



## D3.3: “Stakeholder Visions and Perspectives on the Future from the Santiago Comaltepec Case Study in Mexico”

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September 2014



# Project information

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**Programme acronym:** FP7-Environment

**Subprogramme area:** ENV.2011.4.2.3-1

**Project reference:** 282845

**Contract type:** Research for Civil Society Organisations (CSOs)

**Partners:**

- ↪ 1. UCO: Universidad de Córdoba (Spain) (Project coordinator)
- ↪ 2. NILU: Norsk Institutt for Luftforskning (Norway)
- ↪ 3. JHI: The James Hutton Institute (Great Britain)
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- ↪ 11. CEIUCN: Comité Español de la UICN - Unión Internacional para la Conservación de la Naturaleza (Spain)

**WP3**

**Lead Contractor:** UNAM

**Other contractors involved:** ERA

**Due date of deliverable:** Month 32

**Actual submission date:** Month 32

**Dissemination level:** Public

**Acknowledgements:** We, the authors would like to express great appreciation to Dr M<sup>a</sup>. del Mar Delgado, Dra. Adelaida Farah, Dr. César Ortíz, Natalia Ocampo, Alejandra X. Cruz Bayer and all COMET-LA project participants for their comments and valuable suggestions throughout the planning and development of this research. We would also like to express our deep gratitude to the community of Santiago Comaltepec, its local authorities, and workshops participants for providing us with all the facilities during the workshops and fieldwork. Likewise, we extend our sincere thanks to external stakeholders for their decisive support and collaboration. Thanks to PAPIIT RN300613 "Manejo comunitario de los efectos del cambio climático en México" project, funded by the National Autonomous University of Mexico (UNAM), which also contributed to developing this research.

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# Executive Summary

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Worries about the inevitable environmental challenges of the future and the possible destruction of several Social-Ecological Systems (SESs) are increasing around the world. The COMmunity-Based Management of EnvironmenTAl challenges in Latin America (COMET-LA) Project uses a civil society-social scientists partnership to identify sustainable community-based governance models for the management of natural resources that can respond to global environmental change. Within this framework, three case studies have been selected to identify local governance models for natural resources management: forest management in Mexico, biodiversity and water management in Colombia, and coastal management in Argentina. The research teams have applied a methodology involving three different phases: SES characterizations (2012), Prospective Structural Analyses (PSA) (2013), and Scenario-Building Processes (SBP) (2014). This document presents the results of the final stage of the project (deliverable D3.3): SBP performed in the Mexican case.

The research in the Mexican case study has been carried out in the community of Santiago Comaltepec located in the Sierra Norte of Oaxaca, in south-eastern Mexico, and focuses on how the community of Santiago Comaltepec is managing its natural resources and keeping them on the track of sustainable development by practicing a community-based democratic model based on a non-paid activities system (“cargos” system). The case study analyses the SES performance, which includes all interactions between inhabitants (the social system) and the forest (the ecological system).

In this final stage, the challenge was to find out how the current governance and management system of the natural resources under analysis can respond to potential changes in the future. The idea is to help communities to prepare themselves for environmental changes and challenges as well as to illustrate a route from existing arrangements to robust strategies in the future.

To identify such robust management strategies, the Scenario-Building methodology was used, following the methodological guidelines proposed by the James Hutton Institute (JHI). This methodology involves four stages: the first one consists in exploring how drivers (external forces) of future change may influence the system; the second one deals with the construction of alternative future scenarios using archetypes; the third one, identifies response options to future challenges; and, the fourth one, discusses implications of response options to local plans.

As a result of the first step of stage 2, in which the COMET-LA Mexican team “navigated” through a morphological space elaborated in the previous stage, five narratives were constructed based on archetypes suggested by Hutton’s methodology. After that a set of response options was identified for the previously constructed scenarios - (1) market forces–resource reallocation, (2) predominant policy, (3) social entrepreneurship, (4) sustainable SES, and (5) chaotic world. The scenario which was chosen as the preferred one was the sustainable SES. The next step was a discussion about the best possible responses for the five scenarios. Two lists of possible response options for each scenario were compiled—one list from external

stakeholders and the other one from internal stakeholders. Once a set of responses had been proposed by each group of stakeholders, workshops' participants and the research team carried out a response robustness analysis. A robust response represents a relatively useful action to face future challenges.

Three responses could be considered robust because both internal and external stakeholders identified them as possible responses in all scenarios: Training and advice, Strengthening the links between the community and institutions, and reviewing and improving development and forest management plans. However, it is also important to take into account the robust responses for each type of stakeholders. In the case of internal stakeholders, Strengthening the customary practices and collective memory were perceived as the backbone of the system in any situation, while Human capital formation occupies the most important role in the external stakeholders' vision. This result is not unexpected. If the sustainable SES was the most preferred scenario, customary practices and collective memory must be reinforced if the scenario is to be achieved and maintained.

Another possible and useful strategy would be to combine four responses: 1) Creating local financial institutions; 2) New sustainable investment projects based on individual and collective schemes; 3) Diversifying and modernizing economic activities diversification; and 4) Strengthening customary practices and collective memory. This robust strategy reveals two important facts. First, there is a notion of sequence in growth patterns: in order to diversify economic activities, new investments must be done, and for these new investments to be done, a financial institution must be acting as a supplier of affordable credit. Second, there is a notion of development: development, which cannot be achieved without strengthening customary practices and collective memory.

Finally, as a result of the scenario-building methodology, internal stakeholders have realized that complex and global economic, environmental and political contexts have major and serious impacts on a local scale such as Santiago Comaltepec. Considering that the community as an isolated and independent system has never been an option, and least of all in a period of great transformations as the current one, envisaging the future becomes a strategic tool to guarantee its sustainability. Climate change, new technologies applications, timber prices, migration controls are all determined to a different extent not only by external but also by internal forces and require careful consideration to be able to come forward with plausible solutions. The impact on the community is big enough to realize that the governance system should encourage internal stakeholders' participation in order to ensure resilience. Resilience to climate change and environmental shocks are better coped with when the actors are directly involved in the management of the affairs concerning their vital resources. To visualize the future is unavoidable and necessary.

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# List of abbreviations

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CBNRM	Community-Based Natural Resources Management (Manejo comunitario de los recursos naturales)
COMET-LA	COmmunity-based Management of EnviromenTal challenges in Latin America
CONAFOR	National Forestry Commission (Comisión Nacional Forestal)
CONAGUA	National Water Commission (Comisión Nacional del Agua)
CONANP	National Commission on Protected Natural Areas (Comisión Nacional de Áreas Naturales Protegidas)
ERA	Rural Studies and Consultancy (Estudios Rurales y Asesoría)
INEGI	National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía)
JHI	James Hutton Institute
NGO	Non-Governmental Organization
PROCAMPO	Programme of Direct Support to the Rural Areas (Programa de Apoyos Directos al Campo)
PSA	Prospective Structural Analysis
SAO	The Oaxaca Environmental Services Association (Servicios Ambientales de Oaxaca)
SBP	Scenario-Building Process
SEMARNAT	Secretariat of Environment and Natural Resources (Secretaría del Medio Ambiente y Recursos Naturales)
SES	Social-Ecological System
UNAM	National Autonomous University of Mexico (Universidad Nacional Autónoma de México)
UNSIJ	Sierra Juárez University (Universidad de la Sierra Juárez)
UZACHI	Zapotec and Chinantec Peoples' Union (Unión de pueblos Zapotecos y Chinantecos)



## 1 Introduction

There exist several approaches to the management of environmental challenges around the world. The COmmunity-Based Management of EnvironmenTal challenges in Latin America (COMET-LA) Project uses a civil society-social scientist's partnership to identify sustainable community-based governance models for the management of natural resources that can respond to global environmental change. Within this framework, three case studies have been selected to identify local governance models for natural resources management: forest management in Mexico, biodiversity and water management in Colombia, and coastal management in Argentina. The research teams have applied a methodology involving three different phases: Social-Ecological Systems (SES) characterizations (2012), Prospective Structural Analyses (PSA) (2013), and Scenario-Building Processes (SBP) (2014). These phases have been carried out for all the three case studies. This document presents the results of the SBP performed in the Mexican case.

To better understand the Mexican project, it is convenient to contextualize the area of intervention, both from the natural and the social perspectives. Santiago Comaltepec is a community located in the Sierra Norte of Oaxaca, in south-eastern Mexico. Two main areas integrate this region: the *Ixtlán* and *Villa Alta* districts, each one with several settlements. The region covers 18,366 ha, under a communal property regime, and is inhabited by 1,115 dwellers (587 women and 528 men), according to INEGI's (National Institute of Statistics and Geography) 2010 population census. Two main ethnic groups form the population: the Chinantec and Zapotec communities, each one speaking its own native language. All settlements are under a governance regime largely based on customary practices, in contrast with the prevailing national regime (a democratic system with a multi-party basis). Traditions inherited from one generation to the next are at the core of the SES. The most conspicuous example is the intergenerational transmission of forest management know-how, including the respect for existing rules to ensure the sustainability of resources extraction.

Santiago Comaltepec's main ecosystems are temperate rainforest, rainforest and mountainous cloud forest (which is characterized by its high value, due to its excellent conservation condition). In fact, this region is one of the most biodiverse ecosystems in Mexico. More than 4,000 species of plants, 400 species of birds and 350 species of butterflies have been documented. The region is home to the jaguar (*Panthera onca*) and of the ornate hawk eagle (*Spizaetus ornatus*); both species are emblematic of the region. The region plays a key role in the hydrological regulation, as it is one of the top rainy regions of the country.

The case study focuses on how the community of Santiago Comaltepec is managing its natural resources and keeping them on the track of sustainable development by practicing a community-based democratic model based on "cargos" system (non-paid system)<sup>1</sup>. The case study analyses the SES performance, which includes all interactions between inhabitants (the social system) and the forest (the ecological system). In the previous stages of COMET-LA Project, a SES characterization and a PSA to identify the main variables and drivers in the SES

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<sup>1</sup>For a deeper description see Deliverable D3.1 and Deliverable D3.2.

dynamics were carried out in order to establish the most relevant issues whose present state it was necessary to consider before identifying future scenarios. This report presents the results of the final stage of the project (deliverable D3.3), based on the results of the initial characterization of the SES (see deliverable D3.1 Stakeholders' Vision on the Socio-Ecological System (SES) situation in Mexico. A Case Study: [http://www.comet-la.eu/images/comet\\_la/delivrebles/D%203.1\\_Comaltepec.pdf](http://www.comet-la.eu/images/comet_la/delivrebles/D%203.1_Comaltepec.pdf)) and the analysis of problems and drivers using PSA (see deliverable D3.2 Stakeholders' vision on problems and drivers related to environmental challenges in Mexico: [http://www.comet-la.eu/images/comet\\_la/delivrebles/COMET-LA%20D3.2.pdf](http://www.comet-la.eu/images/comet_la/delivrebles/COMET-LA%20D3.2.pdf)). At this stage, we consider how the current governance and management system of the natural resources under analysis can respond to potential changes in the future. The idea is to help communities to prepare themselves for environmental changes and challenges as well as to illustrate a route from existing arrangements to robust strategies in the future.

To identify such robust management strategies, we used the Scenario-Building methodology proposed by COMET-LA (see Deliverable 1.3 Locally-adapted Scenario Building Evaluation Methods for further details). This methodology involves four stages: the first one consists in exploring how drivers (external forces) of future change may influence the system; the second one deals with the construction of alternative future scenarios using archetypes<sup>2</sup>; the third one, identifies response options to future challenges; and, the fourth one, discusses implications of response options to local plans. One advantage of using scenario-building methods is to use the potential of several plausible futures, medium and long term, to explore alternative strategies without becoming overly conditioned by the status quo. This allows for a more inventive process that is less likely to be constrained by path dependency or vested interests. However, the outcomes of scenario building exercises have to be grounded in reality and also work as a clear mechanism provided by communities themselves, to allow them for the adoption of new community-based management and governance models that they identify.

For the sake of clarity, in order to present the SBP and results, this document has been divided into nine sections. (1) An introduction to scenario- building approaches; (2) description and analysis of the data collected; (3) the selection of drivers and internal variables to be included in the SBP; (4) the morphological analysis of internal and external variables; (5) the narratives construction and validation by internal and external stakeholders; (6) suggestions of robust response options to face future challenges; (7) the implications of each response option; (8) the impacts of such options on the current governance system; and (9) some conclusions.

## 2 Introduction to the Scenario-Building Methodology

Nowadays, several societies around the world are concerned about their future. Even small populations are discussing how they will be subject to inevitable challenges in the long term.

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<sup>2</sup> Archetypes have been used to characterize different world states such as conventional worlds, great transitions and barbarization.

In this context, numerous studies have been conducted in order to systematically analyse what the future could be like. These approaches can be classified into quantitative and qualitative methods.

The most widely accepted quantitative methods for scenario building could be summarised as follows: Future Group estimations using time series and Monte Carlo processes, logistic models (Greene, 2003), cross section models, regressions and panel data models (Wooldridge, 2010), and dynamic models (Forrester, 1961 and Sterman, 2000). As for the most used qualitative techniques to analyse future trials, the following should be considered: the Delphi method (Bas, 2004), structural analysis (Godet, 2003), scenario planning (Schwartz, 1991), and morphological analysis (Hunt et al., 2012).

