COmmunity-based Management of
EnviromenTal challenges in Latin America

D1.5: "Sustainable Management and Governance Models"

John Icely[1],
Sirak Robeles[2],
Pablo Ramos[3],
Alice Newton[4]

[1]Sagremarisco- Viveiros de Marisco Lda (SGM); [2]ERASMUS MUNDUS PhD programe in Marine and Coastal Management (MACOMA); [3]Pontifica Universidad Javeriana (PUJ); [4]Norsk Institutt for Luftforskning (NILU)

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- 3. JHI: The James Hutton Institute (Great Britain)
- 4. SGM: Sagremarisco-Viveiros de Marisco Lda. (Portugal)
- 5. PUJ: Pontificia Universidad Javeriana, School of Environmental and Rural Studies (Colombia)
- 6. UNAM: Universidad Nacional Autónoma de México (Mexico)
- 7. IADO: Consejo Nacional de Investigaciones Científicas y Técnicas (Argentina)
- 8. AQM: Fundación Aquamarina-CECIM (Argentina)
- 9. CCC: Consejo comunitario de la comunidad negra de la cuenca baja del río Calima (Colombia)
- 10. ERA: Estudios Rurales y Asesoría Campesina Asociación Civil (Mexico)
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Executive summary

This document is the fifth deliverable (D1.5) of work package 1 (WP1) which has the objective of identifying sustainable community based governance models for the management of natural resources by integrating, synthesising and up-scaling the results from the three case studies (CS) in Argentina, Colombia and Mexico, at the core of the EU project - "Community based Management of Environmental challenges in Latin America" (COMET-LA). The results have been obtained using similar methodology at each site over three phases: one, using Ostrom´s Social- Ecological System (SES) framework to characterise the SESs at each of the CS; two, using Prospective Structural Analysis developed by Godet to characterise the dynamics of the different variables present in the CS; three, using a Scenario Analysis developed by the James Hutton Institute to focus on how the management and governance systems for community based natural resource management (CBNRM) might respond to future changes and pressures e.g changes in climate.

COMET-LA can be considered a transdisciplinary project that integrates academic researchers from different unrelated disciplines with non-academic participants, such as resource managers and the public, to research a common goal for the creation of new knowledge and theory. With this transdisciplinary approach, the COMET-LA methodology has been used on the three selected SESs in Latin America that include: the three municipalities of Bahiá Blanca, Coronel de Marina Leonardo Rosales and Monte Hermoso in Argentina; the community council of Bajo Calima and Alto y Medio Dagua in Columbia; and the community of Santiago Comaltepec in Mexico. The data obtained from this study has been used to compare the natural resource governance system in terms of the kinds attributes that are considered good governance, including participation, representation, deliberation, accountability, empowerment, social justice and organisational features such as being multilayered and polycentric.

Using the Policy Appraisal on Local Actors and Sustainable Governance Models compiled for the three CS by the Spanish IUCN, it has been possible to evaluate the management models for the three COMET-LA CS in terms of governance style, flexibility, adaptation capacity, resilience and external support.

- *Governance style* can be "top-down" where there is only limited co-management of natural resources between government, NGOs and local stakeholders; but where the governance is "bottom-up" there is substantial co-management between government, NGOs and local stakeholders.
- *Flexibility* essentially reflects the attributes of good governance such as participatory, polycentric, accountable, deliberative, multi-layered and just; the more that a system shows these characteristics the more flexible the governance model.

- *Adaptation capacity* in SESs is characterised by open and frequent lines of communication, collaboration, and action between both formal and informal institutions at multiple scales.
- *Resilience* is a measure of the amount of change a system can undergo and still retain the same controls on structure and function.
- *External support* is the amount of resources that an SES can expect to receive from outside its boundaries.

In summary, Argentina has a more "top-down" governance style with relatively poor flexibility, poor adaptation capacity, moderate resilience, and relatively high capacity for obtaining external support from outside the SES; Colombia has a more "bottom-up" governance style with moderate flexibility, high adaptation capacity and resilience, and moderate capacity for obtaining external support; Mexico also has a more "bottom-up" governance style with moderate flexibility, low adaptation capacity, and high resilience, but low capacity for obtaining external support.

We suggest that the use of these approaches for adaptive management and governance, together with occupying the middle ground between completely "top-down" and completely "bottom-up", are more likely to enable better CBNRM at the Argentine, Colombian and Mexican CS. One other interesting point to take into consideration is the legal system controlling natural resource management at the three CS, as there is a view that natural resources cannot be reliably protected without a strong and enforceable mandate. This view has been developed further by the contention that reflexive law will ensure this mandate much better than traditional law, where the reflexive approach has the objective of producing a better fit between institutional and social structures via facilitation as opposed to comprehensive regulation. The Argentine SES has a mixed-private governance model involving both private enterprise and state enterprises where the legal framework is almost entirely controlled by the state, whilst the Colombian and Mexican SESs have common property rights where the legal framework has much greater capacity for involvement of the local stakeholders in collaboration with the state and other NGOs. Thus, in relation to the natural resource governance of the Latin American CS, the current legal systems for Colombia and Mexico would be much easier to adapt to reflexive law than the much more traditional legal system of Argentina. At present, environmental management is more likely to succeed in Colombia and Mexico where the governance is more tuned to the SES. Nonetheless, participatory processes started at the Argentina SES might well initiate incremental changes to the governance system for natural resources in Argentina.

The natural resource management in SESs from twelve areas throughout the world have been briefly reviewed with examples covering coastal and marine areas, water and biodiversity, and forestry.

The principal aspects shared with the findings from the three COMET-LA CS are listed below:

- sustainable resource management relies fundamentally on local communities. However this management does not always achieve sustainability. Indeed, local management strategies can only be effectively addressed when they are nested in general arenas that fully recognize the importance of natural resources conservation;
- natural resource management strategies need to consider different temporal, geographical and political scales and their interdependencies;
- governance structures are complex in all the CS and there is often a contradiction between strong formulations (either "bottom-up" or "top-down") and the mechanisms and the strategies for applying and reinforcing governance.

The legacy of the COMET-LA project is considerable in that there is a substantial data base on sustainable governance models for three SESs that have been evaluated with the same methodology. However, the COMET-LA data base could be used for different research questions that could be addressed with different frameworks, as some frameworks are more appropriate for specific issues than others. Moreover, similar research questions addressed with different frameworks would be useful for testing the robustness and validity of results that have been obtained from only one framework. Other aspects of the COMET-LA legacy include the upscaling efforts by the project such as the Political Conference in Mexico City, the efforts of the project coordinator for COMET-LA to achieve a high status profile within the EU research community, and the achievement by IUCN Spain to enable the successful acceptance for each of the case studies at the Jeju 2012 IUCN General Assembly with: Resolution 053 to Mexico (http://goo.gl/k6Ysqb [ES], http://goo.gl/L8dqPL [EN]); Recommendation 165 to Argentina (http://goo.gl/gfznx3 [ES] http://goo.gl/bzbE2F); and Recommendation 175 to Colombia (http://goo.gl/ViDAuf [ES], http://goo.gl/307bMY [EN]). However the greatest legacy may well be the considerable and highly effective involvement of young people that have all been introduced to community based management of natural resources as well as sustainable governance models, and may well become the future advocates of CBNMR:

- School children in each of the CS;
- Young researchers from each of the communities, notably the teams of "co-investigators" from Bajo Calima and Alto y Medio Dagua CCC;
- Young academic researchers not only from Argentina, Colombia, Mexico and Spain, but also citizen from other parts of the world including Ethiopia, Russia and Brasil.

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List of abbreviations

CBNRM	Community Based Management of Natural Resources
CPRs	Common Pool Resources
CS	Case Studies
COMET-LA	COmmunity based Management of EnvironmenTal challenges in Latin America
DPSIR	Driver, Pressure, State, Impact, Response
E	Ecological
ECAP	Ecosystem Approach Strategy
ES	Ecosystem Services
ESA	Earth Systems Analysis
ESE	Ecological-Social-Economic
GEnS	Good Environmental Status
HE	Healthy Environment
HES	Human Environment Systems Framework
LID	Land Improvement District
MEFA	Material and Energy Flow Analysis
MSFD	Marine Strategy Framework Directive
MTF	Management and Transition Framework
NGOs	Non- Governmental Organizations
S	Social
SAF	System Approach Framework
SES	Social-Ecological System
SESF	Social Ecological Systems Framework
SPICOSA	cience Policy Integration for Coastal System Assessment
SLA	Sustainable Livelihood Approach
TNS	The Natural Step
TVUL	Turners Vulnerability Framework

1 Introduction

1.1 General

The objective of Deliverable 1.5 is to identify sustainable community based-governance models for the management of natural resources by integrating, synthesising and up-scaling the results from the three Case Studies (CS) of the Community based Management of Environmental challenges in Latin America (COMET-LA) project in Argentina, Colombia and Mexico. As this Deliverable is the culmination of the project, it is important to remind ourselves of some of the more important keywords and phrases that are the basis of the project starting with **social-ecological system** (SES) which was originally coined by Berkes and Folke (1998) to *'link systems of people and nature*. Tett and Sandberg (2011) indicate that managing and understanding an SES requires the joint efforts of three different academic disciplines that look at the world as follows: **sociology** describes and analyses human social activity and institutions; **ecology** seeks to understand the role of living beings in the workings of the natural world; **economics** broadly speaking deals with the way humans produce and use resources to satisfy their well-being. Other terms in the context of COMET-LA , are defined by Waylen *et al.* (2015) and include: **sustainable** as governance models that will balance social , environmental and economic resources for future generations; **community** as a place local people are mutually dependent through their shared reliance on local resources; **governance** as multi-level decision making at local, regional, national and international scales between multiple stakeholders including local people, government and non- governmental organizations (NGOs). The core to this project is the concept of **sustainable community-based governance models,** which are described by a series of terms such as **common pool resources , robustness, resilience, panarchy, adaptive management,** culminating in **adaptive governance.** As the theory behind these terms has evolved relatively recently, the next section provides a short review on the development of the theory supporting sustainable governance models.

