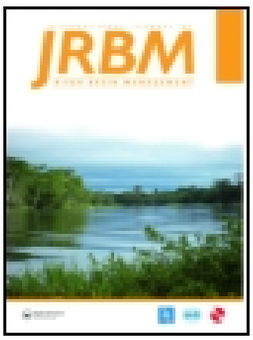


International Journal of River Basin Management

ISSN: 1571-5124 (Print) 1814-2060 (Online) Journal homepage: http://www.tandfonline.com/loi/trbm20

Is collaborative management always possible? the case of Sauce Grande River Basin, Argentina

Mariana I. Zilio, Carina Seitz, Facundo Scordo, Verónica Gil, Paula Zapperi, Paula Costilla, M. Andrea Huamantinco Cisneros, Gerardo M. E. Perillo & M. Cintia Piccolo

To cite this article: Mariana I. Zilio, Carina Seitz, Facundo Scordo, Verónica Gil, Paula Zapperi, Paula Costilla, M. Andrea Huamantinco Cisneros, Gerardo M. E. Perillo & M. Cintia Piccolo (2018): Is collaborative management always possible? the case of Sauce Grande River Basin, Argentina, International Journal of River Basin Management, DOI: 10.1080/15715124.2018.1546727

To link to this article: https://doi.org/10.1080/15715124.2018.1546727

Accepted author version posted online: 14 Nov 2018.

Publisher: Taylor & Francis & International Association for Hydro-Environment Engineering and Research

Journal: *Intl. J. River Basin Management*

DOI: 10.1080/15715124.2018.1546727

IS COLLABORATIVE MANAGEMENT ALWAYS POSSIBLE? THE CASE OF SAUCE GRANDE RIVER BASIN, ARGENTINA

Mariana I. Zilio*[1]; Carina Seitz[3,4]; Facundo Scordo[3,5]; Verónica Gil[5]; Paula Zapperi[5]; Paula Costilla[3]; M. Andrea Huamantinco Cisneros[3,5]; Gerardo M. E. Perillo[3,4]; M. Cintia Piccolo[3,5]

*Corresponding Author; e-mail: mzilio@uns.edu.ar

[1] Instituto de Investigaciones Económicas y Sociales del Sur (UNS - CONICET-), San Andrés 800, Altos de Palihue, 8000 Bahía Blanca, ARGENTINA

[2] Departamento de Economía, Universidad Nacional del Sur, San Andrés 800, Altos de Palihue, 8000 Bahía Blanca, ARGENTINA

[3] Instituto Argentino de Oceanografía (IADO-CONICET), Camino de la Carrindanga, km 7.5, B8000FWB Bahía Blanca, ARGENTINA

[4] Departamento de Geología, Universidad Nacional del Sur, Av. Alem 1253 2 Piso of 202, B8000DIC Bahía Blanca, ARGENTINA. e-mail: cseitz@iado-conicet.gob.ar

[5] Departamento de Geografía y Turismo, Universidad Nacional del Sur. 12 de Octubre 1198, B8000CTX Bahía Blanca, ARGENTINA. e-mail: fscordo@criba.edu.ar

ABSTRACT

The continuous interaction between human activities and environment leads to adopting a broad approach for studying watershed systems. Undoubtedly, designing an efficient but also sustainable river-basin management plan requires considering the ecosystem, the economic and social aspects related to the use of natural resources. Given the practical and theoretical relevance that stakeholders' participation has achieved in the frame of new approaches for watershed management, this paper aims to identify the possibility of implementing a collaborative strategy in the particular case of

the Sauce Grande River Basin (SGRB), Argentina. Such implementation requires the fulfillment of some key conditions that heighten or hinder their execution. Our results indicate that, although the complexity of the basin makes necessary the implementation of a collaborative plan, it is not plausible in the short term. Some issues, such as the engagement of all stakeholders (inside and outside the basin), and the simplification and coordination of the norms and levels of decision making, should be taken into account for implementing a collaborative management in the basin. Otherwise, the implementation could have a non-expected result on the socio-ecological system, generating an immediate reject to more participative strategies.

List of abbreviations (in order of appearance):

SGRB: Sauce Grande River Basin.

ADA: Water Authority (as per its initials in Spanish, Autoridad del Agua).

ABSA: Aguas Bonaerenses SA, operators of water and sanitation supply.

OECD: The Organisation for Economic Co-operation and Development.

PSA: Prospective Structural Analysis.

MDI: Matrix of Direct Influence.

NGOs: Non-governmental organizations.

IFC: International Finance Corporation.

ENSO: El Niño-Southern Oscillation.

1. INTRODUCTION

Studying watersheds from a socioeconomic -instead of a biophysical- point of view implies recognizing the continuous interaction among nature and human activities including their direct and indirect impacts (Montico, 2002; FAO, 2007; IDEAM, 2013). In this context, recognizing the relevance of social aspects in water resources management involves conceiving a river-basin management plan as a continuous and flexible process (Montico, 2002) and implementing qualitative methodologies to capture the whole complexity around the use of natural resources.

The concept of integration encompasses most of these requirements and implies the creation of new dialogue spaces between researchers and policy makers as well as among the users of natural resources. This idea has recently gained ground within the frame of watershed management research (Calheiros et al., 2000; Abers, 2007; Sneddon and Fox, 2007; Voinov and Gaddis, 2008; Mavrommati et al., 2014; Mutekanga et al., 2013; Blackstock et al., 2015). Furthermore, the social perception about the environmental situation of the basin can affect the decisions about the use of water, as well as determining the conservation degree of the resource. Resource sustainability is favored when a watershed management plan, designed according to each particular context, guides its exploitation (UNEP, 2014).

In this context, local knowledge became a critical piece of policy design, and the engagement of local stakeholders is considered a necessary condition to reach a correct implementation of a watershed management plan (Collins et al., 2007; Steyaert and Jiggins, 2007; Reed et al., 2009; Iniesta-Arandia et al., 2015). Besides, empirical evidence suggests that participatory approaches, in which users have an active role in managing their watershed resources, can lead to more efficient projects than the *top-down* models previously implemented (Johnson et al., 2001). If local stakeholders are coerced to adopt technical measures imposed by external agents instead of being included in policy design, they would not feel owners of the strategy, avoiding their participation and, even acting against it. Thus, the collaborative management constitutes a hybrid approach that involves different degrees of *top-down* and *bottom-up* policy implementation (Ayers et al., 2017). Collaborative strategies allow the participation of local stakeholders in policy design but maintain certain features of the top-down models concerning the decision-making and implementation processes. The literature covers a broad range of topics as regards the collaborative processes such as its normative statements and empirical descriptions of different types of collaborative processes (Leach et al., 2002; Jacobs et al., 2008; Mandarano and Paulsen, 2011; Robinson et al., 2011; Dewulf et al., 2011; Borisova et al., 2012; Ananda and Proctor, 2013; Ogada et al., 2017). Furthermore, other authors have focused on the analysis of causal arguments explaining the cohesiveness and longevity of collaborative efforts (Koontz and Thomas, 2006), and discussions about the mere usefulness and implementation of the approach (von Korff et al., 2012; Benson et al., 2013; Ananda and Proctor, 2013; Prokopy et al., 2014; Margerum and Robinson, 2015).