Based on data availability and local conditions, in this case study, a qualitative approach was adopted: in particular, the morphological analysis<sup>3</sup>. Prior to this project, the community of Santiago Comaltepec had not had any scenario-building experience; this manifested through internal and external stakeholders' reluctance to think about the future in the early stages of the project. Several communities in Mexico are not used to devoting time to thinking of future issues due to their day-to-day concerns. Culturally, communities focus on meeting basic needs, which makes them neglect the notion of future. The closest experience the Santiago Comaltepec community had regarding the analysis of the future is the forest management plan, which is designed and written every ten years applying technical tools<sup>4</sup>. However, once the participants in the workshops clearly understood how the scenario-building methodology works, their reluctance faded away and their contributions grew both in frequency and significance.

The methodology suggested by the James Hutton Institute (JHI) has shown its capability to analyse future challenges in contexts like this. Once the SES characterisation and PSA were conducted in previous phases, the idea of thinking about the future with the community was not too hard as was thought when the methodology was first presented to the stakeholders. The SBP was introduced into the internal and external stakeholders' discussions on the grounds that there will inevitably be some social, economic and environmental challenges to Santiago Comaltepec in the short, mid and long-term and that community members must be prepared to face them.

Reflections about how they should face future challenges led to deeper and interesting discussions. The need for tools, responses, mechanisms, programmes, policies, actions, and emergency plans (in case of an important shock) is inescapable. Thus, taking up historical facts such as a forest fire occurred three decades ago, both the community members and the

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<sup>3</sup> See Deliverable D1.3 Locally-adapted Scenario Building Evaluation Methods elaborated by the JHI <http://www.comet-la.eu/index.php/es/publicaciones.html>, in which a complete methodological explanation is provided and justified. In this report only its results will be presented.

<sup>4</sup> This planning exercise is usually implemented by government agencies using top-down methodologies. This process could be classified as a bureaucratic one.

external institutions realized that if they are better prepared to face the future, Santiago Comaltepec as a SES would be resilient to a variety of unpredictable trials.

### 3 Data collection and analysis

The Mexican research team followed the common scenario planning proposed by the JHI (see deliverable D1.3 Locally-adapted Scenario Building Evaluation Methods: <http://www.comet-la.eu/index.php/es/publicaciones.html>). However, it was necessary to suit the needs of the case study. These adaptations and the learning generated are also described in deliverable 1.3. The common methodology set out what data to collect at every stage resulting in:

- A list of external drivers and internal variables chosen by the researchers
- A morphological analysis of driver impacts on these variables
- Field notes on the community's views on the morphological analysis
- Five narratives of the future stemming from the use of global archetypes validated by the community members
- Field notes on the community's' views on the narratives
- A list of possible response options, including present response options
- A matrix of how response options might work under different scenario conditions
- A matrix of how the response options might react to shocks
- A final list of robust response options and strategies
- A list of the implications of the robust response options/strategies
- A plan for taking these response options/strategies forward

As in the SES characterisation and PSA phases, two kinds of views were considered: external and internal stakeholders' views were included in this phase; exclusive women's workshops were not carried out due their multiple activities within the family and community and also due to community's conditions. However, they participated in the external and internal stakeholders' workshops. In addition, information about current projects and development plans was collected in order to take it as a benchmark in this analysis. Finally, information about national or regional plans was included.

These data were collected during fieldwork visits/workshops on March, 30<sup>th</sup>, May, 4<sup>th</sup>, May, 30<sup>th</sup>, and June, 29<sup>th</sup>, 2013, attended by internal (local authorities, commoners, inhabitants) and external stakeholders (UNSIJ, SEMARNAT, CONAFOR, CONANP, UZACHI, ERA and SAO)<sup>5</sup>. The last workshop was conducted as an extraordinary General Assembly because COMET-LA team presented all the project results obtained from 2012 to 2014<sup>6</sup>.

The data were collected using participatory techniques such as workshops, interviews and debates. As in the previous phases, UNAM and ERA invited representatives from external

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<sup>5</sup> The participants' list is in the annex at the end of this report (see table 9).

<sup>6</sup> The participants' list is not included in the annex due to its extension (more than 30 persons).

institutions in order to obtain external views regarding the Santiago Comaltepec SES future performance. Likewise, local authorities and settlers (both commoners and residents) were called to debate the future of their SES.

## 4 Selection of external drivers and internal variables

### 4.1 Selection of external drivers

The first step suggested by the Scenario-Building methodology is to identify and establish a set of key drivers that can affect the local internal variables of a system. Although these external forces do not have predictable effects on the system, they certainly exert big influences on the system performance. Therefore, it is necessary to describe not only the driver and the way in which it is going to be used in the system, but also what states it will take in order to identify the system responses and get the essential elements that let the community develop a SBP.

As the objective of this stage is to identify the external forces that can affect the system structure, these drivers should involve strong elements that could impact the internal variables. Therefore, drivers are not restricted to economic or political factors, which obviously affect any SES; in contrast, they should consider other elements. Studies on both the global and regional levels have already identified several drivers that can play a key role in determining the future of an SES, but whose direction and effects are uncertain (*O'Brien, F. A. 2004*). These studies suggest it is useful to consider five different categories of drivers, called 'STEEP': Social, Technological, Economic, Environmental and Political. Therefore COMET-LA partners had to propose at least one driver within each of these categories (See deliverable D1.3 <http://www.comet-la.eu/index.php/es/publicaciones.html>). Table 1 includes the external driver selected in each of the five STEEP categories for the case of Santiago Comaltepec's SES. The table includes a brief description for such factors, their current status and two possible states.

Table 1 Santiago Comaltepec's Socio Ecological System's external drivers

<b>Social driver of change</b>	
<b>Name:</b>	Tightening/loosening migration controls in the US (external issues)
<b>Description:</b>	<i>Tightening/loosening migration controls</i> refers to the US government capacity to control the entry into and deportation of immigrants from the US territory.
<b>Current status</b>	The United States is the most important destiny of Mexican migrants. The inhabitants of Santiago Comaltepec used to migrate to the US and Oaxaca City in order to look for better economic opportunities (jobs, higher wages, etc.). But, the US is implementing a migration control in order to prevent Mexican migration. It is also important to mention that in recent years, due to the global crisis several people have returned to their places of origin.
<b>State 1</b>	Migration controls in the US are tightened and allow fewer entries per year than at present.
<b>State 2</b>	Migration controls in the US are relaxed and allow more entries per year than nowadays.
<b>Technological driver of change</b>	
<b>Name:</b>	Technological change in timber harvesting machinery
<b>Description:</b>	Technological change would affect specialization. A change in the technology used in timber harvesting refers to the way in which the community could reduce the harvesting costs in order to reach bigger profit rates.
<b>Current status</b>	Today, technology used by the communal firm for extracting and sawing wood, but not to add higher value to products. The maximum level of yearly timber extraction is around 2,500 cubic metres of wood. So, this level is not putting forest conservation at risk.
<b>State 1</b>	Improvements in timber harvesting technology reduce production costs.
<b>State 2</b>	Timber harvesting machinery technology remains the same and productions costs remain the same or increase
<b>Environmental driver of change</b>	
<b>Name:</b>	Climate Change
<b>Description:</b>	<i>Climate Change</i> refers to global warming and the concomitant effects on seasonal temperatures and rainfall
<b>Current status</b>	Currently, the highest rainfall season of the years has been modified.
<b>State 1</b>	Temperatures will increase only slightly and rainfall patterns will remain constant.
<b>State 2</b>	Temperatures will increase 2° C and rainfall will decrease very significantly.

<b>Economic driver of change</b>	
<b>Name:</b>	Changes in global market prices for timber products
<b>Description:</b>	<i>Changes in global market prices for timber products</i> refer to the prices of natural resources, for instance, timber and forest prices. Market conditions refer to the demand for certain forest products; for instance, low or high added value products such as furniture or environmental services.
<b>Current status</b>	The economic value is higher than the market value. The economic value includes use and non-use values (the latter includes carbon capture and sequestration, scenic beauty and hydrological services).
<b>State 1</b>	Timber prices increase
<b>State 2</b>	Timber prices decrease
<b>Political drivers of change</b>	
<b>Name:</b>	Political stability
<b>Description:</b>	<i>Political stability</i> is related to the political conditions on the regional, national and local levels. Federal policies usually are not linked to regional or local rules. Then, the risk of political instability exists if those policies are not aligned.
<b>Current status</b>	Currently, communities in Mexico are dealing with national pressures derived from the lack of consensus about how communal territories have to be managed. Also, some national policies such as education, health, traditions and governance are not aligned.
<b>State 1</b>	Political stability, national and local policies are aligned
<b>State 2</b>	Political instability, national and local policies are not aligned
<b>Political drivers of change</b>	
<b>Name:</b>	Change in the national legislation concerning the collective/communal property right systems
<b>Description:</b>	The <i>Property Rights System</i> describes the existence or absence of formal property rights regarding the resource system and the common pool of resources. Also, it includes the right to manage territories and resources embedded in it. In this case, communal property rights have been allocated to Santiago Comaltepec. The community possesses the right to extract and exclude external agents. But, the commoners (land owners) have the right to manage natural resources.
<b>Current status</b>	The territory of Santiago Comaltepec is under the communal property right regime. This regime allows commoners (inhabitants who have the right of extraction) to manage it. The General Assembly plays a central role in resource management. It can determine who can and who cannot harvest the forest, including both internal and external agents.
<b>State 1</b>	The current situation remains the same: the community keeps the rights of extraction and exclusion.
<b>State 2</b>	Article 27 <sup>7</sup> of the Constitution will be modified stating that communities will lose territorial and natural resources management rights. The private sector or individual interests will be involved in this change.

*Source: Own elaboration based on JHI and UNAM-ERA contributions*

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<sup>7</sup> **Article 27.** Ownership of the lands and waters within the boundaries of the national territory is vested originally in the Nation, which has had, and has, the right to transmit title thereof to private persons, thereby constituting private property. Private property shall not be expropriated except for reasons of public use and subject to payment of indemnity.

### 4.2 Selection process of internal variables

As a part of the first phase of the SBP, UNAM and ERA teams selected seven internal variables that would be included in the morphological analysis. This set results from the fifteen variables used in the PSA, filtered through three criteria: *setting internal and external variables apart, a consensus hammered out by the three types of stakeholders (internal-both men and women- and external), and strong influences over the total system.*

The variables originally selected as the most relevant ones for the SES performance were: economic activities, livelihoods, non-paid activities, migration trends, political stability, types of environmental laws, monitoring and sanctioning processes, government organizations, property rights system, collective-choice rules, exclusion and extraction rights, economic value, importance of resources, history of use, and sanitary conditions. These variables were analysed in the PSA phase<sup>8</sup>.

#### 4.2.1 First filter results

The first filter separates internal from external variables. Thus, *property rights system, type of environmental laws, migration trends, economic value, and political stability* variables will not be incorporated into the analysis. These variables are not internal forces under community control. Instead, external institutions determine them.

External variables (not included into the internal analysis, 5 out of 15 variables):

- Property rights system
- Type of environmental laws
- Migration trends
- Economic value
- Political stability

#### 4.2.2 Second filter results

During the second filtering stage, the UNAM-ERA team compared MICMAC and NodeXL<sup>9</sup> results and excluded autonomous variables (*Sanitary conditions*). Both external and internal stakeholders ratified the following classification:

Internal variables (matching):

- Collective-choice rules
- Extraction and exclusion rights of natural resources
- Importance of resources

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<sup>8</sup> For a more detailed description, please refer to Annex 1 at the end of this document.

<sup>9</sup> These tools allowed research team to identify the strongest relations among the SES internal variables. These tools were applied to identify relationships in a specific system. For more information, consult: <http://es.laprospetive.fr/Metodos-de-prospectiva/Los-programas/67-MICMAC.html>



- Monitoring and sanctioning processes
- Non-paid activities
- Livelihoods
- Economic activities (forestry and agriculture)
- History of use
- Government Organizations

### 4.2.3 Third filter results

The third criterion is based on identifying strong relations between variables; this taking into account the most relevant internal forces during the scenario building analysis. Analysing MICMAC and NODE XLS results through indirect influence graphs for all stakeholders, the UNAM-ERA team has identified the “strongest” connections between internal variables. Once external and autonomous variables had been excluded (6 out of 15), the influence analysis was carried out including nine variables (outcome of the second filter). All stakeholders agreed on a set of seven variables as the ones that exerted the strongest influences. In this process, *importance of resource and non-paid activities* variables were excluded. To simplify the model, we considered that the variable *importance of resources* could be packed into *economic activities*. As for the cargo system, this year the community is trying to change it by implementing a payment scheme.

