and services provided by freshwater ecosystem, (2) users of these goods and services, and (3) the institutions governing the exploitation of water use-user relationship (Fig. 2).

The Chilean freshwater ecosystem provides seven major goods and services, some of which are priority uses promoted by the Water Code. It is added biological demand, all recreational uses, indigenous water use, traditional agriculture and population, which is the end user of the drinking water supply, provided by water companies in urban areas and community based organizations, named Rural Drinking Water (RDW), in rural areas. Since this characterization users can be divided into three types: (1) those with clear water rights and active exercise of those rights, (2) those without rights and whose use of water is regulated by conservation actions and (3) those in a transitional zone, since the current water-rights system is not capable of representing the relationship between user-water use, although legally explicit. This last case include indigenous communities with land titles without water rights, farmers who have rights but are not cadastral, or a population who is supplied of drinking water, and who has the duty to cancel the bill, but at the moment of decision making has no influence, because in practice they do not have water rights.

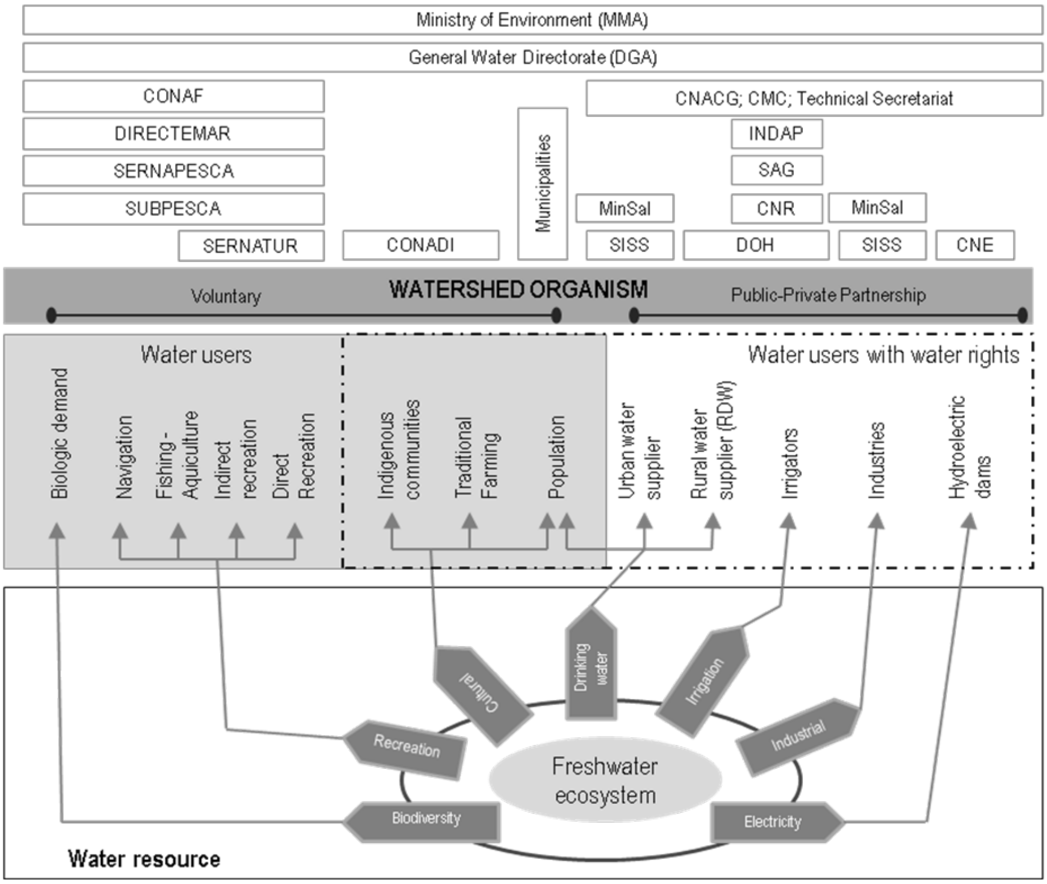

Figure 2 Actual institutional landscape of water in Chile.