However, the practical implementation of any management strategy with higher participation of resource users is complicated and requires the fulfillment of several conditions for being successful. In fact, the characteristics of the resource, the degree of involvement and engagement of local stakeholders, and the institutional and legal aspects of environmental policy could act as strong constraints on the real application of such approaches. The high performance of collaborative management depends on the ability to contribute to the improved exchange of resources, link different levels of organizations, generate access to various skills and competencies, reduce transaction costs, enhance opportunities for risk sharing, and establish conflict resolution mechanisms (Carlsson and Sandström, 2008).

Within this context, collaboration strategies are often advocated as a means to improve river basin management, but is collaboration always possible? This paper will address this question using the Sauce Grande River Basin (SGRB) as an example. The diversity regarding its landscape, social community, climate, hydrology and institutional framework converts this basin into an excellent example of a complex system. This kind of system can be found worldwide, especially in developing countries, but with the advantage that the size of the basin makes it logistically manageable for the present purpose.

The paper is structured in six sections. After the introduction, which presents a short literature review and the aim of this research, Section 2 describes the SGRB as the study area; Section 3 provides an explanation of the Participatory Research approach to conduct the integrated study of the socio-environmental situation of the basin; Section 4 presents the results, and Section 5 discusses the lessons emerged from the fieldwork, analyzing if it is or not possible to adopt a collaborative strategy to manage water resources in this basin. Finally, the concluding remarks explain the reasons that make rather unlikely the short-term implementation of a collaborative approach to water management in the SGRB.

2. CASE STUDY: THE SAUCE GRANDE RIVER BASIN

Sauce Grande River Basin (SGRB) has 4,610 km^2 and is located in the south of the Buenos Aires Province (Argentina) (Fig. 1). The area comprises different natural environments (mountains, plains, lakes and ocean coasts) which offer ample

opportunities for economic and tourism development. A temperate climate is characteristic of the region with high temporal and spatial rainfall variability. Typical wet and dry periods link to regional and global circulation dynamics (Barros et al., 2000; Scian, 2002, Peñalba and Vargas, 2004, Zapperi et al., 2006; Carbone et al., 2008; Bohn et al., 2011; Casado, 2013). The watershed was divided into three sub-basins with significant differences (Gil, 2010; Casado, 2013). The upper basin extends from its headwaters (Sierra de la Ventana System) to the *Paso de las Piedras* reservoir. It has the highest altitude (1300 m.a.s.l.) and slopes. The middle and lower basins have relatively low slope gradients. The former extends from the dam to *Las Oscuras,* where the elevation is 60 m. In the latter, the river has a sinuous pattern and flows into the *Sauce Grande* shallow lake, which is formed by the damming of the river by coastal dunes (Isla et al., 2001). The shallow lake outflow into the continuation of the river is at its southwest margin. Near the outflow, it receives *Las Mostazas* Creek from the north. Finally, the river flows through the dunes and reaches the Atlantic Ocean forming a shallow estuary (Fig. 1).

[Insert Figure 1]

The natural characteristics of the area (mainly the climate) of the SGRB define the production system and its dominant agrarian structure all along the basin. Production is mainly grain crop (soybeans, corn, wheat, and sunflower) and, to a lesser extent, livestock (cattle and sheep). Despite these characteristics, agricultural production has undergone major changes in land use in recent years, with diversification in primary products and new productive alternatives, such as olive growing, winemaking, and aromatic crops. Tourism development, especially eco- and rural tourism, is an important driver of economic activity in the basin; causing significant growth in the villages of the upper basin (Sierra de la Ventana, Villa Ventana, and Saldungaray).

The Sauce Grande shallow lake is also a major tourist attraction with many recreational activities related to Monte Hermoso City (Fornerón, 2013). Also, at the lower basin, the *Paso de las Piedras* Dam gives a particular characteristic to the system. It was built in the 70's to supply drinking water to Bahía Blanca and Punta Alta cities (near 360,000 inhabitants), both located outside the basin boundaries. Its water volume depends only on precipitations over the upper basin.

In Argentina, the National Constitution confers to the provinces the original dominion of the natural resources existing in their territory and authorizes them to create its legislation. The Water Code of the Buenos Aires Province (Law 12.257/99, Provincia de Buenos Aires, 1999) establishes the regime of protection, conservation and the water management of the province. The Water Authority ADA) is the institution designed by this regulation to supervise and monitor all activities and infrastructure works aimed at the collection, use and drainage of water in the SGRB. This institution is also in charge of confering rights for exploitation, and consumption of water and granting permits for the occupation or use of this resource in public waterways.

According to the regulations (ADA Resolution No. 465/13), irrigation, livestock farming, industrial activities and provision of drinking water are considered an extractive use of water. Therefore, users must obtain a permit from the Water Authority to carry out surface or underground exploitation of this natural resource. In order to get the appropriate authorization, infrastructure works involved cannot represent an obstacle to the local and regional flow, nor have to be a threat to the natural composition and quality of the water. On the other hand, users, as concessionaires, must pay a fee which is calculated according to different factors such as the type of user, volume of water used, and the financial cost of studies and works aimed to monitor and conserve the resource.

Aguas Bonaerenses SA (ABSA) stands as one of the largest drinking water and sanitation supply operators of Argentina, and it is also the most important concessionaire of the basin. This company takes water from the Paso de las Piedras reservoir to provide drinking water to the cities of Bahía Blanca (300,000 inhabitants) and Punta Alta (60,000 inhabitants). Although these cities are located outside the physical boundaries of the basin, they are notable for their regional influence. Furthermore, ABSA provides a significant amount of water to the industrial pole located in Bahia Blanca (an estimated 30% of total untreated water provision), which generates conflicting interests around the priorities in the use of water in times of scarcity.

Given this socioeconomic structure, the implementation of any collaborative strategy should consider the participation of certain social actors as a necessary condition for success. In particular, actors related to agriculture and livestock farming and tourism activities should be included on behalf of productive activities, while local

governments, ADA and ABSA should also participate since they are the actors that currently hold the decision making power. The most significant groups of final consumers of the water of the river are located outside the basin. They should be especially considered and, consequently, have strong negotiation power and a relatively higher weight in the decision-making process of water management.

Finally, a basin committee was formally created in 2000. However, since the committee never operated in practice, it was not considered as a relevant stakeholder.

3. METHODOLOGY

An integrated study of the socio-environmental situation of the SGRB was conducted using a set of qualitative techniques proposed by the Participatory Research approach. This methodology allows a comprehensive understanding of the watershed from the perspective of social subjects who use its resources. It is also an opportunity to gather both the decision makers and non-decision makers' stakeholders to identify the emerging problems and the conflicts about water resource use. The activities were conducted to determine the current state of the factors that could strengthen or hinder the implementation of a collaborative approach in the basin.

Adapting the OECD (2015) definition to the context of water management, stakeholders are considered to be individuals or groups who are directly or indirectly affected by the water resource, as well as those who may have an interest in the resource and/or the ability to influence the outcome of its management. Undoubtedly, precise identification of stakeholders is essential for a successful implementation of a collaborative management approach, since their interactions, interests, and perception of problems related to the use of water depend on their position on the social framework. In addition, mapping existing institutions inside and outside the watershed allowed to analyze the stakeholder dynamics and to identify producers and consumers of environmental services.