The list of the seven interval variables showing the strongest relationships includes:

- Collective-choice rules
- Natural resources extraction and exclusion rights
- Monitoring and sanctioning processes
- Livelihoods
- Economic activities (forestry and agriculture)
- History of use
- Government Organizations

The *collective-choice rules* variable has been included in the analysis because the governance system is based on collective decisions and rules. It works as a regulator variable. The General Assembly (based on collectivism) is the only institution that can modify the SES’s rules. *Natural resources extraction and exclusion rights* have allowed for resources conservation. In order to guarantee the rights and rules compliance, the commoners monitor that there is no inappropriate use of the resources of the system and establish sanctions when required (*monitoring and sanctioning processes*). The inhabitants have been responsible for these activities centuries for centuries. Regarding the *livelihoods* variable, it represents one of the community’s most important current concerns. Nowadays, commoners and settlers are worried about how to satisfy their basic needs because the current SES performance is not providing for them. The *economic activities* variable is one of particular importance as it can be

taken as a measure of the SES functioning. The *history of use* is a variable of high importance for the community because it represents the foundation of the whole system. Customary practices and collective memory have been shown to be crucial elements for the SES performance for centuries now. As for the *government organisations* variable, it must be said it is the most relevant variable for this case study. PSA indicates that this variable is the most influential and dependant on the system.

In sum, the morphological space of the system under study can be constructed using seven internal variables, which explain the most relevant relations that determine how the SES runs. So, the scenarios based on this set (7 variables) will be reliable.

## 5 Morphological Analysis

### 5.1 Morphological space construction

Once the seven internal and the six external variables or drivers had been selected, a set of combinations was built in order to identify specific effects of the external factors on the internal ones. As a result of these combinations a matrix named 'Morphological space' was elaborated. In it, each driver took two states (6 drivers times 2 states means 12 external forces) that are affecting the SES functioning. So, the total entries in the matrix include 84 possible conditions, which would describe plausible scenarios. The COMET-LA team firstly approached this space fulfilling each matrix entrance based on previous knowledge acquired through MICMAC exercise and deliverables 3.1 and 3.2. The stakeholders suggested some amendments. Table 2 shows the final version of the matrix, which integrates such suggestions.

Table 2 Morphological space

	Drivers of change					
	Social		Technological		Environmental	
	Tightening/loosening migration controls in the US (external issues)		Technological change in timber harvesting machinery		Climate Change	
	State 1	State 2	State 1	State 2	State 1	State 2
		Recipient countries tighten migration controls and allow fewer entries per year than at present.	Migration controls in recipient countries are relaxed and allow for more entries per year than nowadays.	Improvements in timber harvesting technology reduce production costs.	Timber-harvesting technology remains constant and production costs remain constant as well.	Temperatures will increase only slightly and rainfall patterns will remain constant.
<b>Collective-choice rules</b>	Rules transformation (more population in the community)	Rules would remain constant or they would be indirectly affected due to the lack of people willing to participate in the "cargos" system	Rule transformation to ensure an equitable profit distribution	Rules remain constant or, if higher costs, there will be a stronger pressure on decision making	Rules would remain constant	Rules adaptation to new context
<b>Natural resources extraction and exclusion rights</b>	Extraction level would increase in order to meet needs	Extraction level would drop	There would be an incentive to increase the extraction level and to exclude outsiders	Extraction level would decrease	Extraction and exclusion rights would remain constant	Extraction levels would be lower and exclusion rights would not be affected
<b>Monitoring and sanctioning processes</b>	Monitoring and sanctioning processes would remain constant	There would be fewer people for monitoring activities	There would be an incentive to increase the monitoring and sanctioning activities	Monitoring and sanctioning processes would remain constant	Monitoring and sanctioning processes would remain constant	Stronger pressure to monitor and sanction the use of resources
<b>Livelihoods</b>	There would be a transformation of livelihoods	Livelihoods would remain constant or negatively affected by the decrease in population	There would be an improvement in livelihoods	Livelihoods would remain constant or get worse	Livelihoods might improve	Livelihoods would suffer in quality and/or would decrease
<b>Economic activities (forestry and agriculture)</b>	Economic activities would intensify and diversify	Economic activities would drop	A meaningful boost to the economic activities and their profitability might become possible	Profitability remains the same or reduces slightly	Opportunities to exploit a larger proportion of the forest appear	Productive processes would be transformed
<b>History of use<sup>10</sup></b>	History of use would modify due to do the stronger pressure over the forest resource	History of use would modify in favour of the forest	Resources are used more effectively	The forest is underexploited	History of use would slightly change	Historical patterns of resources use would transform considerably
<b>Government Organisations</b>	The governance system becomes unstable	Fewer people available to take over executive positions	Government organizations would remain constant	Government organizations would remain constant	Government organizations would remain constant or experience slight changes, in which mitigation and adaptation strategies would take place	Government organizations would remain constant

<sup>10</sup> The impacts on this variable were considered modifications of the resource extraction patterns, which are part of the resource extraction path. Otherwise, drivers will not affect an historic variable.

	Drivers of change					
	Political		Political		Economic	
	Change in the national legislation on the property right systems		Political stability		Changes in global market prices for timber products	
	State 1	State 2	State 1	State 2	State 1	State 2
		The current situation remains the same: the community keeps the natural resources extraction and exclusion rights..	Communities will lose territorial and resource management rights.	Political stability. National and local policies are aligned	Political instability. National and local policies are not aligned	Timber prices increase
<b>Collective-choice rules</b>	Rules would remain constant	Collective-choice rules will disappear	Rules would remain constant	Collective-choice rules would disappear	Rules would remain constant	Rules would remain constant
<b>Natural resources extraction and exclusion rights</b>	Extraction and exclusion rights remain constant	Extraction and exclusion rights are under the control of private actors	Extraction and exclusion rights remain constant	Extraction and exclusion rights are controlled by external and violent groups rather than by the community	Extraction rates would increase and outsiders are excluded	Extraction and exclusion drop, at least in relation with the forest resource.
<b>Monitoring and sanctioning processes</b>	Monitoring and sanctioning processes remain constant	Monitoring and sanctioning activities disappear or another agent takes over them	Monitoring and sanctioning processes remain constant	Community would lose monitoring and sanctioning capacity	Monitoring and sanctioning activities become more difficult	Fewer monitoring and sanctioning activities are needed
<b>Livelihoods</b>	There would be the opportunity to improve livelihoods	Individuals would have to search for their own livelihoods	The livelihoods situation will remain constant	Partial abandonment of livelihoods	There would be an improvement in livelihoods	Pressure on resource would increase
<b>Economic activities (forestry and agriculture)</b>	Opportunity to diversify the economic activities arise	A radical transformation in economic activities takes place. These transformations depend on private or individual actors	Increasing opportunities to diversify and intensify economic activities arise	Economic activities would have to experience a transformation such as worse income distribution among users	Economic activities diversification would be lower with everything else held constant, but it would represent an improvement	Community would have to search for new activities to satisfy economic needs
<b>History of use</b>	History of use would have no meaningful changes	Patterns of use would change to an opposite pole	There would be slight and meaningless changes in the resource's use patterns	There would be a meaningful changes in the resource's use patterns	There would be a transformation in the resource's use patterns due to the bigger pressure on it. The community should increase its harvesting level or maintain it.	There would be a lower pressure on the resource
<b>Government Organisations</b>	Local/communal government organisations remain constant	Local/Communal Government organisations disappear or limit their duties to surveillance of the private actors that would own the territory.	Local/Communal Government organizations remain constant	Other types of government are implemented in the territory	Governance system should implement better management practices	Government organizations may weaken

*Source: Own elaboration based on internal Stakeholders' workshops*

In March 2014, during the visit to Santiago Comaltepec (see Figure 1), the community representatives and members of the local authorities participated in the discussion and adjustment of the morphological space. Most participants accepted and validated the relations identified between external drivers and internal variables; however, they raised

some issues regarding property rights reforms, migration issues and climate change. It was obviously necessary to add and clarify these proposals to the model. The following notes summarize what the community expressed on such matters:

- Regarding property rights reforms, specifically on Article 27<sup>11</sup> of the Mexican Constitution, stakeholders pointed out that this would be a threat if it implies losing resources management rights or if common property rights disappear, and that is not the only factor that can modify property or territorial management rights. Even if the reform of the Article 27 is not carried out, other phenomena could change SES performance. For instance, if the General Assembly accepts external funds and associates with external firms in order to develop any kind of project, this would represent a real threat over property or resource management rights. In other words, it could represent the first step towards privatization and the concomitant loss of territorial management rights.
- Internal stakeholders modified the morphological space when migrations issues were discussed. The participants suggested that if the migration rates diminish, there would be differential effects on how the SES runs. One of them would imply that more people would stay in the community demanding resources; thus increasing the pressure over the resource. Likewise, the demand for energy, services, infrastructure, housing and food would rise. Community members do not desire decrements on migration rates; they just want to maintain and improve communication links between people living inside and outside the territory in order to involve external people in community issues.
- Finally, about the climate change, it was acknowledged that the SES's current situation is characterized by the increase in temperatures and by the modification in the rainfall patterns, which has had consequences in terms of production and sanitation. One big challenge regarding these factors is then the constant forest fire risk. Furthermore, this risk grows higher as emigration rises: the lack of people in the community can significantly affect the SES's capacity to face forest fires or any other extreme climate event.

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<sup>11</sup> **Article 27.** Ownership of the lands and waters within the boundaries of the national territory resides originally in the Nation, which has had, and has, the right to transmit title thereof to private persons, thereby constituting private property. Private property shall not be expropriated except for reasons of public use and subject to payment of indemnity.

Figure 1 Morphological space internal stakeholder's workshop (feedback)



*Source: Own elaboration based on internal stakeholders' workshops*

As a part of methodological learning, the COMET-LA team noticed that it was difficult to carry out workshops during community's workdays. Likewise, internal stakeholders are not acquainted with the notion of discussing the future. Most people in the community deal with issues on a day-to-day basis, and are hardly concerned about long-term ones. One of the possible explanations of this behaviour is that the people are so worried about solving present problems and are so attached to traditions, that the notion of change or the idea of a changing future seems alien to them.

## 6 Down-scaled Narratives of the Future

### 6.1 Morphological space navigation

In the scenarios-building process, the following step is to "navigate" the morphological space using a specific approach about how the future is going to be. This "image" of the future, which is actually a broad outline of the scenario, is also known as an archetype, and contains the more representative feature of the system in that specific "world view". So, in order to create a coherent scenario, it is necessary to have a clear idea of which of the two possible states the external variables or drivers would take, subject to each archetype (Hunt, *et al.* 2012).

The combination of all those possible states creates multiple potential futures (e.g. a future in which there will be fewer tourists, increased migration and very few fish; or a future with very few tourists, decreased migration and very few fish). The aim of this step is to select combinations of these variable states, to use them as the basis for future scenarios. However, this is potentially a very challenging task. The combinations are multiple and potentially very numerous. Furthermore, not all combinations are plausible.

The archetypes are used as guidelines to create scenarios. A literature on scenario archetypes asserts that when considering the future for any local case, there are six 'archetypes' (broad outlines of scenarios) that can be relevant in any situation. These six archetypes are listed below; they are part of three contrasting "world views" (in parenthesis)<sup>12</sup>:

- Market forces (conventional world)
- Policy reform (conventional world)
- New sustainability paradigm (great transition)
- Eco-communalism (great transition)
- Fortress-world (barbarization)
- Breakdown (barbarization)

Each archetype implies certain states for drivers. With a selected state for each driver, it is possible to identify the impacts of drivers on the internal variables and start thinking of a narrative to create a scenario. However, the archetypes cannot be intrinsically catalogued as "good" or "bad". In fact, archetypes raise very complex situations in which external variables can have diverse and contradictory effects on internal variables. Thus, the morphological space navigation becomes a non-linear process in which many and substantially different relations are posed. Graphically, these complex relations take shape as arrows not only going from the top to the bottom (on the morphological space) but also as horizontal ones, which shows more complex relations. To clarify the previous idea, the following description about how the "resources re-allocation" scenario (corresponding to the Market forces archetype) was done could be helpful.

Firstly, it would be useful to clarify what the archetype suggests regarding the state of the SES. In the Market forces archetype case, it could be said that fundamental features of the SES situation are characterised by: *"the market optimism remains dominant and proves well-founded; the market driven globalization, trade liberalization, institutional modernization and deregulation drives grow"*. That is an example of how this driver can be interpreted. As has been mentioned, these elements must be used as guides to imagine how each driver is going to impact the system. In other words, these elements should suggest a specific state of drivers. Nevertheless, archetypes are generalisations that should be interpreted in the light of the specific case study where they are applied. In Santiago Comaltepec, not all drivers were

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<sup>12</sup> For more details about SBP, refer to Deliverable D1.3 available on: <http://www.comet-la.eu/index.php/en/publications.html>

thought to have strong effects on all the internal variables because of the necessity to create a summarised version of the system and a coherent narrative. It means that when the research team created narratives, the drivers were considered taking into account previous knowledge about the SES performance coming from the SES characterisation and PSA.

Broadly, morphological space navigation requires 1) the correct identification of each drivers' state, 2) a selection of the most important internal variables impacted by each driver's state and 3) an election of the most probable effect of the driver on internal variables (in case of contradictory effects of drivers' states) according to the archetype. For instance, in the Market forces archetype, the social driver *Migration controls* and the technological driver *change in machinery* showed contradictory effects on internal variables (in the same internal variable). Obviously, the effects on, for example, the *Natural resources extraction and exclusion rights* (internal variable) were contradictory: while the social driver suggested the extraction rates would reduce, the technological driver raised an incentive to increase the extraction rates. So, in order to create a coherent narrative under the Market forces archetype, the technological driver's state was chosen as the most influential effect and, then, it was thought that extraction would increase, as a feature of the SES in this narrative. This mechanism was applied to create the five narratives presented in section 6.2 of this document. Here, the "resources re-allocation" matrix is shown for illustrative purposes. The morphological space below contains a graphic description of the relations for the SES under this scenario (see Table 3). Morphological space navigation implies the creation of a narrative that can illustrate a specific world-view (using archetypes) supported by effects of external drivers on internal variables.