This relationship between water-users reflects the same disproportionality in the watershed organizations promoted by NSIWM, where private actors are those who will be part of the public-private partnership, because there is clarity in the ownership of their water rights. While the others users participation is simply subject to being voluntary; first, to organize them and; second, to choose a representing to this organization. So, this organism promotes representative democracy.

The efficient management of water institutional regime is achieved through the formulation of public policy for each type water-water user relationship, and normative according to freshwater ecosystem, as well as regulations who limit externalities. In Chile, as in many countries, public policy comes after the existence of the legal framework. The NPWR emerged almost 20 years after the Water Code and NSIWM more than 25 years later. Both policies reinforce the separation between users with and without rights, as they continue to promote the priority uses identified in the Water Code. Also the structure and dynamics of governance in Chile were not re-structured, which is still characterized by the presence of many institutions, powers and sectoralized responsibilities, which overlap each other and there is little capacity for coordination, except isolated cases.

While DGA is the state agency in charge of granting water resources, it also has competencies in conservation, which it shares with:

- The National Forestry Corporation (CONAF) to protect forest ecosystems and environmental heritage.
- The National Fisheries Service (SERNAPESCA) to conserve aquatic resources and propose development plans for sport fishing.
- The Undersecretary of Fisheries (SUBPESCA) to ensure that aquaculture facilities operate at levels consistent with the capacities of lakes, rivers, and seas.
- The General Directorate of Maritime Territory and the Merchant Marines (DIRECTEMAR) to preserve the aquatic environment.
- The National Tourism Service (SERNATUR) to maintain essential ecological processes and to help conserve natural resources and biodiversity to ensure the growth of the tourism industry.
- MMA, which should work with relevant agencies in the formulation of environmental policies for the management, use and sustainable use of renewable natural resources and water resources.

Thereby, the entire group of users without rights is characterized by dispersion and clear institutional overlap and more subtly, at present, it does not appear that any of these state agencies have set up a system of "conservation" rights for these users or that there is a prioritization of the enjoyment of these uses of water, over the Chilean priority uses. By contrast, the institutional landscape of the priority uses has less overlap, but retains institutional dispersion. Also, there are independent organs of state that regulate water use and externalities on water pollution.

This research identifies a cluster of associations between the DGA, the Directorate of Hydraulic Works (DOH), and the National Irrigation Commission (CNR) that finance and support irrigation farmers to improve the efficiency of their systems in order to reduce the impacts of climate change. This formal relationship is technical in nature and brings together various local actors moving in the horizontal participation. However, it still ignores the water multi-propose and is uncertain in scaling up participation, since this latter point is not one of its goals.

In relation to transition users are found four key government agencies that regulate some extent the water-user relationship:

- DGA in its role of managing the water resource is in charge, from 2005 modifications, cadastre and regularize water rights.
- The National Development Indigenous Corporation (CONADI) by Waters Programme should "Financing the constitution, regulation or purchasing water rights or finance works aimed at obtaining water resource" for indigenous communities.
- Ministry of National Assets (MBN) that should lead the cadastre of public goods in the nation.
- Municipalities that promote community development and have different functions in the planning of communal land, for example, that the development of community development plans are in harmony with the region.

While governance in this section attends to solve the gaps tenure water rights, it is unclear how they will be solved barriers which generated these problems. For example, the regularization of water tenure in Mapuche communities is only one element of the Mapuche conflict. The population supplied by drinking water does not have spaces where to make decisions about water and its local governments do not have jurisdiction over water management, only administrative aspects of rainwater.

In this section are added other government agencies that have jurisdiction rainwater. DOH and the Department of Housing and Urban Development (SERVIU) of the Ministry of Housing and Planning, have authority over the collection of water. The former is responsible for primary network of rainwater collection, and master plans that are designed and implemented for cities over 50,000 inhabitants. The other agency is in charge of secondary network and if the city is less than 50,000 inhabitants, the storm water network is in charge of the municipality. This element is a threat to management in the future, because many of the recommendations around climate change point to the harvest rainwater or use of the winter flow to ensure agricultural uses.