1.2 Short review of some of the theory behind sustainable governance models

Over the latter half of the last century, there has been increasing awareness about the unsustainable use of natural resources, as highlighted by the Hardin (1968) paper on the "The tragedy of the commons" which triggered environmental concerns for common pool resources (CPRs) that are accessible to a large numbers of people and are susceptible to destruction due to overuse (Dietz *et al.*, 2002). The tragedy starts for the commons at a stage where human society is stable (Hardin, 1968) and, to use Hardin's example, when each rational herdsman on an-open-for all pasture decides to maximize benefit by adding more and more cattle to the field. This implies CPRs are doomed to a tragic end due to an absence of ownership and narrow self-interest. Gordon (1954) has proposed that commons should be subject to a unified directing power under private or public (government) ownership, to avoid their unregulated exploitation. Dietz *et al.* (2002), on the other hand, argue that nationalization of a CPR does not necessarily lead to improvements from the past, and often

results in total rejection of indigenous institutions. This has resulted in *de facto* open access conditions that have encouraged the race for resources and poor harvesting practices, that governments often do not have enough capacity to monitor and control.

However, there have been a series of studies led by Ostrom and her colleagues (Ostrom, 1990, 2009; Dietz *et al.*, 2003, 2009; Andereis *et al.*, 2013) which have demonstrated that in practice there are rules governing real commons which do not allow free access to everyone, and that there are people who go beyond narrow self-interest and are concerned about the society so that commons do not always end up in "tragedies". Over the course of these studies, Ostrom has identified eight design principles which are at the core of sustainable CPRs from which a general framework has been developed (2009) for analyzing the social-ecological system (SES) of each CPR; SES is a term coined by Berkes and Folke (1998) to 'link systems of people and nature'. Ostrom (2009) has developed the framework so that multidisciplinary efforts toward a better understanding of complex social-ecological-systems can be facilitated.

Essentially, there has been increasing recognition based on the work of Ostrom, as well as many other scholars, that **governance** of how humans interact with ecosystems may have to change; governance is defined as the structure and process by which societies share power and shape individual and collective actions (Young 1992). This contradicts the prevailing view that, with economic growth, rapid technological change and the expansion of scientific knowledge, societies have the necessary capacity to manage changes in the environment (Lebel *et al.*, 2006). This confidence appears increasingly misplaced as key elements for understanding how SESs evolve appear to be wrong (Berkes *et al.* 2003). The Millennium Ecosystem Assessment (MEA, 2005) confirms that over the past 50 years humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history and that there is increasing degradation of the ecosystem and increased risks of non-linear changes. The authors of the MEA,, amongst others (see Liu *et al.*, 2007; Ostrom, 2009 and references therein), conclude that many systems of governance lack the necessary flexibility to accommodate dynamic systems. Lebel *et al.* (2006) have listed a number of difficulties for SES governance systems that try to "blueprint" the future: uncertainties and nonlinearities often arise from both complex internal feedbacks and from interactions with structures and processes operating at other scales (Gunderson and Holling, 2002); expert knowledge is incomplete and biased, and participation does not always make things better (Jasanoff and Wynne, 1998; Rayner, 2003); there is no optimal best crop, land management practice, or strategy, and ecosystems may exist in multiple alternate stable states (Scheffer and Carpenter, 2003); regional systems invariably yield a complex mixture of ecosystem goods and services, each with its own set of stakeholders (Walker *et al.*, 2002; Lebel, 2004). Taken together, this has meant that attempts by authorities to tighten control, for example, by excluding disturbances like fires or floods or by establishing alternative property rights systems, have often led, paradoxically, to the creation of larger, more difficult challenges for society than the original set of problems (Holling and Meffe, 1996).

Based on the complex interactions between humans and their environment, Anderies *et al.* (2004) have suggested that there will always be a degree of irreducible uncertainty about the

dynamics of coupled social and ecological processes and that rather than ask how society can better manage ecological resources, society should be asking what makes SESs robust? Carlson and Doyle (2002) show that **robustness** has evolved from engineering where a design involves a trade-off between the maximum performance of a system and a robust performance, which will not drop off as fast as the maximum when the system is subjected to either internal or external stresses. In addition to robustness, there is the term **resilience** which has been developed in ecology and is a measure of the amount of change that is required to transform the maintenance of a system from one set of mutually reinforcing processes and structures to a different set of processes and structures (Holling, 1973). It is suggested that one approach to enhancing robustness in an SES is to focus on governance that enhances the resilience of an ecosystem configuration that produces a desirable bundle of goods and services (Anderies *et al.*, 2004). Lebel *et al.* (2006) have associated the kinds of attributes that are considered good governance (e.g participation, representation, deliberation, accountability, empowerment, social justice and organizational features such as being multilayered and polycentric) to the capacity for managing resilience; this association is summarised in Figure 1.

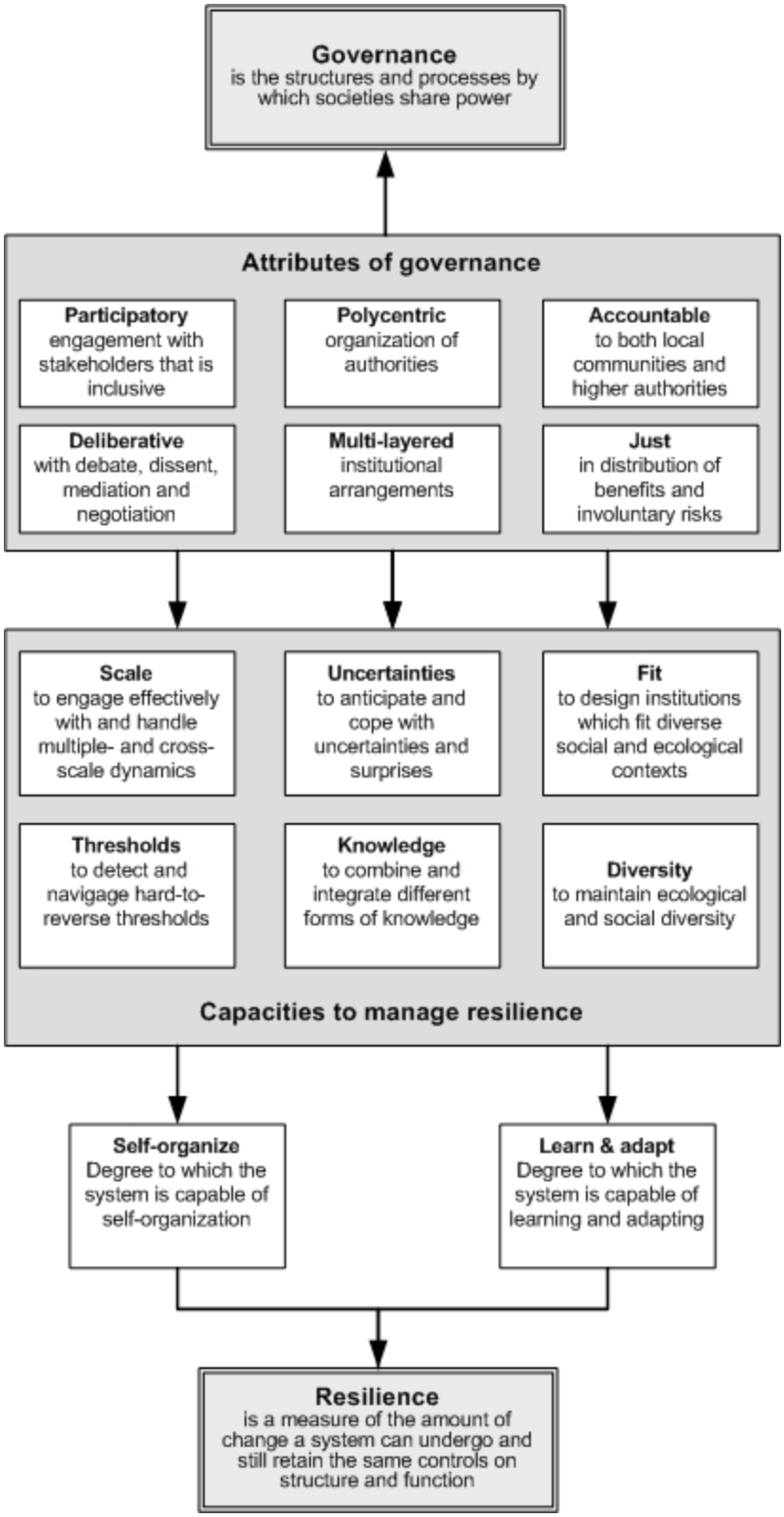

Figure 1. Associations between selected attributes of governance systems and the capacity to manage resilience (from Fig 1 in Lebel *et al.*, 2006).

The attributes of good governance related to resilience, shown in Figure 1, provide a good basic model for sustainable community based-governance of the management of natural resources. However this model does not provide a framework for when a regime shift occurs in a complex system and is characterized by a new set of structures and processes (Garmestani and Benson, 2013). Essentially, this situation requires an **adaptive cycle** to capture the dynamic character of structures and processes in complex systems which can be visualised in Figure 2 as a **panarchy** of a nested set of adaptive cycles (from Gunderson and Holling, 2002). Panarchy differs from hierarchy in that conditions can arise that trigger "bottom-up" change in a system (Garmestani *et al.*, 2009). Because of this subtle, but critical difference, the panarchy model does a better job of capturing the dynamics of complex systems. Furthermore, levels in a panarchy are not static states, but rather adaptive cycles that are interconnected to other adaptive cycles within the panarchy, with each cycle operating over a discrete range of scale in both time and space between the adjacent levels. Because adaptive cycles operate over specific ranges of scale, a system's resilience is dependent upon the interactions between structure and dynamics at multiple scales (Gunderson and Holling, 2002). Indeed, panarchy has been developed to specifically address issues of scale, as well as cross-scale dynamics (Groffman *et al.*, 2006). Small and fast processes and structures dominate at small scales, whereas large and slow processes and structures dominate at larger scales (Allen *et al.*, 2011). Where these processes and structures are separated by discontinuities, there are thresholds between the adaptive cycles in the panarchy. Garmestani and Benson (2013) emphasise that understanding thresholds is essential for managing resilience and that the identification and setting of thresholds is one of the most essential, but also, one of the most uncertain components of resilience science (Walker *et al.*, 2009). However, ignoring this critical aspect for managing resilience will probably lead to failure in an environmental governance model (Susskind *et al.*, 2012).