Table 3 Morphological space navigation

	Drivers of change											
	Social		Technological		Environmental		Political		Political		Economic	
	Tightening/loosening migration controls in the US (external issues)	Technological change in timber harvesting machinery	Climate Change		Change in the national legislation on the property right systems		Political stability		Changes in global market prices for timber products			
State 1	State 2	State 1	State 2	State 1	State 2	State 1	State 2	State 1	State 2	State 1	State 2	
Descriptions	Recipient countries tighten migration controls and allow fewer entries per year than at present.	Improvements in timber harvesting technology reduce production costs.	Temperatures will increase only slightly and rainfall patterns will remain constant.	Temperatures will increase 2° C and rainfall will decrease very significantly.	The current situation remains the same: the community keeps the natural resources extraction and exclusion rights.	Communities will lose territorial and resource management rights.	Political stability. National and local policies are aligned.	Political stability. National and local policies are not aligned.	Timber prices increase	Timber prices decrease		
Collective-choice rules	Rules transformation (more population in the community)	Rule transformation to ensure an equitable profit distribution	Rules remain constant or, if higher costs, there will be a stronger pressure on decision making	Rules would remain constant	Rules adaptation to new context	Rules would remain constant	Collective-choice rules will disappear	States would remain constant	Collective-choice rules would disappear	Rules would remain constant	Rules would remain constant	
Natural resources extraction and exclusion rights	Extraction level would increase in order to meet needs	Extraction level would drop	There would be an incentive to increase the extraction level and to exclude outsiders	Extraction level would decrease	Extraction and exclusion rights would remain constant	Extraction and exclusion rights would not be affected	Extraction and exclusion rights remain constant	Extraction and exclusion rights are under the control of private	Extraction and exclusion rights remain constant	Extraction rates would increase and outsiders are excluded	Extraction and exclusion rates would drop, at least in relation with the forest resource.	
Monitoring and sanctioning processes	Monitoring and sanctioning processes would remain constant	There would be fewer people for monitoring activities	There would be an incentive to increase the monitoring and sanctioning activities	Monitoring and sanctioning processes would remain constant	Monitoring and sanctioning processes would remain constant	Stronger pressure to monitor and sanction the use of resources	Monitoring and sanctioning processes remain constant	Monitoring and sanctioning activities disappear or another agent takes over them	Monitoring and sanctioning processes remain constant	Community would lose monitoring and sanctioning capacity	Monitoring and sanctioning activities become more difficult	Fewer monitoring and sanctioning activities are needed
Livelihoods	There would be a transformation of livelihoods	Livelihoods would remain constant or negatively affected by the decrease in resources	There would be an improvement in livelihoods	Livelihoods would remain constant or get worse	Livelihoods might improve	Livelihoods would suffer in quality and/or would decrease	There would be the opportunity to improve livelihoods	Individuals would have to search for their own livelihoods	The livelihoods situation will remain constant	Partial abandonment of livelihoods	There would be an improvement in livelihoods	Pressure on resource would increase
Economic activity	Economic activities would increase and diversify	Economic activities would drop	A meaningful boost to the economic activities and their profitability might become possible	Profitability remains the same or reduces slightly	Opportunities to exploit a larger proportion of the forest appear	Productive processes would be transformed	Opportunities to diversify the economic activities arise	A radical transformation in economic activities takes place. These transformations depend on private or public access	Increasing opportunities to diversify and in already economic activities arise	Economic activities would have to experience a transformation such as worse income distribution	Economic activities diversification would be lower with everything else held constant, but it would represent an improvement	Community would have to search for new activities to satisfy economic needs
History of use	History of use would modify due to the stronger pressure over the forest resource	History of use would modify in favour of the forest	Resources are used more effectively	The forest is underexploited	History of use would slightly change	Historical patterns of resources use would transform considerably	History of use would have no meaningful changes	Patterns of use would change to an opposite pole	There would be slight and meaningless changes in the resource's use patterns	There would be a transformation in the resource's use patterns	The community should increase its harvesting level or maintain it	There would be a lower pressure on the resource
Government Organisations	The governance system becomes unstable	Fewer people available to take over executive positions	Government organisations would remain constant	Government organisations would remain constant	Government organisations would remain constant or experience slight changes, in which mitigation and adaptation strategies would be chosen.	Government organisations would remain constant	Local/communal government organisations remain constant	Local/Communal Government organisations disappear or limit their duties to surveillance of the private actors that would own the territory.	Local/Communal Government organisations remain constant	Other types of government are implemented in the territory	Governance system should implement better management practices	Government organisations may weaken

Source: Own elaboration

## 6.2 Narratives elaboration

As a result of the first step of stage 2, in which the COMET-LA Mexican team “navigated” through the morphological space elaborated in the previous stage, five narratives were constructed based on archetypes suggested by Hutton’s methodology. First, regarding the market forces archetype, a *resources reallocation scenario* was envisaged in order to indicate how the private interests strengthening and the adoption of market rules would impact not only the relations in the system, but also the property of the resources. Next, with respect to policy reforms, the *predominant policy scenario* was described as a possible world characterized by the existence of a strong federal government and the predominance of federal government rules and policies over the local ones. As a result of team discussions, an extra scenario was included in the analysis (*social entrepreneurship scenario*), in which a more optimistic future was visualized considering present conditions prevailing in the community; in this scenario, social, environmental, economic and institutional sustainability is an achievement with the communal enterprise playing the role of a structuring institution. A fourth scenario, the *sustainable SES*, was introduced; in it, market allocations were considered efficient and optimal not only in economic terms, but also in social and environmental

terms<sup>13</sup>. The last of the scenarios proposed consists of a *chaotic world* based on the chaos archetype, which is considered the worst possible future due to the violence, disorder, and disaster characterizing it. It is important to highlight that the scenarios were clearly differentiated from each other during the workshop development. The set of scenarios is described below.

### 6.2.1 *Market forces archetype*

#### **Scenario: Resources re-allocation (Private interests predominance)**

Individual economic interests might lead to new resource uses, including changes in technological and extraction patterns. Once private agents take control over the forest resource, some changes appear such as a new technological structure leading to high extraction rates. Obviously, the costs of extraction are lower than today's. This transformation could result in overexploitation. Moreover, some internal stakeholders can be excluded. Due to resources privatization and to the exclusion of the community from their use, the community's livelihoods and social cohesion are negatively affected and migration increase. As a consequence of such changes, there is an institutional metamorphosis subject to individual or cartel economic purposes. Likewise, migration trends result in a reduction of the number of people available to carry out "cargos"<sup>14</sup>. Thus, the governance system, and collective-choice rules and actions are weakening. Another outcome is that private actors establish new extraction and exclusion rights. Then, collective decisions are not taken into account anymore. Local government organisations take a secondary role supervising individual's behaviour in order to set some rules. This lack of links between resource management and the community cause negative impacts on monitoring and sanctioning activities. There is a high level of vulnerability with respect to external actors (*see Figure 2*).

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<sup>13</sup> The main difference with respect to the *social entrepreneurship scenario* is that in the *sustainable SES scenario*, the social enterprise is not playing a central role. Rather, the market is considered an optimal mechanism for the economic, social and environmental performance of the system. This trait also explains the difference between the *resources reallocation scenario* and the *sustainable SES scenario*.

<sup>14</sup> The "cargos" system consists of a non-paid governance scheme, responsible for the management of the forest resources and concerning issues.

Figure 2 Scenario: Resources re-allocation (Private interests predominance)



Source: Own elaboration based on narratives

### 6.2.2 Policy reforms archetype

#### Scenario: Predominant policy (Federal government’s strong policy)

The second scenario involves economic, social, institutional and environmental local challenges such as the low economic growth (due to low prices of timber), the sky-high levels of migration, the local government weakness and the change in patterns of timber extraction. To face these trials, the political influence of the national government is required; otherwise, the community is not able to overcome them. Then, in this scenario, the local policies for resources management have to be aligned with national policies. This means that local authorities lose control over their territory and resources in case that they decide not to adopt the federal government’s measures and policies implemented to cope with the situation. However, national policies try to promote not only economic and social, but also environmental sustainability. Thus, efficient and environmentally friendly technology has to be used for extraction purposes. This leads to economic performance improvements. At the same time, national environmental policies take care of problems such as: the mitigation of climate change effects and improvements in community’s livelihoods. As a consequence of these measures, the community attract more people to live there, which reverts current migration trends. So, if there are more persons living in Comaltepec and if the national policies promote sustainability, extraction rates increase but sustainability is maintained. In

order to achieve this contrasting situation, local rules have to be aligned with national policies and both parts have to be harmonized. If this situation is reached, local authorities could strengthen their influence over the territory. So, the only way to exclude undesirable outsiders (drug cartels or private firms) is to forge alliances with the national government (*see Figure 3*).

Figure 3 Scenario: Predominant policy (Federal government's strong policy)



### 6.2.3 Innovation and entrepreneurship archetype

#### Scenario: Social entrepreneurship (Social enterprise innovation)

A social innovative entrepreneurship, in an optimistic context, leads to social, institutional, economic and environmental sustainability. It means that a social enterprise created by the community emerges (it might be the General Assembly of commoners) based on communal property. This firm incorporates more efficient green technology that significantly reduces extraction costs. The pressure over the natural resources is higher than it is today, but sustainability is not at risk. Overexploitation is not a possibility in this scenario. As a consequence of a production process using more efficient technology, higher value -added products are traded on regional, national or international markets, which results in a better income distribution for community and individuals. The philosophy of this new firm is based on the concept of an inclusive sustainable development, in which individuals obtain benefits from the forest exploitation. Thus, higher income levels, better income distribution, improvements in livelihoods and sustainability are essential to this scenario. At the same time, the community is able to stop migration trends due to its improved economic performance. As has been pointed out, the “cargos” system represents unpaid activities, but this scenario allows for the implementation of a payment scheme. However, this has to be

supported by improvements in collective-choice rules in order to obtain benefits both for the community as a whole and for its individual members. Resource extraction patterns become more efficient (see Figure 4).

Figure 4 Scenario: Social entrepreneurship (Social firm innovation)



Source: Own elaboration based on narratives

## 6.2.4 New sustainable paradigm archetype

### Scenario: Sustainable SES (Optimal market allocations)

A sustainable SES, in which the economic, social and environmental conditions are preserved for future generations, requires the transformation of collective-choice rules. For this purpose, efficient markets allocations play a central role. The market brings about individual benefits such as health and education access. As for exclusion and extraction rights, they remain constant because the present resources extraction patterns are sustainable. Extraction rates increase in order to obtain more individual benefits but without negative effects on social cohesion. In this sense, social cohesion promotes monitoring and sanctioning processes as well as lobbying activities. Likewise, economic performance is based on a more efficient resource management and responsible consumption patterns leading to improvements in livelihoods. These conditions allow economic activities to diversify and specialise in higher value-added merchandises.

All these changes imply that the SES sustainability is based on social cohesion, cooperation, communal philosophy, social participation in the “cargos” system on the one hand, and on a market-based allocation mechanism on the other. One of the most important features of this scenario is that it brings along a solution for individuals’ current economic dissatisfaction.

Community members are worried about their personal benefits because communality is not providing them with enough individual wealth (see Figure 5).

Figure 5 Scenario: Sustainable SES (Optimal market allocations)



Source: Own elaboration based on narratives

## 6.2.5 Chaos archetype

### Scenario: Chaotic world

In this scenario, the control of local authorities over the forest resources is lost. Instead, drug cartels or a strong private actor takes over them and excludes the community from the benefits of the extraction process. This scenario is characterised by violence, disaster and disorder. Local economic, social, institutional and environmental performance of the community suffer irreversible modifications. Local inhabitants, due to the practically nil economic growth, cannot stop migration trends. Likewise, climate change derives in unsustainable resources management in the long term. Another consequence is the lack of population to take part in the “cargos” system. Thus, the local government organisations disappear. Moreover, private agents are not excluded from the territory and extract as much as they can. The existence of the forest is under threat. It disappears in the short term. In 20 years, the community loses its forest, collective-choice rules, livelihoods and collective decision processes. Also, private agents gain extraction and exclusion rights and all the economic activities suffer a metamorphosis. Human settlements change due to the exacerbation of migration (see Figure 6).

Figure 6 Scenario: Chaotic world



Source: Own elaboration based on narratives

### 6.3 Confirmed/adjusted final narratives

A workshop was held on May 4<sup>th</sup> to validate narratives and get feedback from the community members. In this exercise, internal stakeholders were involved. It allowed us to identify stakeholders' preferences about scenarios that they really wanted to discuss in order to face future environmental challenges. Although all the scenarios were presented in the same way and devoting the same time to explain each one of them, the participants in the workshops preferred the scenario called *sustainable SES* for discussion purposes. This does not mean that the other scenarios were not considered important; it only means that in terms of priority, the stakeholders considered more urgent to focus on a future where their community exists, is sustainable, and is under the control of its members. However, the rest of the scenarios contain important elements that have to be considered in future debates.