There are other institutional actors such as the National Promotion Corporation (CORFO), which nowadays owns around 40% of the shares in drinking water supplier enterprises. The Ministry of Economy and Development which promotes the economic development of sectors such as aquaculture, fishing and tourism, all direct or indirect users of goods and services provided by Freshwater ecosystems.

Depending on the methodological framework developed in this research, the current governance structure of water is a reflection of the characterization of the stage III. Because it is developing a restructuring of the entire Chilean environmental system, the question of which competencies will pass from all of the key institutions identified as key to MMA and if these changes will lead or not to a qualitative change in the way of governing water in Chile.

3.3 Key stakeholders' perception to IWM facing climate change. Preliminary results

The analysis of this data is still in process, nevertheless there are partial results that help relating the main strengths and weakness of actual Chilean water governance system with the perceptions of key stakeholders and decision makers around these issues. Likewise White et al, (2008)

For understanding the perception of stakeholders was necessary to consider the background work, especially for understanding differences in the level of organs of state. The characterization of the institutional landscape is key for understanding these elements, because there are three areas described above, the structure of water governance that regulates the priority uses, the structure that regulates the transition water use and the one which regulates the conservation of freshwater ecosystem. Of the respondents, those who belong to the landscape of the priority uses are engineers, whether civil or agricultural. In the two remaining landscape professional diversity is greater, civil engineers, biologists and natural resources engineers are more abundant in the institutional landscape in charge of conservation. CONADI and Ministry of National Property stakeholders were not interviewed because their functions can be classified for regularization water rights without clear normative functions regarding the management of water in Chile.

At the beginning of this research, nine different types of stakeholders were expected. Nevertheless, there are six clearly different; also this distinction is related to the division at the institutional landscape. The cluster association between DGA, DOH, CNR in the governance structure of priority water use establishes one type, due they share the same profession, believe that the main source of national problems are caused by the actual water management system and they mentioned that the water code requires a review and re-formulation to improve the integrated watershed management, and at the same time these stakeholders pointed up this task is a very difficult one, because it requires political will to make these changes and is required to reduce the power level of Corporations which pressure the decision making.

Aditionally, these respondents showed participation is a subject unsolved in the Chilean actual water management system. These could be explained due these stakeholders have a strong and close relationship with the freshwater ecosystem and agricultural users, so they mentioned that is necessary an advanced in participation in terms of less representativeness. This is, leading from a representative democracy to another type. Also, they pointed out another result from the literature review, it exists cultural barriers to participation. For example, inside the WUO irrigation users assist to the meetings, but a lot of them they denied to express their opinions, which might be because they have loosen credibility to the government and they feel it does not worth it because the empowered users will take the decision even they opposed to it.

The second group belongs to water governance structure of conservation water uses. Unlike the former and as a reflection of the governance structure of water uses for conservation has a greater variety of responses around the four subjects evaluated. Especially at the moment of defining climate change, because respondents included certain concern about in which amount the effects that are perceived could be explained by natural changes of the climatic system. Many of them also described the climate change as an opportunity for cultural changes at the societal level. And adaptation is the best strategy to deal with climate change, nor mitigation which is considered an efficient economy tool to disincentive just one human activity: green-house gases emissions; however it is not capable of modifying consume behaviors.

The third type of key stakeholders is the industrial water user. Equally as the previous type they are concern about climate change and its impacts over production. Nevertheless, they considered adaptation in a narrower definition. Adaptation is seem as industrial process improvements, like re-circulation of water, augmentation of irrigation surfaces, using more efficient irrigation systems and finally improving knowledge about the impact of climate change over the economy sector, but it should be done by the state and its research institutions like universities and environmental centers.

In relation to citizen participation, these respondents pointed up it should definitely be improved by the government in order to assurance good relationships between industry, government and society, but it should be by representativeness and in terms of information and consultation but not transformative.

Likewise it was mentioned by the first type of key stakeholders, irrigation users interviewed mention participation is a main topic for going towards a sustainable water governance, but they explained that the barriers to participation resides in a low income, low educational level and lack of financial support. Related to climate change it was identified that they perceived it like a threat to their production and person but it is still confused with religious subjects like a God punishment. They mainly perceived climate change trough their relationship to nature, in terms of precipitation patterns, changes in flow river patterns, and quantity of days with no rain.