In this context, the stakeholders were selected according to an exhaustive socioeconomic characterization, previously performed, focusing on the problems related to the use of water (Bryson, 2004; Reed et al., 2009). The methodology proposed was based on "*purposive sample*" (Patton, 1990 in Maxwell, 1996), or what is called "*selection criteria*." In this particular case, two selection criteria were used: pertinence

and representativeness (London et al., 2012). The relationships between users and resources, their knowledge of the system, and their ability to affect the watershed allow the evaluation of pertinence. Whereas how well or how accurately each individual reflects his/her group of interests marks their representativeness.

After identifying the relevant stakeholders, we conducted two workshops to find the main problems related to the use of water from different user's perspectives: one with stakeholders without decision-making power; the other only with the stakeholders who currently act as decision makers. Since different political decision levels do often have very different opinions, the objective of this separation was to avoid the influence in the participation of a group because of the presence of the other, getting a higher level of sincerity when revealing perceptions. In both cases, we used the brainstorming technique (Kemerer and Slaughter, 1997; Geilfus, 2002).

To rank the identified problems related to the use of water in the basin, we organized a third workshop in which all stakeholders met together. Here it is necessary to note that having a meeting with both groups in the same room required a good deal of convincing as they tend to reach a high level of unrest among the participants. Afterward, using the Prospective Structural Analysis (PSA) and the MICMAC software, we defined the linkages and relationships of influence and dependence among the problems identified during the first two workshops.

The PSA is a tool designed to link ideas describing how a system is operating. We reduced the essential components of a system to a matrix which shows the relationships of influence/dependence and the intensity among variables. Such relationships (in this case, problems) emerged from the workshop session of the whole group. For organizational reasons, we separated the attendants to the meeting into two similar (but internally heterogeneous) sub-groups. In each sub-group, a moderator guided the debate to establish the relationship between the problems identified through the brainstorming technique during the first two workshops. We employed mobile displays and double-entry tables to conceptualize relationships among variables and their degree of influence. The stakeholders identified the degree of direct influence with numbers 3, 2, 1, 0, respectively, referring to "a lot," "little," "anything" and "irrelevant," and using a "P" for the potential direct influence.

We then obtained a first approximation of the Matrix of Direct Influence (MDI) (Arcade et al., 1999) from the outcomes achieved in this activity. The MICMAC

software also allows getting a vision of all variables through the Map of Direct Influence. In this map, the key variables are on a Cartesian plane where levels of dependence and influence are in the horizontal and vertical axis, respectively. Based on this map, the role that each variable plays into the system can be analyzed and grouped into five categories: inertia or autonomous variables, outcome variables, motor or regulatory variables, challenge variables and control variables (see Arcade et al., 1999 for further details).

Finally, although a significant effort was made for convening all the relevant stakeholders to participate, one of the essential components of the socio-economic fabric of the basin, the farmers and the ADA authorities did not attend the meetings. For that reason, we implemented an online survey including open, close, multiple choice and text questions. It was sent to all the identified stakeholders to test the perception of those who did not attend the workshops and also to validate the results obtained with the participatory methodology.

We divided the questionnaire into three blocks. The first one aimed to analyze the ecosystem services provision, including questions about the use of water and the identification of problems related to the resource. The second one had statistical purposes. Questions to test the knowledge about climate change issues were included to get guidelines to identify the respondent profile. Finally, the third block searched for necessary information about the labor, professional or lucrative activity of the respondents, as well as their access to water.

Figure 2 briefly illustrates the fieldwork carried out to determine the viability of implementing a collaborative approach in the case of SGRB.

[Insert Figure 2]

4. RESULTS

Near sixty stakeholders were selected, including those who currently act as decision makers and those who are just users of water and have no decision making power. Some of the most important groups identified were artisans, neighborhood groups, rangers, teachers, firefighters, representatives of municipalities and other government agencies,

other social institutions (OSIs), and local non-governmental organizations (NGOs), which were crucial for enabling the interaction between the SH and the research team.

In particular, the NGO *Ambiente Comarca,* located in the upper basin, actively contributed to convene people to workshops and to spread all the project activities and advances. Nevertheless, it is relevant to acknowledge that this NGO is closely linked to educational and social institutions, but scarcely related to productive sectors. In fact, and probably due to the existing conflict with other users of the basin, farmers finally had an almost null attendance to the workshops.

The SGRB is likely to be affected by the occurrence of dry and wet periods. Many farmers of the area have the economic resources to install irrigation equipment during droughts, as well as to construct channels, levees, and (illegal) dams in flooded areas. The accomplishment of such changes over the basin, in some cases without any government authorization (or even against it), originated various confrontations with the rest of the water users in the basin. The possibility of conflicts may have discouraged farmers to participate in the workshops. The online survey above described was then conducted to compensate this unbalance in workshop participation. Figure 3 shows the stakeholders that attended the meetings according to their location in the basin.

[Insert Figure 3]

Regarding the stakeholders who currently act as decision makers, most of the attendants belong to the upper basin, while the counties that consume the drinking water from the dam but are out of the basin boundaries did not participate. The same situation occurred with the decision makers representing the ADA, who rarely engage at any meeting unless political authorities summon it. As the next section asserts, this recurrent absence can be considered a first sign of the difficulty to implement a more collaborative management strategy in the basin.

From the first two workshops, it emerges that the stakeholders without decision power perceive that “pollution”, “legal framework”, “seasonal issues”, “corruption”, “weather issues”, “education”, “consciousness”, and “sustainability of the water resource” are the main concerns over the basin.

Regarding pollution, these stakeholders recognized the agrochemicals as the principal contamination source of soils, surface water, and groundwater, although other

problems were identified as well: open dumps, lack of sewers, dispersion of solid wastes in the environment, and the remote possibility of exploration and oil production activities involving *fracking*.

As regards the legal framework, the whole group agreed that the existing laws for water management along the basin are not adequately applied, probably because the watershed is not actually considered a unit for policy purposes. Moreover, they stated that some improvements in hydrological infrastructure are urgently needed.

Among seasonal and weather issues affecting the basin, this group mentioned the seasonal variability of rainfalls and the strong increase in water demand during summer, which generates serious water supply problems. These factors systematically affect the physic, chemical and biological conditions of water and consequently the development of recreational activities each summer. Furthermore, in the SGRB area, these stakeholders considered that the infrastructure related to water built in the last years was not suitable and had a high cost concerning the benefit they provide. According to their perception, this situation can be found across the entire basin and could be directly related to corruption.

Finally, water scarcity during intense drought periods was almost the only climate concern expressed by this group. However, although climate seems to be a crucial factor, most of the problems related to the water in the basin were almost exclusively assigned to shortcomings in water management.

The workshop with decision maker attendees gave slightly different results. The identified problems, listed according to their relative importance, were “irrigation and reservoirs," “legislation," “infrastructure," “pollution," “drinking water availability," “climate issues," “production-derived pollution," and “lack of control over water resources."