One of the most relevant particular conclusions was that *collective-choice rules* have permanently been at risk. Sometimes the risk comes from outside the community. National government subsidies, such as those offered by the government through the programs "Oportunidades", "65 y más", and "PROCAMPO" are important for families' income.<sup>15</sup> Likewise, migrants living outside the community represent an important income source. Both national programs and remittances might exert pressure over the collective-choice rules process. Due to these subsidies and other factors, Comaltepec's inhabitants have modified their preferences, turning more individualistic and "refusing" communal ideas. The inability of

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<sup>15</sup>*Oportunidades*, *65 y más* and *PROCAMPO* are national programs aimed to compensate the families' income. They are focused on poor families, the elderly and rural producers, respectively, and they consist of a monetary subsidy that attempts to compensate the low consumption of people. *PROCAMPO* deserves special attention: the monetary subsidy given to the rural producers is not necessarily invested in the production, which means that rural production is not always encouraged under this kind of programs.

the system to produce individual benefits has favoured these changes. So, community-based management and sustainability are at risk.

As a result of the May 4<sup>th</sup> workshop, all participants agreed that each scenario contains at least one relevant element that deserves to be discussed in future meetings. In other words, there was not a unique “future”. However, the one that they would like to analyse should integrate factors coming from different scenarios. For instance, elements such as individualistic behaviour (from the *resource re-allocation scenario*) or an external government (from the *dominant policy scenario*) are already essential for the SES functioning. Thus, any scenario, as has been exposed, is considered plausible. Although internal stakeholders suggested some adjustments, they validated the narratives proposed as guidelines recommended by JHI’s methodology.

The main purpose of the external stakeholders’ workshop (May, 30<sup>th</sup>) was to discuss and validate narratives and responses suggested by internal stakeholders. The two points of view should reinforce the analysis. In addition, external stakeholders’ responses will provide a general idea about future policies that could be implemented taking into account that participants represent the most important institutions influencing the SES performance<sup>16</sup>.

## 7 Robust Response Options

Since future response options can include existing actions or conditions, we considered useful to summarise the characteristics of the present governance system (according to the research done in the first two years of the project), in order to expose them at the meeting we would hold with stakeholders. At this stage, the purpose was simply to search for useful ideas concerning ‘response options’ that could be put into effect to meet future goals.

According to the common framework guidelines suggested by JHI, at this stage, a set of response options was identified for each scenario previously constructed. So, in the first part of this section, we present the revision made by the Mexican COMET-LA team of the actions, plans and strategies that the community has already implemented or is implementing at present. In the second part, the outcomes of May 30<sup>th</sup> external and internal stakeholders’ workshops are presented (including response options of two groups). In the third section, the identification and the assessment of the robustness of the response options are discussed in the light of the results of the workshops. Finally, a “shock” that could be a threat for the SES in the future is dealt with.

### 7.1 Local governance system and existing actions

Regarding the detailed description of Santiago Comaltepec’s governance system, deliverables D3.1 and D3.2 should be consulted. Here, we will only remind the reader that, in general terms, the local governance system can be described as a system based on customary

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<sup>16</sup>The internal Stakeholders have been included into the discussions. But, from here to the end of the process, external Stakeholders were also involved.



practices. This system is a characteristic of most indigenous communities in Mexico. Comaltepec's Governance System is characterized by having a direct participatory system. Everybody can be directly involved in the decision-making process concerning the community affairs. Two instances have been devised to exercise such democratic model: commoners' and citizens' general assemblies. The General Assembly of Commoners sets the rules for access to and use of natural resources. Likewise, the community's members have formulated written plans and strategies for the future such as the Municipal Development Plan 2010 and the Forest Management Plan 2004 (the latter is going to be re-elaborated in 2014). According to these documents, existing actions can be grouped into the following categories:

- Environmental issues:
  - Control and education processes related to garbage management
  - Reforestation
  - Waste water and drainage system construction
  - Water conservation and forest programme
- Social issues:
  - Improvements in the basic education system
  - Improvements in the health system
  - Improvements in education infrastructure
  - Improvements in electricity infrastructure
  - Improvements in the drinking water distribution system
- Human/cultural issues:
  - Preservation of customary practices
  - Promotion of traditions
  - Cultural activities
  - Training and advice for inhabitants
- Economic issues:
  - Productive infrastructure, investments and productivity increase
  - Promotion of agro-forestry activities
  - Investments in small firms and creation of more local jobs
- Institutional issues:
  - A programme for the dissemination of duties, rights and customary practices Plans, programmes and projects' surveillance
  - Accountability
  - Promotion of some external programmes and subsidies

As can be seen, this set of actions does not include a long-term vision of the community about its future; furthermore, the actions considered are much too general (only the forest management plan considers a long-run vision). Therefore, further workshops should be carried out to get the community to introduce a long-term-vision component in its plans, strategies and actions, considering the present context as a benchmark for future integral plans.

A workshop with external stakeholders would provide us with ideas concerning some actions that they would take or implement through their institutions. In contrast, internal stakeholders would express their views based on the local context. If these visions are put together, then, better option responses can be visualized, elaborated on and coordinated.

### 7.2 Possible response options identification

Following Hutton's methodological guidelines, two workshops were organized. The first one was carried out on May 30<sup>th</sup> with external stakeholders at ERA facilities, located in Oaxaca City. The internal stakeholders' workshop was conducted in Santiago Comaltepec at the General Assembly's hall on May, 31<sup>st</sup>.

Both workshops were conducted following the same procedure. Coincidences and discrepancies emerged when each type of participant suggested possible response options for each scenario. Because not all the participants in the workshops had taken part in the previous phases, the COMET-LA team explained stages 1 and 2. Then, stage 3 could take off. The first step in stage 3 was a brief presentation of community's current actions and of the five scenarios constructed previously. Once participants understood each scenario, five posters describing all scenarios were displayed on walls around the room. The next step was a discussion about the best possible responses for the five scenarios: (1) *market forces–resource reallocation*, (2) *predominant policy*, (3) *social entrepreneurship*, (4) *sustainable SES*, and (5) *chaotic world*. As said before, this discussion took place twice, depending on which institution the participants were representing (external workshop) or which community's group they belong to (internal workshop). Two lists of possible response options for each scenario were compiled—one list from external stakeholders and the other one from internal stakeholders.

### 7.3 External stakeholders response options identification

In the case of external stakeholders representing the UNSIJ, SAO, CONAFOR and UZACHI suggested some responses taking into account the capacities their institutions have. Since these stakeholders represent institutions, some of their suggestions can be seen as possible future programs, projects, actions, processes and policies that could be really implemented. In this meeting, there was an interesting interaction between external and local authorities. It sounded as if through these interactions they could strengthen relations and manage resources and plans more effectively. For instance, representatives from UNSIJ offered *technical training and advice* in order to contribute to the human capital formation process in Santiago Comaltepec. Thus, external stakeholders agreed and validated the following list of possible response options (see Table 4 and Figure 7):

Table 4 Possible response options identified by external stakeholders

Institution	Scenario 1: resources re- allocation (private interests predominance)	Scenario 2: predominant policy (federal government's strong policy)	Scenario 3:social entrepreneurship (social enterprise innovation)	Scenario 4: sustainable SES (optimal market allocations)	Scenario 5: chaotic world (chaos)
<b>SAO</b>	*Collective investment projects. * Finding investment sources	*Adopting (or implementing) federal government policies  * Adapting to market processes	*Revision of governance system *Strengthening some management processes *Improving accountability	*Strengthening the relation between research institutions and community * Developing research projects	*Promotion and conservation culture *Education
<b>UZACHI</b>	*A clear development plan *Individual and family projects/concessions	*Forest culture *Institutional agreements *Communal statute revision	*Collectivism *Adopting entrepreneur philosophy *The "Comisariado" cannot be responsible for the performance of enterprises anymore *People really committed to performance of enterprises	*Land use plan *Individual and family projects/concessions.	*Strengthening* Strengthening communal organization *Reforestation process *Forest culture *Children's education
<b>UNSIJ</b>	*Projects surveillance *Users inclusion *Training and advice *More interaction with the community	*More interaction with the community *Training and advice	*More interaction with the community *Training and advice *UNSIJ's students involved in the community's activities *Human capital formation *Infrastructure projects	*More interaction with the community *Technical support *Strengthening local institutions	*Migration trends analysis *More interaction with the community
<b>CONAFOR</b>	*Individual and family projects/concessions	*Training and advice *Current plans and statutes revision *Development of local policies according to local development	*Human capital formation * Improving accountability *Payments for "cargos" system * Better management schemes	*Human capital formation *Monitoring processes *Better income distribution	*Promoting e social cohesion *Holding social system *Promoting gender equity *Improving education *Restoring local governance system

*Source: Own elaboration based on external stakeholders' workshop*

Figure 7 External stakeholders' workshop



Source: Own elaboration based on external stakeholders' workshop

As a result of this workshop, important issues were raised. Most of the external stakeholders think that the community has to create individual/family opportunities in order to preserve the SES sustainability and social cohesion. UNSIJ explicitly offered technical support and human capital formation opportunities.

One of the most important outcomes from the COMET-LA project's perspective was the greater interaction between local authorities and external stakeholders as institutions' representatives referred to existing programmes and offered feasible solutions for current and future challenges.

#### 7.4 External stakeholders response options identification

To obtain the internal stakeholders' views on the possible responses to each of the scenarios contemplated, the procedure followed was the same as the one used with external stakeholders. First, the COMET-LA team introduced a brief description of the governance system. Then, the five scenarios were shown and participants suggested response options in order to face each one. At the end of this workshop, the participants agreed with the following response options (see Table 5 and Figure 8)<sup>17</sup>.

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<sup>17</sup> All these response options were suggested as an agreement between internal workshop participants.

**Table 5 Possible response options identified by internal stakeholders**

<b>Scenario 1: resources re-allocation (private interests predominance)</b>	<b>Scenario 2: predominant policy (federal government's strong policy)</b>	<b>Scenario 3: social entrepreneurship (social firm innovation)</b>	<b>Scenario 4: sustainable SES (optimal market allocations)</b>	<b>Scenario 5: chaotic world (chaos)</b>
<b>Knowledge about collective history of the community ("working together")</b>	Inclusive agreements between community and federal government	New investments	Creating a financing institution offering family or individual credits	Territory defense
<b>Collective education philosophy</b>	Territory defense	Better income distribution	Better income distribution	Training and advice provided by research institutions
<b>Territory defense</b>	Social conflict	Creating a financing institution based on communal income	Distributing income among users	Promoting territorial roots
<b>Forest management plan revision</b>	Diversifying economic activities	Revising forest management plan	Infrastructure development plan	Reforestation program
<b>Looking for extra funds</b>	Modernizing customary practices modernization	Strengthening institutional links	New investments	History
<b>Human capital formation</b>	Funding new agricultural production forms	Closer monitoring of firms' performance	Revising forest management plan	
<b>Diversifying economic activities</b>		Promoting ecotourism	Strengthening institutional links	
<b>Modernizing customary practices</b>		Forming human capital	Promoting ecotourism	
<b>Funding new agricultural production forms</b>		Diversifying economic activities	Forming human capital	
		Modernizing customary practices	Diversifying economic activities	
		Funding new agricultural production forms	Modernizing customary practices	
			Funding new agricultural production forms	

*Source: Own elaboration based on internal stakeholders' workshop*

Figure 8 Internal stakeholders' workshop



Source: Own elaboration based on internal stakeholders' workshop

As in the case of the external stakeholders' workshop, participants in this meeting agreed that collectivism has to be promoted through the basic education system. Likewise, a human capital formation process has to be implemented in the community in order to face future challenges. Also, internal stakeholders suggested that individual or/and family concessions have to be carried out such as agricultural projects funded through a local financial institution that could be supported by communal income.

In the next step of this methodology, the aim is to identify the robustness of responses. So, a comparison between the information obtained in internal and external stakeholders' workshops will be carried out. When both internal and external stakeholders' proposals coincided and were mentioned in all the scenarios contemplated, according to Hutton's methodology, such choices were considered robust.

### 7.5 Response options robustness







































































Once a set of responses had been proposed by each group of stakeholders, workshops' participants and the Mexican COMET-LA research team carried out a response robustness analysis. A robust response represents a relatively useful action to face future challenges. For analysis purposes, the set of responses identified so far were grouped in broader categories, which are presented in the following table. For instance, education was subsumed [or "packed"] the more general definition "*human capital formation*".

The large set of response options discussed in the previous section was reduced to 11 broader categories (rows in the table):


- Human capital formation
- Training and advice
- Strengthening links between community and institutions
- Creation of local financial institutions
- New sustainable investment projects based on individual and collective schemes
- Strengthening customary practices and collective memory
- Economic activities diversification and modernization
- Expanding the agricultural sector because of its key role in local economy
- Reviewing and improving development and forest management plans
- Implementing an efficient accountability method in the governance system
- Implementing a payment scheme for "cargos"


A "face" mark indicates if a group of stakeholders proposed it as a response for each scenario (columns). Table 6 shows how stakeholders distributed their responses considering all the scenarios being discussed.