The fifth type is academia stakeholders which had been involved in participation spaces for decision making over environmental issues. The last ones are the social stakeholders as municipalities and communities organizations. These two types at the moment are the more different. The former is very aware about what climate change is and which the main impacts in Biobío River basin and Vergara River sub-basin are. In terms of integrated watershed management they are very precautions about the implementation of it in the Chilean territory because they do not feel that global environmental governance is able to solve the inequities between priority water uses and all the actual and potential water uses, like biological demand.

Managers at municipality level are more aware about the environmental problems in their administrative territory. More deep analysis of the code is in process for understanding which are the perceptions, values and consciousness that could guide the actual water governance in Chile towards sustainability and adaptation to climate change.

4. EARLY CONCLUSIONS

The historical analysis of the main piece of legislation of the water management system in Chile, from the political context and considering the basic principles of Integrated Watershed Management, identified three historical stages. From this analysis I was able to identify three different types of strengths in the current water management system and how they differ in terms of its history and the principles that they promote: integration and/or adaptation.

The first historic strength is produced by legal developments in the tenure of water rights for the priority uses of water in Chile, such as agriculture (i.e., the strengthening of the regulation of water resources and the creation of an agency responsible for the allocation of those rights). Another historic fortress, with gradual and steady progress over time, is the generation of integrated information for decision-making. This was conceived from the first stage and, during it, favored the generation of hydro-meteorological data. With the passage of time, it added other types of information, such as those promoted by the actions defined for facing climate change, for example, the use of climate models to estimate the impact of climate change on hydrological patterns, the availability of water, and economic impact. This close relationship between climate, hydrology, and economy still needs to include the social component, beyond the individuals or communities that have a direct relationship to the use and enjoyment of water. Similarly, in the NSIWM is encouraging the use of adaptive management for pilot watershed organizations, but does not integrate social information.

The third strength identified is inter-sectoral and inter-agency coordination, which is also a characteristic gradually achieved. The first phase generated the basic policy framework for encouraging the organization of water users, and, despite the weakness of its institutional arrangement, the WOU is considered as a basis to promote water management at the watershed scale in NSIWM, where it will also add coordination with institutional actors. Additionally, there is strong coordination among the players responsible for IWM and climate change in the national government, trough the Ministerial Watershed Council and Global Climate Change National Council Advisor respectively. In theory, this coordination is replicated throughout the country through the creation of watershed organizations; however, those have still not created, so it is early enough to make assessments.

As for weaknesses, there is little promotion of inclusive participation in local and watershed-level. Public-private partnership-organizations should be organized whit priority water users and with enough power to take decisions. With poor horizontal integration it cannot be guaranteed that participation scaling up to higher levels of decision-making will occur. This weakness, as well as the strengths identified, stems directly from an unresolved issue in the discussion of how to understand the key concepts of integrated watershed management. In this regard, I note that water and water resources are related, but not equivalent, concepts whose distinction is not clearly defined in the legislation, which adds the notion that integration at the watershed scale is based on the relationship between hydrology and economics. Ultimately it is grounded in the conceptualization that eco-social dynamics of the basin is poor and continues to threaten the effective participation of society.

Under this legal framework, future generations and biodiversity, as well as *in situ* uses are excluded users In the NSIWM, this problem would be overcome by creating river basin organizations, but this document is not binding. Therefore, in many basins in the country decisions on water are based on production factors and not based on the future sustainability. In the event that you have created a watershed organization and had a representative of an organization take custody of biodiversity and/or future generation demands, there are doubts about how much power may be exercised in these spaces or the role that institutional actors that historically had power to make decisions about water management may have.

Despite this weakness so ingrained in the system, this is a time of change, because if it combines both the pressure of global environmental governance with all actors involved directly or indirectly in the management of water in Chile. The only option is moving towards adaptive water governance in Chile, and we can evaluate more complex principles such as inclusion, equity, democracy, or more technical points, such as the identification of the best tools for guiding the process of deliberation in a basin organization.

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