These stakeholders identified as the main problem the lack of control over water extraction through illegal private dams, which are used for crop irrigation and livestock water drinking. Even when legislation regarding water use exists, decision makers indicated serious implementation problems, mainly because each of the six counties that compound the basin has different and overlapped regulations. Meanwhile, infrastructure is also limited and should be adapted to solve the new environmental conditions, especially the water shortage during summer. This group identified the climate

influence over the water resource, but they considered that natural climate variability is less relevant than the anthropic impact.

Finally, collected data was classified listing the problems or variables to perform the PSA analysis. The variables included *Climate Variability, Urban Pollution, Production-derived Pollution, Water Infrastructure, Joint Work between Municipalities, Insufficient Legislation, Lack of Legislation control, Corruption, Awareness / Environmental Education* and *Summer Season*. The information to classify these variables according to their degree of influence and dependence on the rest of the watershed system emerged from the third workshop in which the two groups of stakeholders were together.

The map of influence and dependence indicates that *Urban Pollution* and *Water Infrastructure* exerted the lowest level of influence into the system, which is consistent with the fact that decision makers did not recognize the treatment of solid urban waste as a severe problem. *Climate Variability, Joint Work between Municipalities* and *Insufficient Legislation* exhibited the lowest level of dependency. *Corruption* held the most considerable influence, followed by *Awareness / Environmental Education* and *Insufficient Legislation*.

On the other hand, the most dependent variable was *Urban Pollution*, followed by *Water Infrastructure* and *Summer Season.* The last one was the only variable that exhibited a high level of dependence as well as influence over the whole basin. In this context, *Summer Season* was identified as the only challenge variable of the system, which implies that any policy aimed to solve or mitigate the problems emerging in summer will significantly impact the whole system. Once again, it was clear that governance problems were more relevant than the other variables, confirming the conclusion of the first workshops.

Furthermore, the direct influence maps based on the stakeholder's perception also asserts that corruption, lack of control of legislation and water infrastructure resulted in urban pollution. In other words, the status of local sanitation and environmental conditions could be a consequence of problems related to a poor management and/or administration of local resources.

5. DISCUSSION

The possibility to adopt a collaborative strategy to manage water resources clearly depends on a set of factors that acts as necessary conditions to ensure its implementation. In this context, recognizing some lessons emerging from the fieldwork performed on SGRB can be useful to determine if the current situation on the basin facilitates or hampers the implementation of a collaborative approach.

Degree of engagement of stakeholders

In the SGRB case, the first lesson that emerged from the fieldwork is related to the different degrees of engagement of the stakeholders invited to participate in the proposed activities. Despite the exhaustiveness of the stakeholders mapping, it was complicated to attract two of the more relevant actors of the basin: farmers and the ADA. Furthermore, after several tries involving both actors, the perception of the first group was finally known through a complimentary survey, but it was not possible to convene the ADA to any activity.

Undoubtedly, the more the engagement of the local stakeholders in natural resource management, the more the success of any environmental policy is (Reed, 2008; Talley et al., 2016). In this context, engagement refers to a substantive dialogue with the intended purpose of involving stakeholders in problem-solving and decision making (Avis, 2015). However, securing the participation of stakeholders through the time could be a hard task without the right incentives. These motivations do not refer to economic payments but to find some genuine stimulation to participate in water management.

The absence of the ADA is also a significant obstacle to implement a collaborative approach in the basin. The non-attendance of the highest authority in water management is a clear sign of lack of interest in transforming the water management towards a more participative one. It is evident that existing conflicts around the use and management of water discourage the participation of farmers and authorities, undermining the adoption of a collaborative approach, at least in the current situation. However, constant attacks on the local ADA representatives during official meetings, or through regular and social media, could be a possible justification for not attending non-essential or compulsory meetings.

According to IFC (2014), at least seven benefits stemming from stakeholder engagement are identifiable: 1) building an accurate understanding of the local context;

2) building relationships based on trust and transparency; 3) ensuring consistency in stakeholder engagement and communication; 4) managing stakeholder expectations through an appropriate approach; 5) establishing an early, accessible and responsive grievance mechanism against conflict management; 6) seeking win-win scenarios for the organization and stakeholder groups; 7) mitigating social risks, minimizing risks and maximizing opportunities to create value for local communities. Even if there is a broad agreement to consider stakeholder engagement as an essential part of environmental issues, the practical implementation of the stakeholder engagement processes can vary significantly from country to country, and sector to sector (Avis, 2015).

One of the main challenges of collaboration is the negotiation between competing goals and perspectives of different stakeholders (Fabinyi et al., 2014). Collaborative management should necessarily try to balance interests from all the groups involved to contribute to the social welfare instead of favoring small groups of actors. The empowerment through incentives can encourage the participation of the weaker groups, even if sometimes these measures are insufficient to overcome the power gaps between stakeholders (FAO, 2006).

Finally, the involvement of some particular stakeholder may be important for meaningful engagement. NGOs, industry peers, investors, business partners and the media must necessarily be included in collaborative processes for both illustrative purposes and also to motivate other stakeholders to keep engaged in the basin management (Avis, 2015).

Complexity of the watershed

The complexity of a watershed regarding its physical environment, institutional setting, socioeconomic characteristic, different uses of water, and so on, often involves several and complicated problems, which require a network perspective for being entirely analyzed (Lubell et al., 2014; Scarlett and McKinney, 2016). Besides, the solution of a particular concern implies many times the generation of a new and different problem at another place of the watershed causing conflicts of interests among various sectors. In addition, in the same watershed, several levels of organization and different legal frameworks can coexist, sometimes with opposite objectives or various levels of enforcement.

In such a rich context, the right management strategy should be flexible enough to make the differences compatible and widely adopted along the whole basin. Nevertheless, there are many cases of collaborative management in which micro-scale programs are more successful than large-scale ones. According to FAO (2006), the complexity of ecological and socioeconomic processes in a watershed is best captured at the local level, and implementing intensive watershed management interventions in critical locations are more cost-effective than trying to control extended systems.

Imperial (2001) have expressed that differences in available resources and contextual factors such as physical environment, configuration of problems, institutional setting, situational histories and the programmatic context, determine the scope and scale of the management plans. The mechanism of capacity-building, defined as the sum of efforts needed to nurture, enhance and utilize the skills and capabilities of people and institutions, is critical in this context. Such mechanism is based on a comprehensive view that emphasizes the importance of institutional arrangements, appropriate government policies and legal frameworks and, of course, stakeholder participation (Calrsonn, 2005).

In this sense, the participation can be highly beneficial, not only because of the positive interactions among network members, but also due to its contribution to trust relationships building and the creation of valuable channels of information exchange (Imperial, 2005). In the frame of collaborative management, the politicians and upper-level agency become the beneficiaries of the information about management issues and problems, whereas the lower-level staff gains a greater appreciation of political and resource allocation issues (Wondolleck and Yaffee, 2000).

In the particular case of SGRB, both the extent and the complexity of the basin make challenging to achieve sustainable and efficient management of the water, whose availability entirely depends on climate conditions. The wide diversity of water uses along the basin (agriculture, livestock, tourism and drinking water) as well as the nearly 360,0000 water users living beyond its geographical boundaries, create a very complex conflict of interests that hinders water management. Clearly, the last group has stronger interests and action power in the basin, despite the fact that they did not participate in the proposed activities. Once again, this absence seems to reflect either the scarce willingness to participate in a more integral basin management strategy or a total unawareness about the basin dynamics.