Table 6 Distribution of internal and external stakeholders' responses

Responses / Scenarios	Scenario 1: resources re- allocation (private interests predominance)		Scenario 2: predominant policy (federal government's strong policy)		Scenario 3: social entrepreneurship (social firm innovation)		Scenario 4: sustainable SES (optimal market allocations)		Scenario 5: chaotic world (chaos)		
	I.S. <sup>1</sup>	E.S. <sup>2</sup>	I.S. <sup>1</sup>	E.S. <sup>2</sup>	I.S. <sup>1</sup>	E.S. <sup>2</sup>	I.S. <sup>1</sup>	E.S. <sup>2</sup>	I.S. <sup>1</sup>	E.S. <sup>2</sup>	
1. Forming human capital											
2. Training and advice by government institutions (OR by outside institutions)											
3. Strengthening the links between community and institutions											
4. Creating local financial institutions											
5. New sustainable investment projects based on individual and collective schemes											
6. Strengthening customary practices and collective memory											
7. Diversifying and modernising economic activities											
8. Expanding the agricultural sector because of its key role in local economy											
9. Reviewing and improving development and forest management plans											
10. Implementing an efficient accountability method in the governance system											
11. Implementing a "cargos" payment scheme's											

Source: Own elaboration based on internal and external stakeholders' workshops

<sup>1</sup> Internal Stakeholders ("") marks on this column shows if response was visualized as a possible measure by the Internal stakeholders)

<sup>2</sup> External Stakeholders ("") marks on this column shows if response was visualized as a possible measure by the external Stakeholders)



As can be seen from Table 6, three responses could be considered robust because they were identified by both internal and external stakeholders as possible responses in all scenarios: *Training and advice, strengthening the links between the community and institutions, and Reviewing and improving development and forest management plans*. The three of these responses were thought of as measures that should be implemented under any circumstances. However, there were also robust responses for each type of stakeholders. In the case of internal stakeholders, *Strengthening the customary practices and collective memory* was perceived as the *backbone* of the system in any situation, while *Human capital formation* occupies the most important role in the external stakeholders' vision. This result is not unexpected. If the *sustainable SES* was the most preferred scenario, *customary practices and collective memory* must be reinforced if the scenario is to be achieved and maintained. Accordingly, one robust strategy is that of fostering the formation of an important *human capital stock* in a context of *strengthening customary practices and collective memory*'.

Another possible and useful strategy would be to combine four responses: 1) *Creating local financial institutions*; 2) *New sustainable investment projects based on individual and collective schemes*; 3) *Diversifying and modernising economic activities diversification*; and 4) *Strengthening customary practices and collective memory*. This robust strategy reveals two important facts. First, there is a notion of sequence in growth patterns: in order to diversify economic activities, new investments must be done, and for these new investments to be done, a financial institution must be acting as a supplier of affordable credit. Second, there is a notion of development: development cannot be achieved without strengthening customary practices and collective memory.

To ensure that we captured the broad spectrum of response options considered, these responses were classified as follows, using Hutton's 7 P's as a guide:

- Policies, e.g. rules and regulations;
- Programs, e.g. to build infrastructure;
- Plans, e.g. resource management plans;
- Procedures, e.g. instructions for best practice in resource harvesting or use
- Processes, e.g. monitoring systems;
- Products, e.g. information, or technology; and
- People, e.g. training to build skills, capacities, or to influence attitudes and motivation.

The responses presented in Table 6 were therefore re-classified as follows:

- Policies: implementing an efficient accountability method in the governance system and implementing a payment scheme for the "cargos" system
- Programs: revising an infrastructure development program
- Plans: reviewing and improving development and forest management plans
- Procedures: strengthening the links between the community and institutions, creating local financial institutions, new sustainable investment projects

based on individual and collective schemes, and reinforcing the agricultural sector because of its key role in local economy

- Processes: territory defense
- Products: diversifying and modernizing economic activities
- People: human capital formation, training and advice, and strengthening customary practices and collective memory

### 7.6 Impacts of unexpected shocks on response options

Another major contribution made by external and internal stakeholders was an open discussion of the idea of how they would react if a shock that affects the SES were introduced. A “shock” can be defined as a very influential event that can radically disrupt an SES. In this case study, a forest fire was analysed. This shock could be originated by a natural or human-provoked disaster. In both workshops this shock was described as follows:

*“Imagine that there is a forest fire that strikes the forest cover, affecting production areas (more than 5,000 or 10,000 ha). This forest fire could be originated by a long drought season or human causes. Also, figure out how all responses you already mentioned should be modified. In such event, what would your responses be?”*

Internal stakeholders faced a forest fire two decades ago. It affected more than 2,000 ha. Such area has now been restored. But, considering that experience, workshop’ participants suggested the following responses: *improving forest infrastructure, implementing a firewall system, forming human capital able to manage forest fires, and designing a fire-fighting strategy*. However, participants agreed that responses such as *human capital formation* should be kept whether a shock appears or not.

As for external stakeholders, they offered a variety of responses. The UNSIJ proposed *ecosystem restoration processes, prospective analysis in order to estimate a restoration time horizon, designing a strategic restoration plan including specific issues, long-term monitoring processes and institutional links* (especially with UZACHI). CONAFOR pointed out that *if the community were managing its forest appropriately<sup>18</sup>, the impact of a forest fire would not be relevant*. But, management plans have to be reviewed and this institution can support the community in case they needed so. CONAFOR suggested that after this shock, *several actions should be taken, including conservation of infrastructure, reforestation, a restoration plan, human capital formation related to forest fires management, and upgrading facilities that allow for forest fire fighting*. SAO proposed that *contingency plans be implemented once forest fire takes place*. But it added that, previously, the community should prepare its population (human capital formation). At the end of the workshop, *UZACHI offered technical support, to seek for sources of funding for restoration projects and to contribute to the elaboration of management plans*.

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<sup>18</sup> This implies that an appropriate management of forests includes all kind of preventive actions.

In general, this shock would not modify robust responses, but all actions that have to be taken would respond to the contingency. Both workshops concluded that human capital formation related to forest fire management and infrastructure to prevent or fight forest fires are the most relevant responses<sup>19</sup>.

### 8 Implications of adopting Robust Response Options

In the previous stage, a description of the local governance system, a list of possible response options identified by the community and external institutions, a table linking response options with each scenario, and a description of a shock and results of that stage were presented. In this part, following the common scenario-planning methodology, a report confirming the list of robust response options or strategies, the implications of adopting these responses, a future plan and a summary of how the local governance system may be affected by these responses will be analysed.

In order to improve the analysis of the implications of the responses proposed by the participants, the research team decided to consider seven options according to criteria of robustness based on the community's interest:

1. Training and advice: the community should look for technical training and advice in order to improve resources management.
2. Strengthening the links between the community and institutions: the community should improve external relations with universities (UNSIJ, UNAM, etc.), regional NGO's, the state government, the national government, and private institutions.
3. Reviewing and improving development and forest management plans: currently, the municipal development and forest management plans are not aligned with Santiago Comaltepec inhabitants' interests at all.
4. Creating local financial institutions: these institutions should be financed with communal funds and offer affordable and timely credits to inhabitants.
5. New sustainable investment projects based on individual and collective schemes: the interaction between individual and collective projects should provide families and the community with alternative income sources.
6. Strengthening customary practices and collective memory: in the last years, these practices and collective memory have been deteriorating internally, even if they have been one of the most important factors for forest conservation.
7. A payment scheme in the "cargos" system: payments for local authorities.

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<sup>19</sup>Due to time constraint, other shocks could not be analysed. But, in general, internal and external stakeholders suggested that preventive measures have to be implemented in order to face future environmental challenges such as climate change. Other measures or response options are related to restoration and monitoring activities (plagues surveillance and environmental quality monitoring using various biological indicators).

## 8.1 Implications for future local plans according to external stakeholders

As in the previous stages, two kinds of workshops were conducted in order to identify possible implications for future plans<sup>20</sup>. The first one was held in Oaxaca City, Mexico, on Friday, June 27<sup>th</sup>. Twelve external stakeholders attended, representing the following institutions: SEMARNAT, UZACHI, UNSIJ, CONAFOR, SAO, private institutions, NGO's and the COMET-LA team (see Figure 9). Besides, the international COMET-LA team (Colombian and Argentinian partners) was involved in this workshop, too, with all partners contributing to the discussions by sharing information about their case studies. Moreover, JHI partners made several suggestions about how to conduct internal and external stakeholders' workshops. The main objective of these workshops was to identify implications of the robust responses.

Figure 9 External stakeholders' workshop



Source: Own elaboration based on external Stakeholders' workshop

The original methodology suggests that three sets of questions should be asked to each group of stakeholders. However, due to limitations of time and participants' availability, the most relevant topics were included in the discussions. So, the principal questions to be answered for each robust response, regarding community's views, are: What do we have to do? How do we have to do it? Is the option flexible? Is it reversible? What are its costs? What are its environmental effects? Once these issues were aired, community had the possibility to analyse their implications and to discuss the actions to be taken.

<sup>20</sup> The outcomes of these workshops have been chronologically presented. But, this does not mean that any of them is less or more important than the other one.

According to external stakeholders, the action *Training and advice* has to be addressed to improve current production conditions (timber products) supported by external institutions such as the UNSIJ and UNAM. This group also pointed out that the “Comisariado” must not be in charge of these tasks. Instead, the General Assembly has to appoint an administration council that would be responsible for these activities. With respect to the *Strengthening the links between the community and outside institutions response*, the external participants (SEMARNAT, UNSIJ, CONAFOR, ERA, SAO, CONANP and UNAM) agreed that they are willing to support the community’s development and future projects through specific signed agreements; thus, this response (Strengthening the links...) and the first one (Training and advice) can be said to be flexible<sup>21</sup> and reversible<sup>22</sup> because they can be modified and reversed at any time.

Regarding *Reviewing and improving development and forest management plans*, external stakeholders considered that there are some obsolete conditions in the community’s current plans that need revising and amending. There was a consensus about how this revision has to be implemented: participatory methods are pertinent if the purpose is to identify all the involved stakeholders’ insights. The problem with this response is that municipal and forest management plans are formulated with a three- or ten-year horizon and flexibility is not straightforward. Likewise, the *Creation of local financial institutions* is controversial. Currently, there is a lawsuit against a private external financial institution that committed fraud against a group of commoners, hence the importance of creating trustable local financial institutes even if certified or monitored by national/external authorities.

According to external stakeholders’ views, the *new sustainable investment projects based on individual and collective schemes* could be a suitable response to external pressures over the SES. Currently, there is some kind of individual and family disappointment because collective activities are not providing them with the welfare they expect. Thus, the inclusion of individual private concessions to develop new economic projects approved by the General Assembly should mitigate this social concern. But, reversibility could not be guaranteed since private interests may clash with communal property rights.

At the end of the workshop, the participants discussed the *Strengthening customary practices and collective memory response*, which is one of the most important features and reasons for current forest conservation. The community of Santiago Comaltepec has been characterized by its traditional knowledge and excellent conservation practices. Most of the participants recognized that *primary education* is the best way to face this issue. But, there exists an external pressure over collective memory. Something really interesting is the *implementation of a payment scheme in “cargos” system*, which was thought as a long-term response<sup>23</sup>.

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<sup>21</sup> Flexibility refers to the possibility of modifying an action-response at any time of its application.

<sup>22</sup> Reversibility refers to the chance to reverse a consequence of an action that has been taken before. In other words, if the community makes a decision that can alter the SES’ performance, the consequences of such decision can be partially or totally reversed.

<sup>23</sup> This measure entered into force in January 2014.

Table 7 shows the outcomes of the external stakeholders’ workshop. As a result of an in-depth (or lengthy) discussion, all participants suggested more specific actions and implications about robust response options.