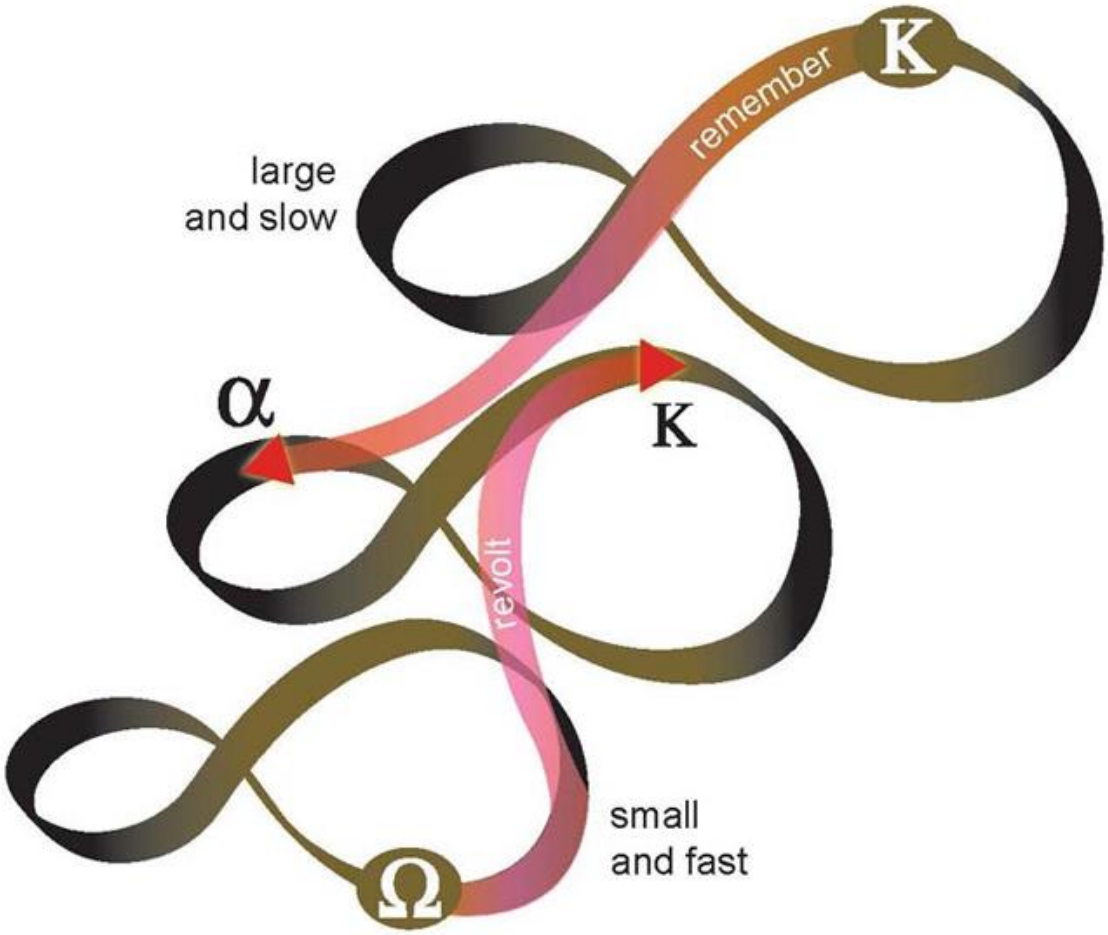

Figure 2. A classic representation of a panarchy: a nested set of adaptive cycles (more detailed explanation in Gunderson and Holling, 2002).

Garmestani and Benson (2013) propose that both adaptive management and adaptive governance are instruments for putting resilience theory into practice. Adaptive management is a strategy to reduce inherent uncertainty in an ecosystem, with a continual learning process that cannot be readily partitioned into discrete packages of knowledge such as 'research' or 'regulatory activities'. **Adaptive governance** is a form of governance that is dependent upon adaptive management and incorporates formal institutions, informal groups/networks, and individuals at multiple scales for purposes of collaborative environmental management (Folke *et al*. 2005). One key aspect for the implementation of these management and governance models is that there should be legal reforms (Garmeestani and Benson, 2013) based on concepts of **reflexive law** which has the objective of producing a better fit between institutional and social structure via facilitation as opposed to comprehensive regulation (Teubner, 1983).

In a discussion on aligning key concepts for global change policy, Anderies *et al.* (2013) suggest that resilience theory offers ideas to address multi-scale and multi-level change that complement ideas about robustness in a policy design framework. This framework should include two key elements. First, the term sustainability should define a superstructure to

support a discourse about the interaction between human societies and the environment: indeed, Folke *et al*. (2011) state that the skeleton for sustainability is the recognition that a functioning biosphere is a precondition for economic and social development. Second, the ideas about resilience and robustness can be used within the broader context of sustainability science to help characterise important aspects of the decision-making context.

We complete this short review by returning to an example from another EU project that clearly demonstrates the benefits for society in developing SES models for exploring different scenarios with a comprehensive environmental accounting framework. In the case of the SPICOSA project (Science Policy Integration for Coastal System Assessment http://www.spicosa.eu/), this is the System Approach Framework (SAF). Hopkins et al., (2011) have produced a diagram they term the Coastal Zone Feedback Loop (Figure 3) which they have used in this project to demonstrate how governance in the coastal zone can take two routes. The first one follows the green default loop in Figure 3 which is likely to have a substantial time delay before any changes in policies will occur; if there is a need for a corrective policy to respond to ecosystem degradation, the time delay in the response might well result in irreversible loss in the ecosystem. The second one follows the purple broken line in Figure 3 to explore a range of scenarios in the ecological-social-economic (ESE) assessment box using the SAF; in this situation it is possible to communicate the outcome of these scenarios to the general public, managers and policy makers, so that there is the possibility of implementing a corrective policy much more rapidly, perhaps before the ecosystems degrades irreversibly. The ESE in the diagram is equivalent to the SES described by Berkes and Folke (1998), whilst the SAF is an alternative version to Ostrom's Social-Ecological Systems Framework (Ostrom, 2009) that is used in the COMET-LA project.

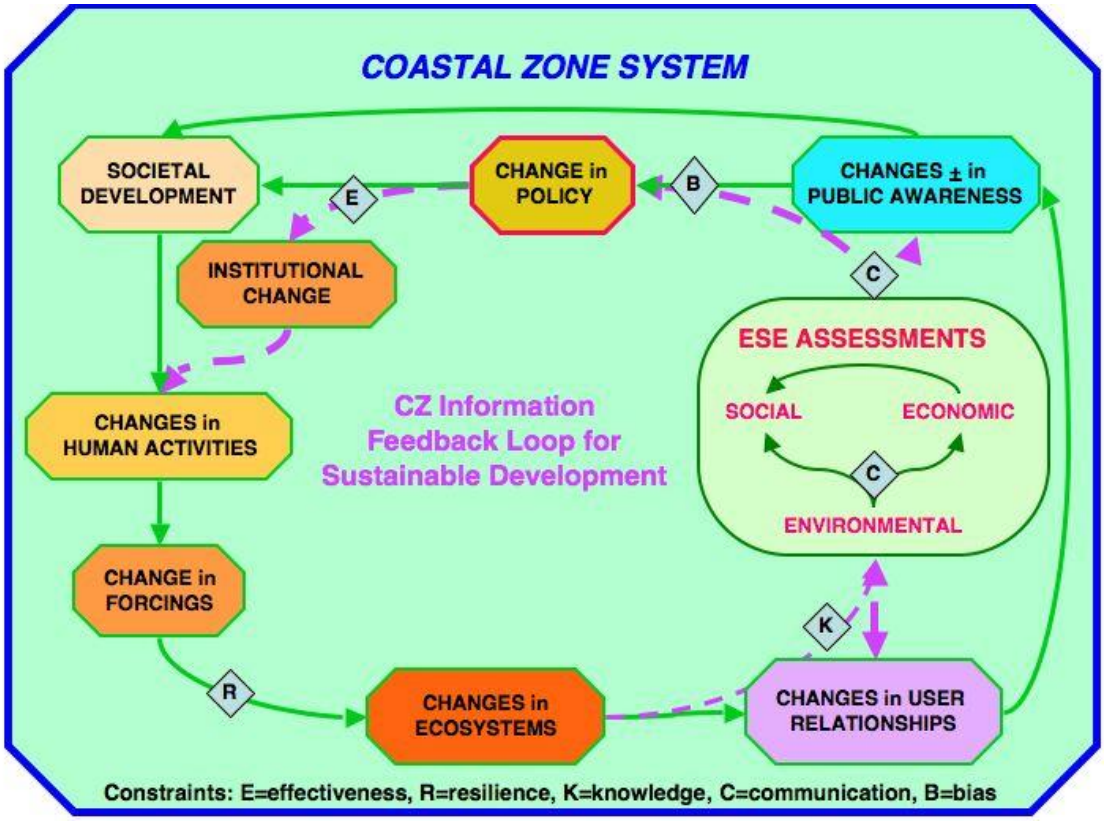

Figure 3. Diagram of the coastal zone information feedback loop for sustainable development.

Essentially, the default loop is shown as the green arrows, and the purple, dashed arrows, represent the SAF augmentation of the loop. The ecological-social-economic (ESE) assessments box represents the major part of the SAF methodology, which links the assessments of the three ESE dimensions. The default loop is slow in forcing policy to react to problems, many of which become irreversible, while the SAF loop provides quick access to policy makers and the public with objective information on how the CZS responds to changes. When this loop is maintained, it can provide prognostic scenario simulations that allow policy to be precautionary regarding emerging problems, including the efficacy of policy directives. The small diamond boxes represent critical threshold constraints on the interactions between components of the system that need to be properly represented for successful forecasting of policy scenarios.

1.3 Objectives of the Deliverable

The COMET-LA project has used a similar methodology to characterise the current and future ecosystem states in each CS. The knowledge acquired from this research has been used to investigate sustainable governance models for each CS and develop scenarios to confront future changes and challenges to the local management of natural resources. The overall objective of the project is *to identify community-based governance models for the management of natural resources that could be used in different social-ecological systems in the context of climate change and increasing competition for the use of these resources*.