Other aspects regarding the complexity are the different uses of the water across the watershed. For example, clandestine dams and channels in the upper and middle basin (to extract water for agricultural activities) affects water availability in the cities, the Paso de las Piedras Dam and the non-consumptive uses related to tourism across the entire basin. Also, the Paso de las Piedras Dam (located in the middle watershed), regulates the water reaching at the lower basin and thus the availability for agricultural and tourism activities in it. The priority is to supply consumptive water to the inhabitants of Bahía Blanca and Punta Alta cities, as well as to ensure the provision of water to the industrial pole. All these conflicts also have different temporal dimensions. They increase during drought years (related to ENSO events) and also intra-annually during summer, which is the driest season of the year and, in addition, the most water demanding period due to the tourism activity in the upper basin and the high temperatures.

This situation could be another indicator that the basin is not ready yet for the implementation of a collaborative management in the short term. The results of an exercise performed during the first workshop with the stakeholders who currently act as decision makers can shed light on this. In the frame of the activity, and after problems identification, decision makers were invited to answer the following questions: 1) what were they doing to solve those problems?, 2) what could they do?, and 3) what do they want to do but were not able to achieve?

The answer to the first question included the design of awareness/education programs, the elaboration of municipal norms addressed to regulate the water consumption all year round and the promotion of the use of native vegetation species in garden and backyards. Regarding what they could do, this group of stakeholders said that they needed to strengthen the control of the regulations already in force, to develop solid urban waste treatment strategies, to encourage environmental awareness at home, and to create a regional roundtable or new basin committee to deal with common problems. Furthermore, they argued about the difficulty of controlling productive activities including the fact that, up to that moment, it had been impossible to localize and stop the illegal construction of dams and dikes.

On the three cases, answers of the actors with decision power led to two main conclusions: 1) the authorities seemed to be working to solve water provision during the summer (the main problem identified during the first workshop by the rest of the

stakeholders), and 2) they were also trying to correct the deficiencies registered on the legislation and control mechanisms. But there is a third conclusion hidden in their answers: their role as decision makers is blurred since they are in fact decision makers, the whole time they speak as if they have no power to design the water policy.

Surprisingly, there are no active signs of commitment to solving problems. Mainly because instead of getting involved with the management of local resources, decision makers feel they are only a small cog of a higher and complex structure difficult to adapt to local conditions. This situation seems to be directly related to the institutional framework instead of being a consequence of the basin complexity in itself. In such way, and linked to the next section, recognizing the need to re-design institutions seems to be a key piece to move forward a watershed management more focused on local needs, even in the case of a very complex system as SGRB.

Institutional framework

Institutions and legal framework constitute key issues in water management. Ostrom (1990) was the first in establishing eight design principles to characterize institutions for managing common-pool resources: 1) well-defined boundaries, 2) congruence between appropriation, and provision rules and local conditions; 3) collective-choice arrangements; 4) monitoring; 5) graduated sanctions; 6) conflict-resolution mechanisms; 7) minimum recognition of rights, and 8) nested enterprises.

Those principles have been significantly discussed in the literature, notwithstanding they constitute the foundation stone of the commons management. In the frame of this debate, Cox et al. (2010) have proposed to reformulate some of these principles. Regarding the first one, they suggest adding the congruence between user and resource boundaries, which would be particularly appropriate for SGRB, where a large portion of final water users live outside the basin limits. To the monitoring principle, Cox et al. (2010) proposed a division into a principle regarding environmental monitoring (over the condition of the resource) and a social monitoring (over users themselves). The latter modification could be useful to implement some internal control mechanism in cases in which authority is not strong enough to enforce the law, as it happens with the clandestine dams in SGRB,.

The principle of minimum recognition of rights can be directly related to the property rights definition, a topic widely explored especially for the case of developing

countries (Agrawal and Ostrom, 2001; Meinzen-Dick et al., 2002; Heltberg, 2002; Lawry et al., 2017). This principle implies that external government agencies do not challenge the rights of local users to create their own institutions. According to Cox et al. (2010), an external agency imposing its own rules on a community managing a common-pool resource may have unexpected results if those rules do not match local conditions. The SGRB experience validates this idea since, in practice, water users ignore some of the formal rules and local community often endorse its non-compliance, often showing any reaction against this irregular and even illegal behavior.

In the current situation of SGRB, both institutional and legal frameworks seem to be extremely rigid and, even worst, too much complicated, generating confusion and some degree of overlapping in the water management matter. Thus, to implement a collaborative strategy in SGRB in the near future, the institutional and law framework need to be restructured and clarified including the stakeholders.

Collaborative measures, such as raising awareness, capacity building, mediation and incentives may help to solve small and self-contained conflicts related to natural resources. Conflicts that are rooted in tenure systems and access rules, however, will also need legal and legislative action to define and accommodate contrasting resource claims and rights.

According to Schlager and Ostrom (1992), the question is how various types of institutional arrangements perform when confronted with similarly difficult environments. Institutional frameworks should be flexible enough to allow, encourage and enforce such arrangement, as well as legal norms should support participatory common-based watershed management. Moreover, institutions should contribute to achieve both the efficiency and the resilience needed to implement a more participatory management within legal norms and also permit the self-organization of the local communities (Erickson, 2015; Peat et al., 2017).

In practice, updating institutions and legal frames are particularly hard to achieve in developing countries, where institutional *inertia* strongly constraints and delays normative changes (Meinzen-Dick et al., 2002). Even more, political issues and institutional instability could eventually undermine any attempt to move forward a more participative approach to water management. As the institutional framework is often organized as a nested hierarchy comprising multiple institutions and rule sets (Ananda

and Proctor, 2013), the scope of collaborative initiatives could be constrained by this puzzling scenery.

6. CONCLUDING REMARKS

Watershed management strategies have been moving forward to more participative approaches during the last three decades. These methods have significant advantages but cannot be implemented in all contexts since they critically depend on local conditions to create the right environment to develop a transparent and constructive collaborative management space.

After performing several participatory techniques and prospective structural analysis in the SGRB, the findings showed that implementing a collaborative approach to water management is not plausible in the short term.

Firstly, the implementation of a collaborative water management strategy requires the engagement of all the relevant actors of the socio-ecological system, and critical absences can undermine the success of the whole approach. Finding the right incentives to encourage the participation of all the relevant actors becomes one of the most challenging issues for a collaborative management. Only if the commitment of both farmers and ADA and ABSA authorities is achieved, a basin management model with a higher level of stakeholder participation could be implemented in the SGRB. To engage these groups of stakeholders, it is necessary to know their interests and profiles. E.g., ADA and ABSA are institutions depending on public policies. Thus, if other stakeholders start working together to develop a collaborative water management plan and their work gets public and politic attention, it is possible that ADA and ABSA will become more interested in participating. To engage the farmers, it is necessary to provide them with concise and technical content about how the collaborative water management plan could improve their productivity.