**Table 7 Implications of robust response options according to external stakeholders**

<b>Response option</b>	<b>What do we have to do?</b>	<b>How do we have to do it?</b>	<b>Who is responsible?</b>	<b>Flexibility or reversibility and costs</b>	<b>Environmental effects</b>
<b>1. Training and advice</b>	Basic education, business training, creation of the timber industry (improving current production processes)	Improving current processes through technical advice provided by external institutions such as UNAM and UNSIJ	Local technicians, youngsters, and the external administration council (this council has to be appointed by the General Assembly, but it possesses a certain degree of autonomy)	This response is reversible, because training and advice do not affect the SES negatively. The community, external institutions and the federal government are responsible for the implementation costs	Training and advice should improve forest conservation through better practices and facilitate the development of better forest management infrastructure and plans
<b>2. Strengthening the links between community and institutions</b>	The community has to strengthen the links with UNSIJ, CONAFOR, SEMARNAT, CONANP, SAO, ERA, UNAM and other external institutions	Local authorities have to be informed about institutions’ plans and programmes and sign some agreements compatible with the community’s interests	Local authorities (through a commission appointed by the General Assembly) and representatives of each institution (previously informed)	This response option is intrinsically flexible in the sense that the community has the power to limit or improve links or agreements depending on its objectives	This response is related to the training and advance suggestion. So, conservation practices could be improved through relationship closer cooperation between institutions and community

Response option	What do we have to do?	How do we have to do it?	Who is responsible?	Flexibility or reversibility and costs	Environmental effects
<b>3. Reviewing and improving development and forest management plans</b>	The current plans have to be revised and adapted to current conditions	All agents involved have to participate in plan formulation processes, which have to be based on participatory methods (including internal and external stakeholders)	Institutions such as SEMARNAT, the federal government, UZACHI, CONANP, CONAFOR, SHCP, SAO, ERA and the General Assembly are responsible. The majority of participants suggested national policies, such as the fiscal one, have to be taken into account throughout the formulation of the community's plan	This response is not flexible and reversible at all because the time horizons of development and forest management plans (3 and 10 years, respectively) are determined outside the community. Plans are usually rigid and, if there is a mistake, the chances for timely amendments are few.	If development and forest management plans were elaborated consistently, forest conservation would be ensured. Conservation infrastructure and knowledge improve forest conditions

Response option	What do we have to do?	How do we have to do it?	Who is responsible?	Flexibility or reversibility and costs	Environmental effects
<b>4. Creating local financial institutions</b>	The community has to implement a financial scheme in order to fund local projects	Financial institutions have to offer credits to commoners or settlers to implement family or individual projects in the territory. But, funding has to be based on external sources	External financial institutions and the federal government are responsible for this task (according to external stakeholders' view)	The flexibility and reversibility degree of this option is not certain since the introduction of external financial institutions increases the possibilities of fraud or other irregularities (as has already occurred). Regaining reputation is not easy for financial institutions (reputation is one of the most complicated issues in the community and its irreversibility is not straightforward)	There will not be significant environmental effects (at least, directly)
<b>5. New sustainable investment projects based on individual and collective schemes</b>	Currently, collective activities are not providing enough individual welfare. So, it is important to generate individual projects	Individual projects have to be based on private concessions to individuals, families or groups inside the territory	Local authorities and the General Assembly are responsible for these concessions, supported by federal legislation	Current rules are not flexible at all to implement individual or family concessions	Individual, family or group's concessions might increase resource extraction rates and eventually imply some threats to forest conservation



Response option	What do we have to do?	How do we have to do it?	Who is responsible?	Flexibility or reversibility and costs	Environmental effects
<b>6. Strengthening customary practices and collective memory</b>	Customary practices and collective memory have been weakened because of several factors. But, they have to be strengthened	Primary education is the best way to approach this issue. External prototypes are threatening customary practices among young inhabitants, so children's education has to promote collective memory in primary and secondary school (and/or at home)	Heads of families, teachers, primary and secondary schools' staff are responsible for this task	The flexibility of this measure is not clear because elementary education teachers are outsiders and usually reluctant to customary practices and collective memory. However, if they are from the community or educated in a similar context, the knowledge spread by them should be aligned with these initiatives	Customary practices and collective memory are essential to forest conservation.
<b>7. A payment scheme for the "cargos" system</b>	The community cannot keep functioning without introducing a payments scheme in the <i>cargos</i> system. People with "cargos" need to earn some money for their job.	Workshop' participants indicated that the best way to implement this payment scheme is through the approval by the General Assembly.	Commoners	Flexibility is not easy because paying for <i>cargos</i> is a controversial issue in the community. The General Assembly's rigidity could limit this initiative	Indirectly, this response should improve local authorities' performance, which leads to better conservation practices

Source: Own elaboration based on external Stakeholders' workshop

## 8.2 Implications for future local plans according to internal stakeholders

The second meeting was held in the hall located in Santiago Comaltepec on Sunday, June 29<sup>th</sup>. At this meeting, around 35 local stakeholders were involved in the discussions about response options implications (see Figure 10). Because the General Assembly of Commoners approved the COMET-LA project in 2012, an extraordinary General Assembly was convened to inform the community about the project's results. In this session, the COMET-LA team recapitulated all the commitments included in the project agreement and how they have been honoured from 2012 to 2014.

Figure 10 Internal stakeholders' workshop



Source: Own elaboration based on internal stakeholders' workshop

In this meeting, it was not possible to conduct a detailed discussion about the implications of response options. But, the UNAM and ERA research team decided to conduct a survey and personal interviews with each participant in previous stages workshops. As a result of this consultation, some conclusions about implications could be drawn.

From the internal stakeholders' views, *training and advice* are vital for future plans. Currently, the community is elaborating a new forest management plan for the next ten years, so *technical advice* is required to know how the forest has been and will be managed. To this end, ties between the community and external educational institutions have to be strengthened. Also, if some projects were carried out, several institutions would have to support their implementation and assist with technical advice. For instance, the UNSIJ should teach local people to process wooden products in order to obtain better prices. Likewise, UNAM may provide accountability advice or may be implementing marketing training as well.

There is a concern about current municipal and forest management plans. The municipal plan has been designed following external guidelines (federal government's suggestions), but the

community members ask for a plan in which local needs are incorporated and integral holistic approach to elaborate it is adopted. As for the forest management plan, diverse actors such as local authorities, ERA, UZACHI, and other partners are elaborating it. However, from the internal stakeholders' point of view, some local needs and concerns are not included in it. Thus, internal stakeholders suggested that all stakeholders must be taken into account, using participatory methods, to construct a new integral plan that includes communal, municipal, cultural and resource issues.

Few months ago, the community faced several difficulties with an external financial institution that defrauded commoners. So, in order to carry out individual or family projects, a *local financial institution* would be a suitable alternative to address this issue. Deciding on the best source of funds for such financial institution remains as a challenge. Internal stakeholders suggested that a local institution should be funded with communal income, maybe remittances, and that the General Assembly establish an accountability scheme in which this institution shows how the community's resources are being invested. Once this financial entity has been created, individual and family projects can be launched. But, the procedure to allocate those resources among users gives rise to internal controversy. It represents a challenge from the collective perspective.

The most important factors for forest conservation are the *customary practices and collective memory* that have been preserved for centuries. However, in the last decades this ideology has been weakened because of several factors, especially external ones. If the community wants to preserve these practices, basic (primary) education has to be modified. Workshops' participants indicated that the best way to preserve traditional knowledge and collective memory is through children, which implies hard work on basic (primary) education.

As has been discussed, when the COMET-LA project started, three years ago, a *payment scheme for the "cargos" system was not regarded as a response* to the SES's current situation, in the light of the pressures the "cargos" system is experiencing; that is, not many young commoners are willing to work without being paid. Now, this payment schemes a reality initially instrumented by the municipal authorities. But, communal authorities followed that initiative. The General Assembly approved of it on condition of productivity because these payments have to be funded by communal resources. This structural change in the governance system could bring about changes that deserve to be analysed. Among other consequences, this decision could lead to reinforced SES sustainability.

Table 8 shows how the internal stakeholders will face future challenges based on robust response options identified in the previous stage. At this stage, participants were interviewed in order to capture their opinions about specific issues related to each of the seven robust responses.

Table 8 Implications of robust response options, internal stakeholders

Response option	What do we have to do?	How do we have to do it?	Who is responsible?	Flexibility or reversibility and costs	Environmental effects
<b>1. Training and advice</b>	The community needs forest management training and advice provided by diverse institutions and universities. The most effective way is through project proposals in which young people get involved and design technical assistance programmes	Santiago Comaltepec should support its development and future plans on training and advice given by some institutions (all included in the external stakeholders' category). The General Assembly should be the platform to ask for a specific training and advice. This response should be targeted to young inhabitants.	The UZACHI should play an important role in this activity. The UNAM should be a sourced of high education related to administration and accounting. The UNSIJ should be responsible for the technical advice. Local authorities will be responsible for workshops or training sessions.	This response is flexible and reversible because the community possesses the capacity to limit or break down agreements signed with diverse institutions and it could amend the contents of courses and advice	Training and advice promotes better conservation practices. Commoners and settlers acquire knowledge to improve their current relationship with the resource. <i>The effects of this response option</i> would be transmitted through better forest management plans
<b>2. Strengthening the links between the community and institutions</b>	Maintaining close relations between institutions and the community. Also, communication between institutions and the community has to be strengthened.	Governmental institutions have to be invited to support local development. Also, some forums have to be organised in order to inform about programmes and projects offered by the institutions. Likewise, collaboration agreements have to be signed.	The community and the institutions are responsible for this task. A special commission appointed by the General Assembly and formed by municipal and communal authorities is in charge of this task.	This option is both flexible and reversible in the sense that the community is able to decide upon its partners and that making changes is easy.	Environmentally, this response should improve conservation practices in the same way as training and advice do. The interaction between the community and institutions allows for more information sharing.
<b>3. Reviewing and improving development and forest management plans</b>	The community has to revise current plans. Plan must be tested.	The General Assembly must be the principal actor in the plan elaboration process. Also, participatory methods have to be followed to obtain most of the actors' views. Monitoring is also important to evaluate how the new plans are working.	Municipal and communal present and former authorities, UZACHI, CONAFOR, SAGARPA and SEMARNAT have to be included in the discussions and formulation processes	This response is not flexible at all and its reversibility is rather limited. Time horizon inconsistency should create some problems because municipal and forest management plans are devised for 3 and 10 years, respectively	Its impact over the forest is relevant because the forest management plan establishes how the resource will be used in the next ten years

Response option	What do we have to do?	How do we have to do it?	Who is responsible?	Flexibility or reversibility and costs	Environmental effects
<b>4. Creating local financial institutions</b>	The community is conscious of the lack of local financial resources to invest in family and/or individual projects. The existence of local financial institutions is crucial for future plans	Currently, there is a controversy against an external financial entity because it defrauded some commoners. So, the best alternative to create a financial institution in the community is with its own resources. This institution should be created and supervised by the General Assembly but not operated by the Assembly	The General Assembly and a special commission (appointed by the Assembly) will be responsible for this task. It is clear that the commoners should closely monitor the new financial institution	Reversibility seems complicated due to some community members' reluctance to individual or family projects. So, if there is a local financial institution funded with communal sources, internal disputes might arise.	The impact of this response over natural resources is not relevant, at least not directly. It depends upon the projects that are implemented with these local financial resources.
<b>5. New sustainable investment projects based on individual and collective schemes</b>	In order to improve inhabitants' welfare, individual projects should be implemented	The General Assembly has to allocate territorial, temporal and financial resources in order to promote individual projects, under a collective scheme funded by the local financial institution	The actors responsible for this task include those commoners, settlers, local authorities and external institutions able to fund these projects	As has been mentioned, there is a controversy between individual and collective behaviours in Santiago Comaltepec. So, if individualism becomes the main ideology, reversibility would not be straightforward	If the collective scheme and the land use are not really modified, there will not be significant impacts on the environment. Otherwise, pressures over the resource would arise
<b>6. Strengthening customary practices and collective memory</b>	In the last years, customary practices and collective memory have been weakened due to external pressure over the system. But, they must be strengthened in order to preserve good conservation practices as well as their culture and traditions. Research initiatives concerning local history must be conducted	This response involves hard work based on integral initiatives, which include research, historical documentation, workshops, and collective work. The best way to face this task is basic education.	All community's members have to be involved in this task	If some of these initiatives were implemented, reversibility would not be a relevant issue	Regarding environmental impacts, the customary practices and collective memory have been the basis of the current conservation status. So, if the community improves them, the resource will be positively affected

Response option	What do we have to do?	How do we have to do it?	Who is responsible?	Flexibility or reversibility and costs	Environmental effects
<b>7. A payment scheme for the "cargos" system</b>	A payment scheme has been established in the "cargos" system. Those occupying "cargos", that is, local authorities must be monitored to check their productivity	Municipal and communal authorities have to manage projects that generate some benefit for the community. So, their payment is subject to the number of projects they implement or to productivity that they can give evidence of before the General Assembly	Local authorities and the General Assembly are responsible for this task	Reversibility is not straightforward because once this scheme has been implemented; future generations will not work as local authorities unless they get paid. The cost of this response is a financial burden on communal resources	Currently, the governance system is one of the strongest factors of environmental sustainability. So, any improvement in it will lead to better conservation practices

Source: Own elaboration based on internal stakeholders' workshop

Once the views of internal and external stakeholders were systematized, they were compared and contrasted to obtain useful information that would be valuable input for the future plans or to amend current ones. In general, external stakeholders' views indicated that national governmental policies have to be integrated in the future community plans. In contrast, the internal stakeholders suggested that collective and individual projects, funded by them, should be the most important factor for future planning. In the next section, the implications of the responses and the contrasting views for the governance system will be discussed.

## 9 Implications for local governance system

The local governance system has been described in this document on stage 3 and in deliverable 3.2. Here, we focus on how the response options could affect the SES performance. One of the SES's most relevant features is the key role local governance plays in its functioning. Thus, it is imperative to discuss the implications of each scenario's response options for the local governance and to identify the transformations each option and scenario could bring about.

Although several challenges and responses have been analysed by internal and external stakeholders, there are other risks to the performance of the current local governance system. The most relevant threats could be reduced to the following categories<sup>24</sup>: lack of opportunities, rigidity towards innovation, external and internal pressures (such as globalization, national education model imposed to the community, the system of political parties), and migration of youngsters. The local governance system has a high capacity to cope with forest management, but not enough youngsters or women take part in this management, which contributes to producing a sense of injustice and some resentment

<sup>24</sup> Other risks were identified, but these are the most relevant ones.

against the governance system in the excluded groups. The reduced profitability of the system is a real threat to the local governance system. According to stakeholders' views, currently, the SES's performance is not providing the commoners and settlers with the level of social welfare that they expect. That is why the creation of individual and family projects is seen as an answer to this situation. The workshops' participants insisted that collective and individual interests should be part of the SES modernisation process. At present, the important community challenge is how to achieve the harmonious coexistence of individual and collective interests. Some people are reluctant to individual projects, especially the elderly, on the grounds that customary practices have been successfully used generation after generation in forest management and that individualism could threaten it. On the other hand, younger people, supported by other sections of the community, have also pointed out the necessity of individual concessions to create other opportunities inside the system.