How this overall objective has been achieved is described further in the following sections:

2. Management and governance models for the Case Studies;

3. Management and governance models from other SESs;

4. Conclusions about sustainable governance models from the COMET-LA project.

2 Management and governance models for the Case Studies

2.1 Location of the three Case Studies (CS)

The Argentine CS is the Bahia Blanca Estuary (Figure 4) in the south west of Buenos Aires province, Argentina encompassing the three municipalities of Bahiá Blanca, Coronel de Marina Leonardo Rosales and Monte Hermoso, extending approximately 100 Km along the estuary. Bahía Blanca estuary is the second largest estuary of the country and a large portion of it is a natural reserve. The estuary location is important in economic and political terms because it is located and strongly influenced by the transport activities of the largest national deep-water harbour (London *et al.* 2012). For more information see the Deliverables 4.1 and 4.2.

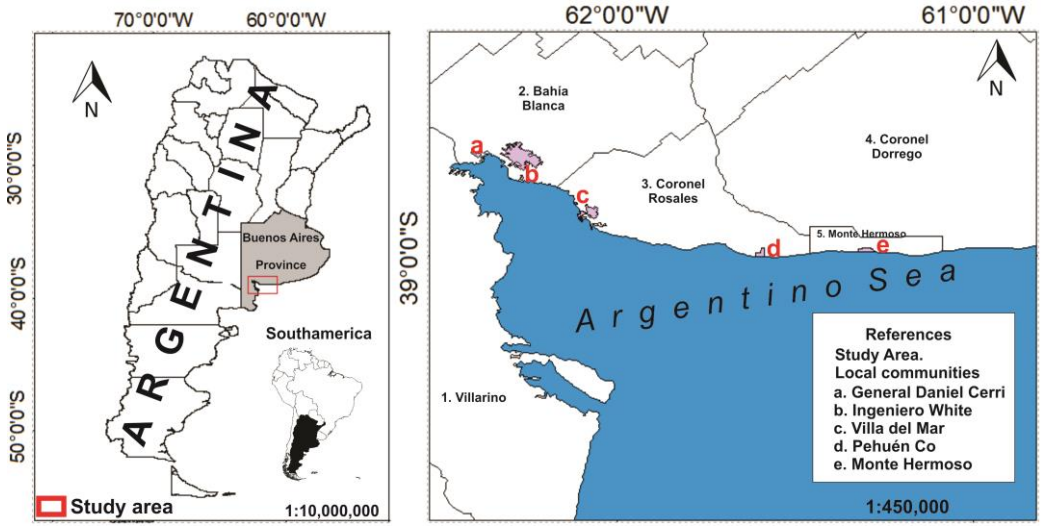

Figure 4. Location of the Argentine CS (from London *et al.* Deliverable 2.5 2015).

The Colombian CS is the Community Council of Bajo Calima and Alto y Medio Dagua (Figure 5) in the special district of Buenaventura in the Department of Valle de Cauca, Colombia comprising 77,724 ha and 12,335 ha, respectively. The CS is located in an area with one of highest levels of biodiversity and water availability in the world; it also has a high cultural diversity (Farah et al., 2012). The CS is located along the road connecting the centre of the country with the Buenaventura port, which is the most important seaport on the Pacific coast

of Colombia. The exceptional environmental conditions and the high availability of goods and environmental services has been always important factors attracting new settlers and has also encouraged the permanent presence of illegal armed actors. For more information see the Deliverables 2.1 and 2.2.

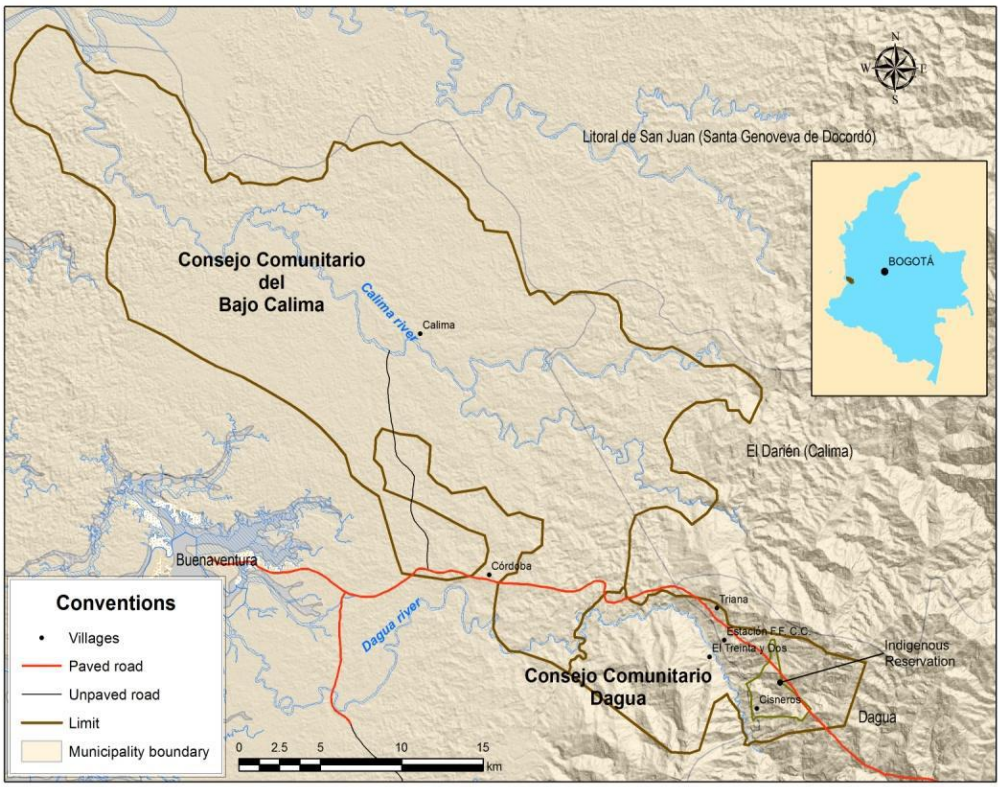

Figure 5. Location of the Argentine CS (from Farah *et al.*, Deliverable 4.5, 2015).

The Mexican case study is the community of Santiago Comaltepec (Figure 6) which includes the settlements called: Comaltepec, Zoyolapam and La Esperanza in the northern part of the State of Oaxaca, occupying an area of 18.366 ha. Santiago Comaltepec is located about 2.052 meters above sea level, in high mountains dominated by tropical rainforests that are managed under a common property regime and collective governance based on customary practices of the indigenous community (Escalante et al. 2012, 2014); the success of this community in achieving sustainablility has ensured that the forests of Comaltepec are among the best preserved in the world. For more information see the Deliverables 3.1 and 3.2.

Figure 6. Location of the Mexican CS (from Escalente *et al.*, 2012).

2.2 Phases of the COMET-LA Project

The COMET-LA project has been divided into three phases of research over the three year of the project with similar methods implemented for each phase at the three CS.

Phase 1 identified locally adapted tool(s) to characterise the SES at each CS site. The method was based on the multilevel, nested framework developed by Ostrom and colleagues (Ostrom, 1990, 2009; Anderies, *et al.*, 2004) based on the eight design principles that Ostrom identified as common to all cases for the management of local common pool resources (CPRs). The framework provides a common set of potentially relevant variables and their subcomponents to use in the design of data collection, the conduct of field work and the analysis of the findings about the sustainability of complex SESs (Ostrom, 1990; Ostrom, 2009; Anderies *et al.*, 2004). Figure 7 below is an overview of the framework showing the relationships among four first-level core subsystems of an SES that affect each other as well as linked social, economic, and political settings and related ecosystems. The results from phase1 are presented in the Deliverables (1.1, 2.1. 3.1, 4.1) at the end of the first year of the project (http://www.comet-la.eu/index.php/en/).

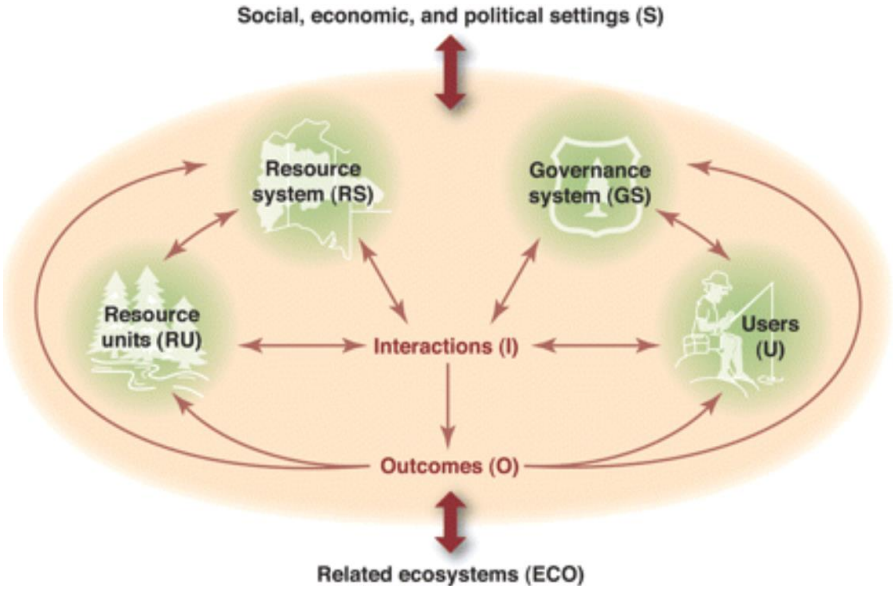

Figure 7. An overview of the Ostrom framework showing the core subsystems for analyzing Social-Ecological Systems (SESs).

Phase 2 identified the role played by the different variables present in the SESs of each CS, and characterized the dynamics of these SESs using Prospective Structural Analysis (Godet, 1993, 2000). Again the results for this phase are presented in a series of Deliverables (1.2, 2.2, 3.2, 4.2) at the end of the second year of the project (http://www.comet-la.eu/index.php/en/)

Phase 3 focused on the governance systems at each CS and how they might respond to future changes using Scenario Analysis (Waylen *et al.*, 2014), with results presented in a series of Deliverables (1.3, 2.3, 3.3, 4.3) towards the end of the third year. (http://www.comet-la.eu/index.php/en/)

The data from the three phases have provided the information for a final series of Deliverables at the end of project which include: D1.4 "Management and conflict resolution tools for learning arenas"; D2.4 "Community-based sustainable management and governance models in water and biodiversity systems"; D3.4"Community -based sustainable management and governance systems in forest systems"; D4.4 "Community- based sustainable management and governance models in marine and coastal areas"; and D5.2 "Implications for multi-level resource governance in the future". This final series of Deliverables are the basis for Deliverable 1.5 which summarises the lessons learnt for sustainable management and governance models at the CS of the COMET-LA project. This information is used to compare how these lessons might benefit other CS of SESs, highlighting their usefulness for different stakeholders, policy makers and decision makers.