Second, the complexity (different uses of water in the upper, middle and lower basin, climate seasonality and differences in the legal framework across the watershed) of SGRB makes collaboration a necessity. However, the particular characteristics of this watershed need special attention while the development of water management strategy is taking place. The main aspect is the significant number of water users that live outside of the basin boundaries but are directly impacted by management decisions as

well as the diversity of rules and competent authorities coexisting in the area. A collaborative strategy in SGRB should include all the stakeholders related to the water in the basin, independently of living inside or outside of it. Moreover, a process of simplification and coordination of the norms and levels of decision making is a necessary condition for moving from the current top-down approach to a more collaborative plan. This process needs to include the participation of all the stakeholders involved in the use of the water resource.

Finally, the adoption of a collaborative strategy is closely related to the maturity and flexibility of its legal and institutional frameworks: they have to be flexible enough to enable the changes required to implement a more participatory approach. Considering local knowledge in both design and implementation of water management is possible only in case social consensus about the convenience of collaboration is achieved, and coordination rules go with this process. In the particular case of SGRB, the watershed is still legislated by old norms. While the current frame would be maintained, there will be no place to formally incorporate stakeholders into the design and implementation of water policy.

In summary, the SGRB is an example of a complex watershed in which several factors currently hinder the implementation of a collaborative approach to water management. Any attempt to forcing such adoption could have a non-expected result on the socio-ecological system, generating an immediate reject to more participative strategies. In this context, it is necessary to keep on working on encouraging the participation of stakeholders, strengthening the commitment of decision makers and creating the adequate conditions to foster the emergence of a collaborative strategy as a natural result of the own socio-ecological system dynamic.

ACKNOWLEDGMENTS

The Inter American Institute for Global Change Research (IAI) is gratefully acknowledged for supporting part of the research work behind this paper through the Inter-American Institute for Global Change Research (IAI) CRN3038 (under US NSF Award GEO-1128040) and also under the special grant “Socio-Environmental Evolution of the Sauce Grande River Basin (Argentina).” Partial support is also provided by the network PAMPA^2 (CONICET), and Universidad Nacional del Sur (PGI

24/G059). We are also very grateful to the NGO Ambiente Comarca, especially to his president Mr. Hugo Kloster, for providing logistical support for the meeting organization; and Leticia Giles for reviewing the language of the manuscript.

REFERENCES

Abers, R. N., 2007. Organizing for governance: building collaboration in Brazilian river basins. *World Development*, *35*(8), 1450-1463.

Agrawal, A. & Ostrom, E., 2001. Collective action, property rights, and decentralization in resource use in India and Nepal. *Politics & Society*, *29*(4), 485-514.

Ananda, J. & Proctor, W., 2013. Collaborative approaches to water management and planning: An institutional perspective. *Ecological Economics*, *86*, 97-106.

Arcade, J., Godet, M., Meunier, F. & Roubelat, F., 1999. Structural analysis with the MICMAC method & actor's strategy with MACTOR method. *Futures Research Methodology, American Council for the United Nations University: The Millennium Project*, 1-69.

Avis, W. R., 2015. Engaging SH in areas of cross-border infrastructure investment. (GSDRC Helpdesk Research Report 1277). Birmingham, UK: GSDRC, University of Birmingham.

Ayers, A., Kittinger, J., Imperial, M. & Vaughan, M., 2017. Making the transition to co-management governance arrangements in Hawai'i: a framework for understanding transaction and transformation costs. *International Journal of the Commons*, *11*(1). DOI: 10.18352/ijc.709.

Barros V., González M., Liebmann B. & Camilloni I., 2000. Influence of the South Atlantic Convergence Zone and South Atlantic Sea surface temperature on interannual summer rainfall variability in Southeastern South America. *Theoretical and Applied Climatology*, 67, 123-133.

Benson, D., Jordan, A., Cook, H. & Smith, L., 2013. Collaborative environmental governance: are watershed partnerships swimming or are they sinking? *Land Use Policy*, *30*(1), 748-757.

Blackstock, K., Dinnie, L., Dilley, R., Marshall, K., Dunglinson, J., Trench, H., Harper, K., Finan, K., McPherson, J., Johnston, E. & Griffin, A., 2015. Participatory

research to influence participatory governance: managing relationships with planners. *Area*, 47 (3), 254–260.

Bohn V. Y., Piccolo M. C. & Perillo G. M. E., 2011. Análisis de los períodos secos y húmedos en el sudoeste de la provincia de Buenos Aires (Argentina) *Revista de Climatología*, 11, 31-43.

Borisova, T., Racevskis, L. & Kipp, J., 2012. Stakeholder analysis of a collaborative watershed management process: A Florida case study. *JAWRA Journal of the American Water Resources Association*, *48*(2), 277-296.

Bryson J. M., 2004. What to do when SH matter. *Public Management Review*, 6 (1), 21-53.

Calheiros, D. F., Seidl, A. F. & Ferreira, C. J., 2000. Participatory research methods in environmental science: local and scientific knowledge of a limnological phenomenon in the Pantanal wetland of Brazil. *Journal of Applied Ecology*, *37*(4), 684-696.

Carbone, M.E.; Scian, B. & Piccolo, M. C., 2008. Agricultural drought in the Claromecó river basin, Buenos Aires province, Argentina. *Revista de Climatología* 8, 1- 13.

Carlsson, L. & Berkes, F., 2005. Co-management: concepts and methodological implications. *Journal of Environmental Management* 75, 65–76.

Carlsson, L. & Sandström, A., 2008. Network governance of the commons. *International Journal of the Commons* 2, 33–54.

Casado, A. L., 2013. Human impacts and fluvial metamorphosis. The effects of flow regulation on the hydrology, morphology and water temperature of the Sauce Grande River, Argentina. Thesis (PhD). Universidad Nacional del Sur - Universite Blaise Pascal Clermont-Ferrand. 358 pp.

Collins, K., Blackmore, C., Morris, D. & Watson, D., 2007. A systemic approach to managing multiple perspectives and stakeholding in water catchments: some findings from three UK case studies. *Environmental Science and. Policy* 10 (6), 564–574.

Cox, M., Arnold, G., & Tomás, S. V., 2010. A review of design principles for community-based natural resource management. *Ecology and Society* 15(4), 38.

Dewulf, A., Mancero, M., Cárdenas, G., & Sucozhanay, D., 2011. Fragmentation and connection of frames in collaborative water governance: a case study of river

catchment management in Southern Ecuador. *International Review of Administrative Sciences*, *77*(1), 50-75.

Erickson, A., 2015. Efficient and resilient governance of social–ecological systems. *Ambio*, *44*(5), 343-352.

FAO (Food and Agriculture Organization of the United Nations) & European Observatory of Mountain Forests, 2006. The new generation of watershed management programmes and projects: a resource book for practitioners and local decision-makers based on the findings of an FAO review. FAO, Rome.

FAO (Food and Agriculture Organization of the United Nations), 2007. *Más vale prevenir que lamentar. Las cuencas y la gestión del riesgo a los desastres naturales en Guatemala*, Guatemala.

Fornerón, C.F., 2013. Hidrografía de la laguna Sauce Grande (provincia de Buenos Aires) en época de sequía. Thesis (PhD). Universidad Nacional del Sur. 216 pp.