On the other hand, and as has been said, the seven response options analysed by external and internal stakeholders regarded the "cargos" payment scheme as one of the changes that would significantly modify the local governance system. It does not mean that other responses will not affect it; but analysing the payments scheme would help understand how the local governance works at present. At the beginning of the COMET-LA project in 2012, the community was not paying anything to its local authorities. This situation had prevailed for decades, even centuries under the name of "cargos" system. However, early this year (2014) payments for "cargos" were established by the General Assembly.

It is important to highlight that the General Assembly conditioned those payments to the local authorities' productivity. In exchange, the General Assembly has to be regularly informed of the communal authorities' performance in order to approve future payments. In other words, in the communal sphere, authorities have become employees of the community whereas in the past they were considered special persons because they were doing unpaid honorary work.

The importance of this response lies in its influence over the local governance system. Once the local authority figure has been modified because no longer working for free, authorities can be seen as employees of the General Assembly. In terms of response options, authorities' payments are subject to the number of projects they manage. Other response options even suggest setting guidelines for local authorities. This set of responses will be reinforced by the notion of local authorities' productivity.

The community is facing one of the most important challenges: how to carry out its local governance system modernisation process. External pressures from the national government and globalisation are pushing the community to standard prototypes in terms of education, organisation and culture. Several communities all over Mexico's territory have disappeared as a consequence of this pressure because it opposes their customary practices and collective organisation. Moreover, internal pressures over the local governance system have appeared as a new cultural transmission process derived from migration trends. This process is promoting individualistic and "modern" behaviour, copying global prototypes. So, the challenge is to engage in a modernisation process that can align and harmonize collective and individual interests within the local governance system.

### 10 Conclusions on the use of scenarios for community-based natural resources management in Santiago Comaltepec case study

Building scenarios, as an output of this methodology, represents not only organising the information required to understand the SES, but also the possibility to assess the performance of the principal variables intervening in it, given a complex succession of events. *Both the morphological space, which represents the relevant information concerning the SES, and the navigation across it, which allows exploring possible world views, forms a useful tool, not to predict, but to understand how the SES would look like if any of the possible futures happened.*

As a result of the Scenario-Building Process for Community-Based Natural Resources Management (CBNRM) in Santiago Comaltepec, the community has found this methodology as a powerful tool for analysing environmental, social and economic future challenges regarding the Socio Ecological System. The process inaugurated a new consciousness. Workshop' participants and the General Assembly acknowledged this technique as an analytic instrument to deal with future trials. One of the most important problems any kind of human association (societies, firms, countries, towns, even families) faces when thinking about the future is uncertainty. So, methods capable of organising information are required. Then, the more precise the methods, the more prepared the members of such groups will be to face the future trials.

In the course of COMET-LA project discussions involving all stakeholders, the community identified specific actions, or response options, for several scenarios. The information thus collected is now at the disposal of the community for it to apply it under other unpredictable scenarios. Even if the community is not now completely prepared to face an important shock, stakeholders possess valuable information that could be used to improve SES's resilience to environmental, economic and social shocks. However, this is only an initial stage. A much more refined capacity to gather information, but more importantly, a clear idea on how to analyse it and translate it into decisions and actions, is required. The planning exercise has not really been in the hands of the community. It is now an attractive course of action but its management is still unknown.

Even though Santiago Comaltepec had had very few self-directed planning exercises, the community had managed to formulate several development plans. Now, it is an attractive idea for internal and external stakeholders not only to adopt, but also to intervene in the planning process. Due to the community's lack of experience in this area, adaptive management and planning are both big challenges, demanding lots of actions in order to achieve the goal of a real self-made plan of action.

The most important contribution of the COMET-LA project to Santiago Comaltepec is the agreement on a common framework for analysing the Socio Ecological System considering historical, current and future issues. The community has been provided with a package that allows for a general vision of the SES performance. Currently, CBNRM is being confronted to powerful pressures around the globe because it is not considered an effective method for resource management by the mainstream. Partly because of this, communities as Santiago Comaltepec inevitable must think about adaptation and modernisation processes. To this



end, the scenario-building methodology serves as a method to compile, systematise and share information and data. Moreover, it is a participatory method in which internal and external views can be considered to explore the future and ways to face it. This is also an important output of the whole research exercise. History is determining the present. However, due to the overwhelming new developments globalisation has brought about, history is not enough. Change is required, demanded. In fact, a precise combination of newness and history is required in order to face the future and strengthen the SES' resilience.

Normally, conventional models for future prediction deal with complex models or several theoretical abstractions. Nevertheless, the framework applied in this case study was locally adapted. It was helpful for the learning arena in which COMET-LA is based on. Now, the community has three powerful tools: a SES characterisation, the Prospective Structural Analysis and Scenario-Building frameworks. In the future, when trying to understand their SES performance and to design policies to improve it, future generations or local authorities can update the information and apply these tools.

Another contribution of the project has been the strengthening of the link between local authorities and external institutions that derived from workshops. Divergences and coincidences on stakeholders' views have been aired and openly discussed promoting consensus about resource management and community's issues such as the lack of opportunities for youngsters. The scenario-building process helped to develop local and forest management plans. Currently, these plans had been elaborated attending a partial vision. The workshops and discussions gave the chance to include more actors. But, more importantly, they made the need for stronger relationships evident. Local and external institutions cannot work efficiently unless a real dialogue is implemented. Top-down relationships have to be replaced with more horizontal ways of interactions.

Now the community, UNAM and ERA will re-elaborate an integral development plan in 2015, based on COMET-LA project's results. Findings derived from the last stage, (the response options) are useful for this purpose. Moreover, according to COMET-LA team, internal and external stakeholders, the learning arena promoted by this project has been considered as a relevant factor for multi-level governance processes. National, regional and local governance institutions were included in the debates and workshops. So, the local and external stakeholders' interaction should result in better resource management practices once adaptation and modernisation processes take place.

The cooperation among and the inclusion of several types of stakeholders should characterise the modernisation of the SES's local governance. This interaction must not only be understood as cooperation between internal and external stakeholders, but also as an inclusion of the missing sectors in the public life: women, youngsters and even migrants should be able to influence the SES's performance in terms of governance and resources management. COMET-LA's outcomes have shown that not only is the methodology implemented useful in terms of thinking about the future and the measures needed to cope it, but it is also an example of the sort of results that can be achieved when cooperation and learning arenas are established as the basis for knowledge construction.

Last but not least, in part as a result of the scenario-building methodology, internal stakeholders have realised that complex and global economic, environmental and political contexts have major and serious impacts on a local scale such as Santiago Comaltepec. Considering the community as an isolated and independent system has never been an option, and least of all in a period of great transformations as this one. Climate change, new technologies applications, timber prices, migration controls are all determined to a different extent not only by external but also by internal forces. The impact on the community is big enough to realise that Santiago Comaltepec's governance system should encourage internal stakeholders' participation in order to ensure resilience. Resilience to climate change and environmental shocks are better coped with when the actors are directly involved in the management of the affairs concerning their vital resources.

### 11 References

- Bas, Enric. 2004. "Megatendencias para el siglo XXI. Un estudio Delfos". Fondo de cultura económica.
- Escalante, R., Basurto, S., et al., 2012. "Stakeholders' Vision on the Socio-Ecological System (SES) situation in Mexico. A Case Study" Deliverable 3.1 Available on: [http://www.comet-la.eu/images/comet\\_la/deliverables/D%203.1\\_Comaltepec.pdf](http://www.comet-la.eu/images/comet_la/deliverables/D%203.1_Comaltepec.pdf)
- Escalante, R., Basurto, S., et al., 2013 "Stakeholder vision on problems and drivers related to environmental challenges in Mexico" Deliverable 3.2. Available on: [http://www.comet-la.eu/images/comet\\_la/deliverables/COMET-LA%20D3.2.pdf](http://www.comet-la.eu/images/comet_la/deliverables/COMET-LA%20D3.2.pdf)
- Forrester, J. W. 1961. Industrial Dynamics. MIT Press: Cambridge, Massachusetts.
- Godet, M. 2003. La caja de herramientas de la prospectiva estratégica. Cuarta Ed. Ed, Grupo de Desarrollo Económico de la Región Centro Occidente. México.
- Greene, W., 2003. Econometric Analysis. Prentice Hall N.J.
- Hunt, Dexter V.L. et al, 2012. "Scenario Archetypes: Converging Rather than Diverging Themes", Sustainability, No. 4, Basel, Switzerland, April, pp. 740-772
- INEGI, 2010. Population Census 2010. Mexico D.F.
- James Hutton Institute, 2014. Locally Adapted Scenario Building: Evaluation of Methods. Deliverable 1.3. Available on: <http://www.comet-la.eu/index.php/es/publicaciones.html>
- Schwartz, P. 1991. The Art of the Long View. Doubleday Currency, New York.
- Sterman, J. D. 2000. Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin/McGraw-Hill, New York.
- Wooldridge, J., 2010, Econometric Analysis of Cross Section and Panel Data, 2nd ed., MIT Press, Cambridge.

# Annex I. External and internal workshops' participants

Table 9 External and internal workshops' participants

External Stakeholders		Internal Stakeholders	
Gender and position	Institution	Gender and position	Institution
1. Female, teacher	UNSIJ	1. Male, peasant	
2. Male, secretary	Commissariat	2. Male, peasant	
3. Male, treasurer	Commissariat	3. Male, commoner	
4. Male, president	Commissariat	4. Male, commoner	
5. Male	UZACHI	5. Male, president	Commissariat
6. Male	UZACHI	6. Male, president	Supervisory Council
7. Male	SAO	7. Male	Commoner
8. Male	UZACHI		

Source: Own elaboration based on external and internal stakeholders' workshops

## Annex II. PSA variables description

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### **Economic activities**

*Economic activities* represent a third-tier variable according to Ostrom's framework, derived from the second-tier variable Economic development. These *Economic activities* are those that represent a source of income for the community members.

### **Livelihoods**

The variable *Livelihoods*, according to the framework for analysing SES, is originally labelled as *Subsistence Activities*. The name was changed to *Livelihoods* due to the fact that the research team considered this concept more consistent with the case study. *Livelihoods* are the day-to-day activities performed by all inhabitants for the subsistence of the families and the community regardless of whether or not they generate monetary income.

### **Non-paid activities**

*Non-paid activities* are those held by the commoners without payment and on a mandatory basis. These activities strengthen the community ties. Some of the most important activities in this category are: service to the community (*cargos* and commissions), unpaid labour for the community (*tequios*), domestic labour, and monitoring activities.

### **Migration trends**

*Migration trends* refer both to changes in the migration patterns and to the nature of such changes over the years, as well as to the reasons for the changes. This variable also includes identifying who migrates, why and where. In the case study, migration started in the eighties and nineties and there has been a stable trend since then, showing some declining tendency over the past few years.

### **Political stability**

*Political stability* is related to the political conditions on the regional, national and local levels, (if) whether stability or conflict (either current or potential) prevails. It also refers to the degree of compliance with the rules due to the knowledge that community members have of such rules and also due to the community's enforcing power. The trust and predictability of behaviour and reciprocity among commoners is important for *migration trends* and *political stability*. The same can be said about the trust in the authorities' performance.

### **Types of environmental laws**

This variable includes environmental laws affecting the interrelations among the resource units on the regional, national and local levels; for instance, if the community performs or stops performing certain activities related to the natural resources management due to regional environmental laws.

### **Monitoring and sanctioning processes**

These processes allow for the strengthening of operational rules within the system. The commoners monitor the correct use of the system resources and verify compliance with the established rules. When compliance with the rules is not effective or the resources are used inappropriately, the authority imposes sanctions (monetary fines, community labour or imprisonment).

### **Government Organisations**

*Government organisations* are a second-tier variable that refers to the multilevel organisations affecting the system, its performance and its structure; for instance, the Commoners' Assembly, the Citizens Assembly, the municipal authorities, the Communal Property Commissioner, and the Surveillance Council.

### **Property Rights System**

The *Property Rights System* describes the existence or absence of formal property rights regarding the resource system and the common pool resources.

### **Collective-choice rules**

The *Collective-choice rules* consist of rules for collective action and community-based management of resources.

### **Exclusion and extraction rights**

This variable refers to the rights to define who has access to the resources and to their management. The assembly of commoners defines who can use the resources and how. It also intervenes in the decision making process related to *exclusion and extraction rights*. It makes a lot of difference when these rules are clear or not.

### **Economic value**

*Economic value* refers to the prices of the natural resources, for instance, timber and forest prices.

### **Importance of resources**

This variable is related to how important the resources are for the lives and economy of the commoners and how much they depend on such resources.

### **History of use**

It is the history of the community, regarding land use and natural resources management. It also comprises how the interactions among the resources units have changed over the years.

### **Sanitary conditions**

A *sanitary condition* is related to the infrastructure and services that improve health conditions in the community.