2.3 Details of the Social-Ecological System for each C S for evaluating governance models

The data required for an effective analysis of government models for the CS has been summarised in two sections in the form of tables: the first compares the legal basis for natural

resource management at the three CS (Table 1); and the second compares natural resource governance systems for each CS (Table 2).

2.3.1 *Comparison of the legal basis for natural resource management for the three Case Studies*

Table 1. Legal framework for natural resource management (from Deliverable 1.4).

Case Study		Argentina	Colombia	Mexico
International documents ratified by the three countries		Convention 169 of the ILO on Indigenous and Tribal Peoples in independent countries (1989) Rio Declaration (1992) United Nations Framework Agreement on Climate Change (1992) and its Kyoto Protocol (1997) Millennium Declaration and its Millennium Goals (2000)		
Legal system	**Land ownership rights**	**National Constitution of 1853** art. 75.5, 124	**National Constitution of 1991** art. 58, 64, 332	**Federal Constitution of 1917** art. 27
		Constitution of the Province of Buenos Aires of 1994 art. 28	**National Law 21 of 1991** which approves Convention 169 on rights of indigenous peoples art. 14.1, 15.1	General **Federal Law** on **sustainable forest management of 2003** art. 5
			National Law 70 of 1993 protection of cultural identity and rights of the black communities of Colombia art. 4, 5	**Federal Agrarian Law of 1992** art. 2, 9
				Law on **sustainable forest development of the State of Oaxaca of 2013** art. 6
	Protection of the environment and natural resources	**National Constitution of 1853** art. 41	**National Constitution of 1991** art. 8, 79, 95	**Federal Constitution** art. 4 paragraph 5
		Constitution of the Province of Buenos Aires of 1994 art. 28	**National Law 2 of 1959** Forest reserve, ground protection and water	**Federal Law on Ecological Balance** and protection of the environment of 1998 art. 157, 158
		Provincial Law 11.477 of 1993 on fisheries art. 1, 2, 3, 4, 9, 10, 17 (domain in waters and Fishery Councils)	**Decree 1.449 of 1977** Conservation and protection of waters, forests and terrestrial and aquatic fauna	**General Federal Law on Sustainable Forest Development of 2003**
		General **National Law 25.675 of 2002** on the Environment art. 2, 10	**National Law 29 of 1986** regulates protected forest reserve areas	**Federal Agrarian Law** of 1992
		National Law 24.922 of 1998 Fishery system	**National Law 13 of 1990** General Fishery Statute	**Ecological Balance Law** of the State of Oaxaca of 1998
		National Law 23.968 of 1991 maritime spaces	**National Law 99 of 1993** creates the Ministry of the Environment and SINA	**Law of Sustainable Forest Development** of the State of Oaxaca of 2013
		National Law 25.688 of 2002 System for environmental water management	**National Development Plan 2010-2014** Environmental sustainability and risk prevention	**Climate Change Law** of the State of Oaxaca of 2013 art. 2.1

Table 1. Legal framework for natural resource management (from Deliverable 1.4).				
Case Study		**Argentina**	**Colombia**	**Mexico**
		Environmental Law of the Province of Buenos Aires no. 11.723 of 1993 art. 1, 2, 3	**Code for Renewable Natural Resources and Environmental Protection of 1974**. Art. 1, 307	
		Water Code for the Province of Buenos Aires art. 55, 79, 81, 97, 126, 127		**Municipal Development Plan** Santiago Comaltepec 2030
Legal system	**Participation of population in natural resource management**	**National Law 25.675 of 2002** art. 19, 20, 21	**National Constitution 1991** art. 2, 40, 79, 80	**Federal Law on Ecological Balance** and Environmental Protection of 1998 art. 157, 158
		National Law 8.912 of 1977 territorial planning art. 2	**National Law 21 of 1991** art. 15.1	General **Federal Law** on sustainable **Forest Development** of 2003, title VII
		Environmental Law of the Province of Buenos Aires no. 11.723 art. 1, 2, 3	**National Law 70 of 1993** art. 4, 5	**Law** on **Ecological Balance** of the State of Oaxaca of 1998 art. 11
				Law on **Rights** of **indigenous peoples** and communities of the **State** of Oaxaca of 1998 art. 51, 53, 55
				Climate Change Law of the State of Oaxaca of 2013 art. art 2.11, 43.7
	Rights of indigenous and tribal peoples		**National Constitution of 1991** art. 330	**Federal Constitution of 1917** art. 1, 2
			National Law 21 of 1991 art. 2.1, 14.1, 15.1	**State Constitution of 1922** art. 16
			National Law 70 of 1993 art. 1, 3, 4, 5	**Federal Law** on **Ecological Balance** and environmental protection of 1998 art. 157, 158
			National Law 160 of 1994 agrarian art. 1, 3	**Federal Agrarian Law** of 1992 art. 9, 10
			Decree 1745 of **1995** land ownership of black communities	**Law** on **Rights** of **indigenous peoples** and communities of the State of Oaxaca art. 28, 29, 51, 52, 53, 55
			Decree 1320 of 1998 prior consultations of indigenous and black communities	**Climate Change Law** of the State of Oaxaca of 2013 art. 2.1

2.3.2 *Comparison of the natural resource governance system for the three Case Studies*

Table 2 is separated into five sections for the evaluation of each CS:

- Who wields power and responsibilities?
- How are decisions made at local level?
- What are the organisational structures (networks) for natural resource management?
- How do citizens participate in natural resource management?
- Conflicts between local actors and governance systems.

Case Study	Argentina	Colombia	Mexico
Table 2. Natural resource governance systems (from Deliverable 1.4).			
Who wields power and responsibilities?			
Main governmental actors	**Local.** Coast guard of Argentina. Governments of the Municipality of Bahía Blanca, Coronel de la Marina and Monte Hermoso. **Provincial.** Provincial Nature Reserve Bahía Blanca, Bahía Falsa and Bahía Verde, provincial institutions for Agrarian Affairs, Public Works, Hydraulics and Sustainable Development. **National.** Federal Fisheries Council, Undersecretary for Fisheries and Aquaculture and National Aquatic Sports Council.	**Local.** Community Councils of the Black Communities of Buenaventura (CCCs), Local Government of Buenaventura. **Regional.** Government of Valle del Cauca and Regional Autonomous Corporation of the Valle del Cauca. **National.** Ministries of the Environment, Mines and Energy, Social Welfare, Agriculture, Education.	**Local**. Citizens Assembly and Community Assembly, Municipal Council and Permanent Positions. **Regional.** Government of the State of Oaxaca, Delegation of the District of Oaxaca. **National.** Mexican Federal Government and its Departments.
Main non-governmental actors	Aqua Marina International, FRAAM (Foundation for Reception and Assistance of Marine Animals), Rotary Club, Lions Club of Pehuén Co, Network of Young Leaders in Conservation, Association of Bahía Blanca Artisanal Fishermen, Chamber of Fishing Fleets and Owners of the Bahía Blanca Estuary, Gral. D. Cerri Fishing Club, Fishing Associations of Pehuén Co and Monte Hermoso, Bahía Blanca y Coronel Rosales, Neighbours Associations of Gral. D. Cerri and Pehuén Co, Chambers of Commerce and Industry of Pehuén Co, Monte Hermoso and Bahía Blanca, Chemical Industry Association of Bahía Blanca.	FUNDAPAV (NGO which has accompanied the CCCs for the last 7 years), ECOBIOS, AGROESOP Foundation, Puerto Aguadulce Foundation, Simbiosis Foundation, FUNDELPA (Foundation for Economic Development of the Pacific Coast), San Cipriano Foundation, Port Society Foundation, JUBCA (United Youth Working to Strengthen Calima), Save the Children, Calima Verde Foundation, International Red Cross, ONCAPROTECA (Black Farmers Organisation for Protection of the Territory of Bajo Calima).	WWF (World Wide Fund for Nature), FSC (Forest Stewardship Council), Inter-American Foundation, UZACHI (Union of Zapotec-Chinantec Forestry Production Communities), ERA, Métrica Empresarial y de Negocios S.C.
How are decisions made at local level?			

Power of local actors in natural resource management	They have no power in decision-making or in dictating policy and usage standards for managing and handling natural resources. However, there are certain structures and associations of fisherman with social rules and forms of organisation enabling them to confront and intervene in government decisions.	The communities have custody of the territory and therefore the power to intervene via the CCCs in natural resource management.	Governed via the system of *uses and customs* of indigenous peoples. Their main institutions are the Assembly of Co-owners, which establishes the system of duties and *tequio* (unpaid public positions and labour), whereby the communities have a high power of intervention in the natural resource management in the territory
Operational rules for natural resource management	Non- existent.	The Community Councils issue internal and external rules and standards to regulate the use of resources, water and biodiversity; protect reserve areas; prevent illegal logging, regulate and prohibit activities that contaminate or directly affect the natural resource conservation.	The Community Assembly issues authorisations for the commercial use of natural resources. Permission from the Commission for Communal Goods and the Vigilance Council is required to use natural resources for own consumption.
Women in decision-making	Women play a dominant role in domestic and community labour, with little participation in fishermen's associations and good representation in tourism, business and trade associations.	Traditional gender roles remain unchanged in the Community Councils, although women have more participation. It is clear that collective land rights have not led to fair access between women and men.	The first female co-owner was elected in 2010 and women's participation has increased in the assemblies, due to emigration of the men. The women's role in nature conservation is being tenuously acknowledged, though their actions are not fully visible and recognised.