Geilfus, F., 2002. *80 herramientas para el desarrollo participativo. Diagnóstico, Planificación, Monitoreo y Evaluación.* San José, C.R.: IICA.

Gil, V., 2010. Hidrogeomorfología de la cuenca alta del río Sauce Grande aplicada al peligro de crecida. Thesis (PhD). Universidad Nacional del Sur. 269 pp.

IDEAM, 2013. *Guía técnica para la formulación de los planes de ordenación y manejo de cuencas hidrográficas*, Ministerio de Medio Ambiente y Desarrollo Sostenible, Bogotá, D.C.

IFC, 2014. A Strategic Approach to Early Stakeholder Engagement: a Good Practice Handbook for Junior Companies in the Extractive Industries. Washington DC: IFC.
https://commdev.org/userfiles/FINAL_IFC_131208_ESSE%20Handbook_web%201013.pdf.

Imperial, M. T., 2001. Collaboration as an implementation strategy: An assessment of six watershed management programs. Unpublished doctoral dissertation, Indiana University, Bloomington, IN.

Imperial, M. T., 2005. Using collaboration as a governance strategy: lessons from six watershed management programs. *Administration & Society*, 37, 281–320.

Iniesta-Arandia, I., Del Amo, D. G., García-Nieto, A. P., Pineiro, C., Montes, C. & Martín-López, B., 2015. Factors influencing local ecological knowledge

maintenance in Mediterranean watersheds: insights for environmental policies. *Ambio*, *44*(4), 285-296.

Isla, F. I.; Cortizo, L. & Orellano Turno, H., 2001. Dinámica y Evolución de las Barreras Medanosas, Provincia de Buenos Aires, Argentina. *Revista Brasileira de Geomorfología* 2, (1): 73 - 83.

Jacobs, K., Lebel, L., Buizer, J., Addams, L., Matson, P., McCullough, E., Garden, P., Saliba, G & Finan, T., 2016. Linking knowledge with action in the pursuit of sustainable water-resources management. *Proceedings of the National Academy of Sciences*, *113*(17), 4591-4596.

Johnson, N., Ravnborg, H. M., Westermann, O. & Probst, K., 2001. User participation in watershed management and research. *Water Policy*, *3*(6), 507-520.

Kemerer, C. F. & Slaughter, S., 1997. Methodologies for Performing Empirical Studies: Report from the International Workshop on Empirical Studies of Software Maintenance. *Empirical Software Engineering*, *2*(2), 109-118.

Koontz, T. M., & Thomas, C. W., 2006. What do we know and need to know about the environmental outcomes of collaborative management? Public administration review, 66(s1), 111-121.

Lawry, S., Samii, C., Hall, R., Leopold, A., Hornby, D., & Mtero, F., 2017. The impact of land property rights interventions on investment and agricultural productivity in developing countries: a systematic review. *Journal of Development Effectiveness*, *9*(1), 61-81.

Leach, W. D., Pelkey, N. W., & Sabatier, P. A., 2002. Stakeholder partnerships as collaborative policymaking: Evaluation criteria applied to watershed management in California and Washington. *Journal of policy analysis and management*, *21*(4), 645-670.

London, S., Recalde, M., Rojas, M., Zilio, M., Perillo, G. M. E., Bustos, M. L., Piccolo, M. C., Rodríguez, M. C., Fidalgo, G., Pascale, J. C., Berninsone L., Huamantinco Cisneros, A. & Bordino, P., 2012. Stakeholder vision on social- ecological-system situation in Argentina case study. First Deliverable of the Community-based Management of Environmental Challenges in Latin America (COMET – LA) Project. 7º Programa Marco de la Comisión Europea. http://www.comet-la.net/sites/default/files/DELIVERABLE%20ARGENTINA%20FINAL.pdf.

Lubell, M., Robins, G., & Wang, P., 2014. Network structure and institutional complexity in an ecology of water management games. *Ecology and Society*, *19*(4).

Luyet, V., Schlaepfer, R., Parlange, M. B., & Buttler, A., 2012. A framework to implement Stakeholder participation in environmental projects. *Journal of environmental management*, *111*, 213-219.

Mandarano, L., & Paulsen, K., 2011. Governance capacity in collaborative watershed partnerships: evidence from the Philadelphia region. *Journal of environmental planning and management*, *54*(10), 1293-1313.

Margerum, R. D., & Robinson, C. J., 2015. Collaborative partnerships and the challenges for sustainable water management. *Current Opinion in Environmental Sustainability*, *12*, 53-58.

Mavrommati, G., Baustian, M. M., & Dreelin, E. A., 2014. Coupling socioeconomic and lake systems for sustainability: A conceptual analysis using Lake St. Clair region as a case study. *Ambio*, *43*(3), 275-287.

Maxwell, J. A., 1996. Qualitative research design. An Interactive Approach. Thousand Oaks, California: Sage Publications.

Montico, S., 2002. Manejo integrado de Cuencas Hidrográficas Rurales: Base para el ordenamiento territorial. *Revista Agromensajes de la Facultad*, Facultad de Ciencias Agrarias Universidad Nacional de Rosario, 7.

Mutekanga, F. P., Kessler, A., Leber, K. & Visser, S., 2013. The Use of Stakeholder Analysis in Integrated Watershed Management: Experiences From the Ngenge Watershed, Uganda. *Mountain Research and Development*, *33*(2), 122-131.

OECD, 2015. Due Diligence Guidance for Meaningful Stakeholder Engagement in the Extractives Sector. Paris: OECD. http://www.oecd.org/daf/inv/mne/OECD-Guidance-ExtractivesSector-Stakeholder-Engagement.pdf

Ogada, J. O., Krhoda, G. O., Van Der Veen, A., Marani, M., & van Oel, P. R., 2017. Managing resources through stakeholder networks: collaborative water governance for Lake Naivasha basin, Kenya. *Water International*, *42*(3), 271-290.

Peat, M., Moon, K., Dyer, F., Johnson, W., & Nichols, S. J., 2017. Creating institutional flexibility for adaptive water management: insights from two management agencies. *Journal of environmental management*, *202* (1), 188.

Peñalba O. C. & Vargas W. M., 2004. Interdecadal and Interannual variations of annual and extreme precipitation over central-northeastern Argentina. *International Journal of Climatology*, 24, 1565-1580.

Prokopy, L. S., Mullendore, N., Brasier, K., & Floress, K., 2014. A typology of catalyst events for collaborative watershed management in the United States. *Society & Natural Resources*, *27*(11), 1177-1191.

Provincia de Buenos Aires, 1999. Ley Provincial 12257/99 – Código de Aguas. Available at: http:// www.gob.gba.gov.ar/dijl/.

Reed M. S., 2008. Stakeholder participation for environmental management: a literature review. *Biological Conservation*, 141 (10):2417-2431.

Reed M. S., Graves A., Dandy N., Posthumus H., Hubacek K., Morris J., Prell C., Quinn C.H. & Stinger L.C., 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90, 1933-1949.