Case Study	Argentina	Colombia	Mexico
Organisational structures (networks) for natural resource management			
Social	There are social organisations to deal with environmental contingencies and cultural and recreational activities.	There are social organisations that enable or mediate in the interchange of physical, financial and human resources and are involved in providing environmental services and in the economic and cultural aspects, the provision of public services and policy generation.	There are social organisations whose main activities concern how natural resources are dealt with, financing of farm and forest production and the generation of regional policies.
Environmental	There are organisations of neighbours and for protection of the coastal environment which promote activities associated with natural resource conservation.	There are environmental organisations that draw up conservation agreements in specific instances. Remedy of environmental impacts and public policies to protect and regulate NRs, social networks for extraction, processing and distribution of natural resources and collective action activities associated to the natural resource management.	There are local organisations that promote sustainable development models. Regional organisations that help appropriately manage natural resources. Global organisations to create ecological market networks (green labelling and compliance with standards).

Market-related	There is a public/private organisation for management of the Bahía Blanca maritime port. Organisations for integration of industry in society. Formal organisations of artisanal fishermen. Companies involved in tourism activity.	There are organisations for agro-livestock production, community exchange and local markets. Informal organisations for gold mining and fishery production.	There are organisations for usage and advice regarding sustainable forest management, commercialisation of wood products and ecotourism.

How citizens participate in natural resources management			
Participative election rules	There are no collective election rules.	Agreements are made, backed and endorsed by means of participative assemblies of the Community Councils.	Collective agreements are made, backed and endorsed by the Community Assembly. Agreements are made in the Council of Elders, endorsed by representatives with the most experience in the community.
Mechanisms for monitoring and sanctions	There are no mechanisms for users' participation in the monitoring and sanctioning offences associated to natural resource management. Artisanal fishermen informally report the presence of illegal boats.	The Steering Committees of the Community Councils are co-responsible for compliance with rules and standards associated to natural resource management.	Every member of the community is obliged to report to the authorities any incident of improper natural resource use. A penalty system is in place at local level. Additionally, the community's members begin a dialogue process with an offender to resolve the problem the moment the infringement is detected.

2.4 Evaluation of the governance models for each Case Study

Using the information both from Table 1 for comparing the legal basis for natural resource management and from Table 2 for comparing the natural resource governance system, it is possible to evaluate the management models for the three COMET_LA CS in terms of governance style, flexibility, adaptation capacity, resilience and external support. *Governance style* can be determined from the information in Table 1 as governance which is essentially "top-down" and there is only limited co-management of natural resources between government, NGOs and local stakeholders, but where the governance is "bottom-up" there is substantial co-management between government, NGOs and local stakeholders. *Flexibility* essentially reflects the attributes of governance summarised in Figure 1 in section 1.2 (Lebel *et al.*, 2006); the more participatory, polycentric, accountable, deliberative, multi-layered and just the management model, the more the governance will show flexibility. *Adaptation capacity* in SESs is characterized by open and frequent lines of communication, collaboration, and action between both formal and informal institutions at multiple scales (Garmestani and Benson, 2013). *Resilience* is a measure of the amount of change a system can undergo and still retain the same controls on structure and function (Holling, 1973; Lebel *et al.* 2006). *External support* is the amount of resources that an SES can expect to receive from outside its boundaries.

With regard to the specific management models of CS in Argentina, Colombia and Mexico, those sections of laws and regulation in Table 1 that are highlighted in orange show a higher degree of co-management of natural resources and participation of stakeholders, whilst those sections highlighted in red do not consider any type of co-management. In addition, elements in Table 2 concerning *who wields power and responsibilities*, *how are decisions made at local level*; *organizational networks for natural resource management*; and finally, *how citizens participate in natural resources managemen*t enable an evaluation of the governance models for the three CS in terms of governance style, flexibility, adaptation capacity, resilience and external support. Figure 8 shows that Argentina has a more "top-down" governance style with relatively poor flexibility, poor adaptation capacity, moderate resilience, and relatively high capacity for obtaining external support from outside the SES. Colombia has a more "bottom-up" governance style with moderate flexibility, high adaptation capacity and resilience, and moderate capacity for obtaining external support. Mexico also has a more "bottom-up" governance style with moderate flexibility, low adaptation capacity, and high resilience, but low capacity for obtaining external support.

Case Study	Governance Style	Flexibility	Adaptation capacity	Resilience	External support
Argentina	Top-down	↓	↓	±	↑
Colombia	Bottom-up	±	↑	↑	±
Mexico	Bottom-up	↓	±	↑	↓

Figure 8. Summarises the characteristics of the governance models for the three CS.

Reflecting high potential (↑), moderate potential (±) and low potential (↓) for flexibility, adaptation capacity, resilience and external support.

As a summary, the Argentine SES has a mixed-private governance model involving both private enterprise and state enterprises where the legal framework is almost entirely controlled by the state, whilst the Colombian and Mexican SESs have common property rights where the legal framework has much greater capacity for involvement of the local stakeholders in collaboration with the state and other NGOs. This does have repercussions for any future efforts to improve community based natural resource management (CBNRM) at all three CS. There is a view expressed by Flournoy and Dreisen (2010), amongst others, that "we cannot reliably protect a natural resource legacy without a strong and enforceable substantive mandate." Garmestani and Benson (2014) address the question on how can a substantive mandate be achieved in a manner that accommodates the need for adaptation, as well as enforceability at a broad scale that fosters rather than diminishes creativity at smaller scales. There is certainly the contention that a "bottom-up" legal process has the capacity to be better than more comprehensive approaches in that environmental problems (e.g., climate change) can be divided into different categories so that policy makers can determine which regulatory and/or market strategies are most appropriate and at which scales (Orts 2011). Garmestani and Benson (2014) suggest a framework of resilience-based governance of social-ecological systems, which focuses upon the integration of resilience science, i.e., panarchy, adaptive management, and adaptive governance, with reflexive law (see section 1.2 above). In

relation to the natural resource governance of the Latin American CS, the current legal systems for Colombia and Mexico would be much easier to adapt to reflexive law than the much more traditional legal system of Argentina (see Table 1). At present, environmental management is more likely to succeed in Colombia and Mexico where the governance is more tuned to the SES. Nonetheless, participatory processes started at the Argentina SES might well initiate incremental changes to the governance system for natural resources in Argentina.

Andersson and Ostrom (2008) make an important point regarding good environmental governance by suggesting that it should be context-specific, and that there should be generalised guidance that accounts for scale, but a "blueprint formula" for environmental governance should be avoided as this is usually a recipe for disaster. As part of the generalised guidance, they recommend the polycentric systems (see also Figure 1 in section 1.2), which are complex adaptive systems without a central authority controlling the processes and structures of the system; Ostrom (2010) defines polycentric systems as multiple governance units at multiple scales, with each unit having some capacity to govern at its specific scale. The dynamics of these complex systems over time can be captured by the panarchy model (see Figure 2 in section 1.2) which are a nested set of adaptive cycles (Gunderson and Holling, 2002). We suggest that the use of these approaches for adaptive governance together with occupying the middle ground between completely "top-down" and completely "bottom-up" are likely to enable better CBNRM at the Argentine, Colombian and Mexican CS.

2.5 Frameworks for analysing social-ecological systems to support governance models

The data that has been acquired in the COMET_LA project to understand and provide guidance on sustainable governance models for the Latin American CS is based essentially on the SES Framework developed by Ostrom and co-workers (see details and references in Ostrom, 2009). However there are many other frameworks that have been used for analysing SESs. Binder *et al*. (2013) have compared 10 established frameworks and have suggested that some frameworks might be better for dealing with some issues rather than others. However, it is also important that whatever framework is selected, the outcomes from the research can be compared with other assessments. It is also important that there is a characterisation and typology of frameworks so that researchers can select those that are most relevant to the issues that they want to address. Although we do not intend to discuss this in great detail, Biden *et al*. (2013) have provided three main criteria for classifying frameworks: i) whether a framework conceptualizes the relationship between the social and ecological systems as being uni- or bi-directional; (ii) whether it takes an anthropo-centric or an eco-centric perspective on the ecological system; and (iii) whether it is an action-oriented or an analysis-oriented framework. This is illustrated Figure 9 below which is from Figure 1 in Binder *et al*. (2013).

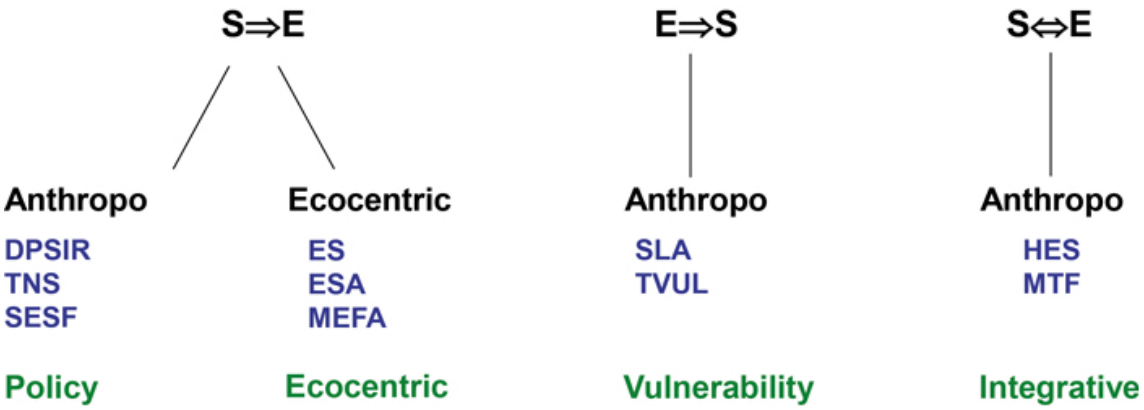

Figure 9. Guide for selecting adequate frameworks (From Figure 1 in Binder *et al.*, 2013).

The letters S and E are f or "social" and "ecological", respectively, and the arrows are uni or bi-directional. The acronyms for the different frameworks are DPSIR (Driver,Pressure,State, Impact,Response), ESA (Earth Systems Analysis); ES (Ecosystem Services), HES (Human Environment Systems Framework), MEFA (Material and Energy Flow Analysis, MTF (Management and Transition Framework); SESF (Social_Ecological Systems Framework), SLA (Sustainable Livelihood Approach); TNS (The Natural Step); TVUL (Turners Vulnerability Framework). Reference material for these frameworks can be found in Binder *et al.*(2013).

With regard to COMET_LA's choice to work with the Ostrom´s SES framework, Binder *et al.* (2013) suggest that, out of the 10 frameworks that they have reviewed, the SESF of Ostrom is probably the best suited as an initial approach for analysing an SES. Their reasons are that Ostrom's is the only one to treat the social and the ecological system in almost equal depth, and that it also allows the development of different degrees of specificity for differentiating different tiers. However, they also suggest that developing a data base from which different research questions could be addressed with different frameworks could be particularly useful. Moreover, similar research questions addressed with different frameworks would be useful for testing the robustness and validity of results that have been obtained from only one framework. Based on the concepts illustrated in Figure 9, Binder *et al.* (2013) have suggested three guiding questions for the supporting the selection of a framework:

- Do you study the effect of the social system on the ecological system, the effect of the ecological system on the social system, or are you interested in understanding the reciprocity of both systems?
- How do you conceptualize the environmental system? Do you conceptualize it from the perspective of its utility for humans? Or do you want to understand it by itself?
- Does the research question require an analysis or an action framework?

These ideas about using different frameworks for analysing SESs emphasise the value of the COMET_LA data that has been collected over the past three years, as this data is the basis for future studies on community based management of environmental challenges for sustainable governance. Indeed, Gari and co-authors (under submission) have already used data from the Colombian CS to carry out a DPSIR analysis of water uses and related water quality issues in the Alto and Media Dagua and Bajo Calima Community Councils; Semeoshenkova and co-authors have developed an Integrated Beach Management Framework for Bahia Blanca (in

preparation); whilst Bernisone and co-authors have carried out a DPSIR analysis for fisheries management and conservation biodiversity in Bahia Blanca (in preparation).

3 Some examples of other studies on governance of SESs for comparison with the three CS

There are myriad of studies on SESs and only twelve are select here for comparison with the coastal and marine, water and biodiversity, and forest themes of the CS for COMET-LA. Many of the studies, but not all have been based on Ostrom´s SES framework (2009).

3.1 Coastal and marine

3.1.1 Mediterranean

(See Cinerella *et al.*, 2014 for more details and further references)

The Mediterranean region is of fundamental importance to Europe given its strategic position. The responsibility of its overall ecosystem integrity is shared by European Member States and other Mediterranean Partner Countries. An interesting juxtaposition between governance instruments with an overlapping scope has been raised recently in the region by the appearance of the Marine Strategy Framework Directive (MSFD) for EU Member States and the Ecosystem Approach Strategy (ECAP) for the all Mediterranean Countries, including EU Member States. Both, MSFD and ECAP, are structured around vision-driven processes: Good Environmental Status (GEnS) and Healthy Environment (HE), respectively, and have clear ecosystem-based integrated policy objectives to guarantee the preservation and integrity of Mediterranean resources and services. Cinerella *et al.* (2014) identify prerequisites on what more needs to be done in order to facilitate effective implementation of MSFD and ECAP. On one hand, a better synergy between both instruments requires alignment of visions and strategic goals; on the other hand, a strategy for stakeholder engagement to facilitate measures and implementation of actions. Both are key issues for the future success of these strategies and, taking into account both societal and ecological objectives, the achievement of these respective objectives appears to be a considerable challenge. With respect to the COMET-LA CS, this Mediterranean example demonstrates how, even at a continental scale, achievement of sustainable CBNRM is almost impossible without the involving the active participation of stakeholders.

3.1.2 Portugal

(See Stewart *et al.*, 2014 for more details and further references)

The stalked barnacle, *Pollicipes pollicipes*, is a shellfish resource which has been traditionally harvested by the coastal communities of the Iberian Peninsula. However, in recent years Pollicipes has attracted increased harvesting pressure due to its high market value. In a national park on the south-western coast of Portugal, legislation has been formulated to address the overharvesting of this resource; however, its success has been limited due to lack of consensus among stakeholders. A Systems Approach Framework (SAF) has been used to

assess the socio-economic and cultural issues surrounding the harvesting of *Pollicipes*. As part of this, interviews and a questionnaire survey were undertaken in the municipality of Vila do Bispo, in order to explore the perspectives of the shell fishers, local residents and restaurateurs. The majority of the stakeholders believed that the resource was overharvested and that their needs should be considered as part of the legislation formulation process. The stakeholders also agreed that the local market should be re-established and that the temporal closure period should be reconsidered. Stakeholder opinions differed with regard to the level of coastal management enforcement required, the licence distribution process and the restrictions implemented by national park authorities. It is concluded that using information such as that gathered from local stakeholders, it should be possible to effectively extend the SAF to simulate scenarios for future management options. This *Pollicipes* CS has much in common with the management of the artesanal fishery in Bahia Blanca and demonstrates that the "top down" imposition of management actions are usually unsustainable.

3.1.3. New Zealand

(See Yandle, 2003 for more details and further references)

A market-based fisheries co-management regime in New Zealand has been assessed in relation to Ostrom's design principles. The co-management system was formed between the government and the commercial Stakeholder Organizations, but notably with the exclusion of other concerned stakeholders, such as recreational fishers, environmentally concerned entities and the indigenous communities of Maori people. The co-management regime showed a considerable deficiencies in terms of Ostrom's design principles. The neglect of the important stakeholders, such as the Maori people, affected the definition of the social boundary and collective choice arrangements, whilst hesitation to apply graduated sanctions seriously undermined the robustness of this co-management regime. The author showed that the co-management started with the 1999 fisheries amendment act passed by the New Zealand government. Therefore, Ostrom's seventh principle: minimal recognition of rights to organize was manifested to the full. Conflict resolution and nested enterprises have only had modest success. Yandle (2003) concluded that the co-management regime was fragile and suggested that the fundamental design should have been addressed early to build robust institutions. The CS shows that not involving key stakeholders in the participatory process, however difficult, is essential to achieve sustainable governance models and further emphasises the difficulties that the management of the artisanal fishery in Bahia Blanca has yet to overcome.

3.2 Water and Biodiversity

3.2.1 Japan

(See Sarker and Itoh, 2000 for more details and further references)

This CS examines a Japanese Irrigation CPR in Nishikanbara Land Improvement District (LID) in Niigata prefecture, in terms of Ostrom's design principles and found that all of them were present in an efficient and sustainable regime. The authors slightly modified the seventh

principle by adding a phrase "non-interventionary investment in the solicited physical capital entrusted to appropriators' organizations. This was to indicate that despite the substantial involvement of the government in setting up these CPRs, it did not interfere with their self-governance. The irrigation system, as all others in Japan, is organized as a LID through a water users association which is not necessarily confined to a specific geographic area. Sarker and Itoh (2000) attributed the success of the CPR institutions to the non-coercive presence of the government (with its large contribution of physical capital) and the high social capital manifested in strong group consciousness, mutual trust and high moral value of the society. This has made the monitoring system low-cost and graduated sanction incidents almost absent. The government, according to the authors, did not interfere with the LID because It recognized the congruency of these institutions with the local conditions and admitted the likelihood of its own incompatibility with internal characteristics of the systems. In many ways this CPR has much in common with the governance of the water resources in Colombia by the CCC of Bajo Calima and Alto y Medio Dagua in the COMET-LA CS.

3.2.2 Bulgaria

(See Theesfeld, 2004 for more details and further references)

In sharp contrast to the Japanese CS above, Theesfeld has shown how an irrigation CPR in three regions of Bulgaria has failed to apply a collective action due to lack of social capital resulting from distrust and envy, opportunistic behavior and corruption. Despite the efforts of the government to pave the way for collective action in order to enable the rural communities develop self-governance and sustainable water management system, for example, by enacting the Bulgarian Water Law in January 2000 and Water Users association act in March 2001. Theesfeld traces these shortcomings back mainly to the old socialist system which bequeathed distrust and corruption to the emergent transitional economic system. "During socialism, Bulgaria was a country in which the system of corruption encompassed a particularly large proportion of the population" (Theesfeld, 2004).

Based upon in-depth studies on four villages of the southern region, the researcher claims to have identified four major features that attest to this absence. These are: incongruity between formal and informal rules, information asymmetry, power abuse and deteriorating social capital. Thus, Ostrom's design principles were virtually absent in these CPRs, which are almost open access due to the absence of coherent management.

3.2.3 South Africa

(See Schmidtz and Willott, 2003 for more details and further references)

Contrary to the conventional idea that private ownership will prevent the commons from inexorably heading towards a tragic end, advocated by several authors (Gordon, 1954, Hardin, 1968, Block 2011), Schmidtz and Willott (2003) describe a CS where transformation of private ownership has been transferred into communal management. The Sabi Sand Game reserve encompasses an extensive area comprising various privately owned ranches. Schmidtz and Willott (2003) have described a combination of economic and ecological forces that has

encouraged to owners of the ranches to devise a communal management system while still retaining private ownership of the individual ranches: the economic forces are non-profitability of ranches due to foot and mouth disease of cattle, the poverty of the local customer base, and the high cost of transporting products to distant markets; the ecological forces are scarcity of water, soil degradation, and abundance of predators. By merging with the neighbouring Kruger national park, the ranches have been transformed into a game reserve for ecotourism. This communal management executed by a committee consisting of elected members representing each property, is a true example of cooperation, characterized by mutual respect, non-competitive relations, concern for one another and where free-riding is eliminated. What is particularly interesting about this CS for the COMET-LA CS is the change from the private property management of the ranches to the more communal approach for the Sabi Sand game reserve. Thus giving credit to the Andersson and Ostrom (2008) postulation that good environmental governance should be context-specific, and that a "blueprint formula" for environmental governance should be avoided.

3.2.4 Nepal, Ethiopia and Brasil

(See Boef et al. 2013)

A number of studies reported in a book edited by Boef *et al*. (2013) on Community Biodiversity Management focuses on reporting some advances in different community based strategies to manage biodiversity in communities from countries as diverse as Nepal, Ethiopia and Brasil. Their axis is agro biodiversity and landscape conservation and some of their conclusions are:

1. biodiversity conservation happens mainly at local level, but this particularity has yet to be fully recognized and effectively included in strategies for international protection of natural resources;
2. to support biodiversity conservation it is necessary to support local management strategies covering all the steps of extraction-production chains. It includes also intervening in the way local and regional markets impact biodiversity.
3. enhancing local participation in biodiversity protection strategies happens when the community participates in research designed to know how to respond to increasing variations in their ecological, social and economic contexts.
4. the findings help to provide support to the importance of not only analysing but also promoting the effective integration among different systems to improve resilience, as effective biodiversity management can promote local resilience.