Robinson, C. J., Margerum, R. D., Koontz, T. M., Moseley, C., & Lurie, S., 2011. Policy-level collaboratives for environmental management at the regional scale: lessons and challenges from Australia and the United States. *Society & Natural Resources*, *24*(8), 849-859.

Scarlett, L., & Mc Kinney, M., 2016. Connecting people and places: the emerging role of network governance in large landscape conservation. *Frontiers in Ecology and the Environment*, *14*(3), 116-125.

Scian, B., 2002. "Variabilidad de las condiciones hídricas en la región semiárida pampeana Argentina". *Geoacta*, 27, 30-52.

Sneddon, C. & Fox, C., 2007. Power, development, and institutional change: Participatory governance in the lower Mekong basin. *World Development*, *35*(12), 2161-2181.

Steyaert, P. & Jiggins, J., 2007. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. *Environmental science & policy*, *10*(6), 575-586.

Talley J. L., Schneider J. & Lindquist E., 2016. A simplified approach to stakeholder engagement in natural resource management: the Five-Feature Framework. *Ecology and Society*, 21(4), 38

UNEP (United Nations Environment Programme), 2014. Towards Integrated Water Resources Management. International experience in development of river basin organizations. United Nations Environment Programme. Sudan. 31p.

Voinov, A. & Gaddis, E. J. B., 2008. Lessons for successful participatory watershed modeling: a perspective from modeling practitioners. *Ecological modelling*, *216*(2), 197-207.

Von Korff, Y., Daniell, K., Moellenkamp, S., Bots, P. & Bijlsma, R., 2012. Implementing participatory water management: recent advances in theory, practice, and evaluation. *Ecology and Society*, *17*(1).

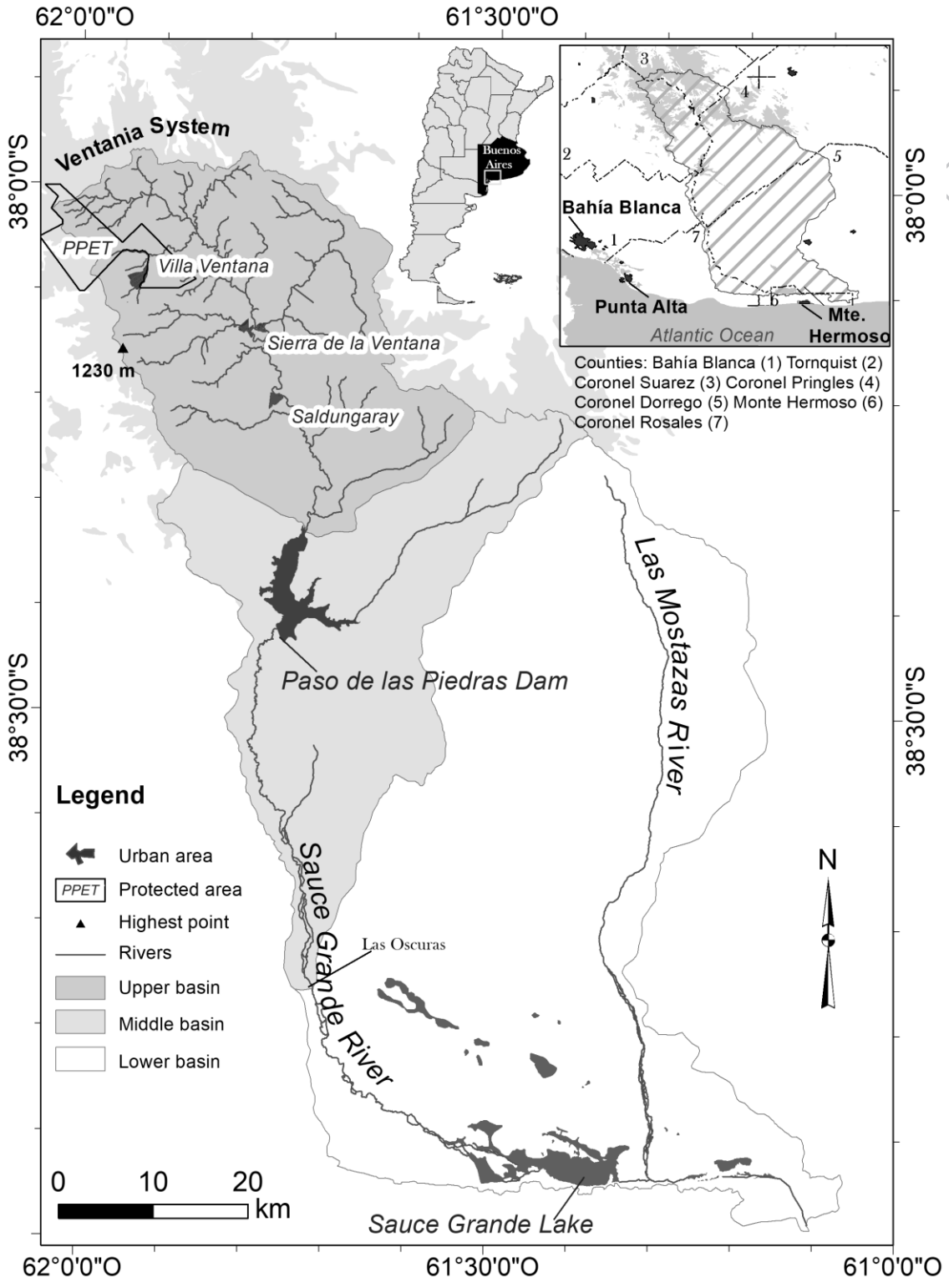
Wondolleck, J. M. & Yaffee, S., 2000. Making Collaboration Work: Lessons from Innovation in Natural Resource Management. Washington, D.C.: Island Press.

Zapperi P., Casado A., Gil V. & Campo A. M., 2006. Caracterización de las precipitaciones invernales en el Suroeste bonaerense. In: Cazzaniga N., Vaquero M. (Ed.), Ambiente natural, campo y ciudad: Estrategias de uso y conservación en el Sudoeste Bonaerense, Ediciones UNS, Bahía Blanca, 63-68.

Figure 1. Sauce Grande River basin

Figure 2. Fieldwork at Sauce Grande. A) Brainstorming meeting with non-decision makers stakeholders. B) Brainstorming meeting with decision maker stakeholders. C) Brainstorming results. D) Meeting with all the stakeholders to rank the problems identified during the former meetings

Figure 3. Geographical distribution of stakeholders according to their level of attendance to participatory activities.


62°0'0"O
61°30'0"O
61°0'0"O
38°0'0"S
38°30'0"S
Ventania System
PPET
Villa Ventana
Sierra de la Ventana
1230 m
Saldungaray
Paso de las Piedras Dam
Las Mostazas River
Sauce Grande River
Las Oscuras
Sauce Grande Lake
Buenos Aires
Bahía Blanca
Punta Alta
Mte. Hermoso
Atlantic Ocean
Counties: Bahía Blanca (1) Tornquist (2)
Coronel Suarez (3) Coronel Pringles (4)
Coronel Dorrego (5) Monte Hermoso (6)
Coronel Rosales (7)
Legend
Urban area
Protected area
Highest point
Rivers
Upper basin
Middle basin
Lower basin
N
0 10 20
km