Essentially these ideas resonate strongly with the outputs from the COMET-LA CS, particularly in biodiversity and water management. For example, the term "in-situ" conservation used in this book is important to include as part of the learning that could be used in local communities were COMET-LA has worked, because it has been clearly discussed, analyzed and supported at international negotiations for biodiversity protection.

3.3 Forestry

3.3.1 Honduras

(See Tucker, 1999 for more details and further references)

The forest CPR on mountainous area of western Honduras, La Campa, exhibits aspect of the Ostrom design principles. However Tucker (1999) observes that the poor implementation of some of these principles could eventually compromise the sustainability of the CPR. For example, Tucker (1999), finds that the residents of La Campa have delineated rights and obligations with respect to appropriation of forest resources and provision to the community, but they are more prone to capturing benefits than fulfilling duties. Apart from some patrol duties by community members, there is no regular and organized monitoring system, and usually only very serious transgressions are the ones which attract attention. Graduated sanctions are nominally present but rarely applied. On top of these weaknesses, development processes such as agricultural programs for coffee production appear to undermine the CPR, though these programs are deemed a major economic benefit by the population in spite of the resulting forest loss. Tucker further reasons that market integration and agricultural innovations might change the cost-benefit equation that previously favored the CPR. It is clear that, in contrast to the COMET-LA Santiago de Compaltepec CS, the La Campa sustainable governance of the La Campa forest resource is failing.

3.3.2 Costa Rica

(See Global Environment Facility, 2008 for more details and further references)

The Guaymí people occupy a region that stretches from the Osa Península on the Pacific Coast, to the heights of the Brunca mountains, bordering the Talamanca Mountain Range in La Amistad International Park, the first World Heritage Site in the region. The Guaymi Integrated Development Association has been entrusted with the management of nearly 28,000 hectares of wilderness area on the slopes of the Brunca mountains, an area with significant strategic importance for national conservation authorities. These temperate, fragmented forests contain nearly 70 percent of the forested areas to be included in a biological corridor that will join La Amistad International Park with the Piedras Blancas and Corcovado National Parks. A management plan has drafted and approved to keep the indigenous populations informed and attempt to minimize the project's impact on their lifestyles. In addition, an Indigenous Cultural Centre has been set up in Buenos Aires de Osa which organizes workshops and distributes information about the project. However, the Guaymí livelihood is threatened by plans to build the Boruca Dam that will flood extended areas in the Coto Brus and Osa lowlands, and its environmental and social impacts will affect most of the indigenous settlements of the Southern Pacific watersheds. In relation to COMET-LA this would be a CS that would benefit from the Scenario Analysis approach developed by the James Hutton Institute.

3.3.3 Ecuador

(See Global Environment Facility, 2008 for more details and further references)

The Quichua communities of Yana Yacu, Nina Amarun and Lorocachi, in the border area of the province of Pastaza, Ecuador occupy approximately 250,000 hectares of tropical Amazonian rainforest which host one of the greatest concentrations of biodiversity on earth. A project has been implemented to conserve and attain *in situ* management of the forest ecosystems and biodiversity through the implementation of three components: 1) design and application of management plans in three community territories; 2) establishment of a socio-environmental information centre for the indigenous territories of Pastaza; and 3) design and implementation of a capacity-building program on environmental and natural resource management. The project results have surpassed initial expectations, with the implementation of a conservation zone which serves as an inter-community biological corridor for the conservation of flora and fauna, defined in a participatory manner by the three communities. During all stages of design and implementation of the management plan for an Inter-Community Biological Conservation Zone, the project has applied participatory methodologies oriented also towards the rescue of ancestral knowledge. These methodologies have facilitated the integration of approaches for land, ecosystem and biodiversity management grounded on both ancestral knowledge and modern science. This combined approach in the three community territories has helped to also strengthen the community organization and regain ancestral land use practices. The Quichua project has much in common with both the CCC communities in Columbia and the community in Santiago de Comaltepec in Mexico, and demonstrates the success of CBNRM when it is fully implemented within a SES.

3.4 How does governance of other Case Studies relate to the three COMET-LA Case Studies

After analysing and comparing the natural resource management in SESs from twelve areas throughout the world that represent coastal and marine areas, water and biodiversity, and forestry, three principal aspects are shared in common with the findings from the three COMET-LA CS:

- sustainable resource management relies fundamentally on local communities. However this management does not always achieve sustainability. Indeed, local management strategies can only be effectively addressed when they are nested in general arenas that fully recognize the importance of natural resources conservation;
- natural resource management strategies need to consider different temporal, geographical and political scales and their interdependencies;
- governance structures are complex in all the CS and there is often a contradiction between strong formulations (either "bottom-up" or "top-down") and the mechanisms and the strategies for applying and reinforcing governance.

4 Conclusions about sustainable management and governance models from the COMET-LA project

1) The COMET-LA project is an ambitious project with a complex partnership with: wide geographical differences between the partners; communities with very different historical origins; and a diversity of political states. For example, within the project consortium, there are academic institutions comprising a range of disciplinary expertise; civil society organisations (CSO), again with a range of expertise; and even a commercial small medium enterprise (SME). In terms of the definitions by Tress *et al.* (2014) COMET-LA could be considered a transdisciplinary project e.g **interdisciplinary** *projects involve several unrelated academic disciplines in a way that forces them to cross subject boundaries to create new knowledge and theory and solve a common research goal.*; **multidisciplinary** *projects involve several different academic disciplines researching one theme or problem but with multiple disciplinary goals;* and **transdisciplinary** *projects both integrate academic researchers from different unrelated disciplines and non-academic participants, such as land managers and the public, to research a common goal and create new knowledge and theory*.

2) The implementation of the Ostrom SES framework, the Godet PSA analysis and the James Hutton scenario analysis within the SES communities of Bahiá Blanca (Argentina), Bajo Calima and Alto y Medio Dagua (Colombia), and Santiago Comaltepec (Mexico) has provided an detailed dataset on the legal framework for natural resource management the on the natural resource governance systems for each of the Latin American Case Studies (CS) at legal, regional and international scales which has been analysed and presented at various fora including:

- The participatory approach in the field visits to all three CS; as well as the additional project meetings at Bahia Blanca, Buenaventura, Oaxaca, Cali, Cordoba, and and has affected how all members of the consortium understand sustainable governance model for SESs ;
- Upscaling efforts by the project such as the Political Conference in Mexico City, the and the achievement of a high status project with the EU through the promotion efforts of the project coordinator;
- Effort by IUCN Spain to present that the motions presented at the Jeju 2012 IUCN General Assembly be applied to each of the case studies: Resolution 053 to Mexico (http://goo.gl/k6Ysqb [ES], http://goo.gl/L8dqPL [EN]), Recommendation 165 to Argentina (http://goo.gl/gfznx3 [ES], http://goo.gl/bzbE2F) and Recommendation 175 to Colombia (http://goo.gl/ViDAuf [ES], http://goo.gl/307bMY [EN]).

3) Using the COMET-LA data base it has been possible to describe the sustainable natural resource governance models for the three CS where Argentina has a "top-down" governance style with relatively poor flexibility, adaptation capacity and resilience, but it can and does receive resources from outside the SES. In contrast, both Colombia and Mexico have a more "bottom-up" governance styles with relatively high flexibility, adaptation capacity and

resilience, but with less capacity to obtain external support directly from government. We suggest that the sustainable governance models will be more successful where they occupy the middle ground between completely "top-down" and completely "bottom-up", and use the polycentric system which is a complex adaptive system without a central authority controlling the processes and structures of the system.

4) Differences in the legal systems between the CS may have a substantial influence on the future sustainability of the governance models as reflexive law has the objective of producing a better fit between institutional and social structure via facilitation (Teubner, 1983), as opposed to comprehensive regulation under more conventional legal systems

- The natural resources in Argentina are legally under control of the Federal government, which contrasts with the more (see Table 1).
- On the basis of the concept of reflexive law, it is probable that legal systems at the CPR of Columbia and Mexico are more likely to be adaptable to sustainable management of natural resources than Argentina's more rigid conventional legal system.
- Nonetheless, participatory processes started at the Argentina SES might well initiate incremental changes to the governance system for natural resources in Argentina.
- All three CS would benefit from a framework of resilience-based governance for the SESs, which focuses upon the integration of resilience science, i.e., panarchy, adaptive management, and adaptive governance, with reflexive law.

5) The COMET-LA data base could be used to address different research questions with different frameworks, as some frameworks are more appropriate for specific issues than others. Moreover, similar research questions addressed with different frameworks would be useful for testing the robustness and validity of results that have been obtained from only one framework.

6) The COMET-LA data base will also be very useful to compare with research on other SESs throughout the world. For example comparing the twelve CS in this Deliverable with three COMET-LA CS it has been possible to identify some features in common such as: sustainable resource management relies fundamentally on local communities, but this management does not always achieve sustainability; natural resource management strategies need to consider different temporal, geographical and political scales and their interdependencies; and finally and, most importantly, governance structures are complex in all the CS and there are often contradictions in the mechanisms and the strategies for applying and reinforcing governance.

7) The activities of this consortium over three years will have affected how sustainable management and governance of the three Case Studies are viewed by the local communities which may have repercussions well beyond the life of the project. For example:

- the Artisanal Fishery Chamber in Bahia Blanca Argentina is actively collaborating with members of the COMET-LA consortium (AquaMarina and Sagremarisco) on the implementation of a new fishing terminal with the purpose of supporting a sustainable fishery and aquaculture production.
- the natural resource management in Santiago de Comaltepec will be fundamentally affected by recent changes within the Assembly of Co-owners. A system of uses and customs of the indigenous people within the community ensured public positions and labour for the community were unpaid, but recently the Assembly has voted to changes these to remunerated positions.

8) The final conclusion is left to probably the most important legacy of the COMET-LA project and that is the considerable and highly effective involvement of young people who have all been introduced to the concept of community based natural resource management (CBNRM) as well as sustainable governance models, and may well become the future advocates of CBNRM and sustainable governance for natural resources.

- School children from each of the communities in the CS.
- Young researchers from each of the communities, notably the teams of "co-investigators from Bajo Calima and Alto y Medio Dagua CCC.
- Young academic researchers not only from Argentina, Colombia, Mexico and Spain, but also citizen from other parts of the world including Ethiopia, Russia and Brasil.

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