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**BIOSPHERE RESERVES AS MEANS FOR SUSTAINABLE DEVELOPMENT. THE CASE OF  
SIAN KA'AN, MEXICO**

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# **Biosphere reserves as means for sustainable development. The case of Sian ka'an, Mexico.**

## **Abstract**

This research project aimed at analyzing the role of Sian Ka'an biosphere reserve (SKBR) in the processes of development and environmental protection in Colonia Javier Rojo Gómez (JRG), the most important settlement in the reserve from a demographic perspective. SKBR is known for observing well preserved states of natural assets as well as vibrant economic dynamics, based on lobster commercialization and nature based tourism (NBT). At the same time, it is recognized that the regional dynamics of mass tourism in Cancún, Playa del Carmen in the north of the reserve and Mahahual and Bacalar in the South are potentially threatening the environmental integrity of the protected area (PA). On another hand, it results interesting to observe that regardless of the active economic dynamics in JRG some poverty conditions prevail in the settlement and also among the population. Motivated by these facts, an analysis of the productive processes, development and environmental protection was performed using the sustainable livelihood approach.

Keywords: JRG/SKBR - Sustainable development - Biosphere reserve - Sustainable livelihoods - CONANP.

## **Resumen**

Este proyecto de investigación tiene el objetivo de analizar el rol de la reserva de biosfera de Sian Ka'an (RBSK) en procesos de desarrollo y protección ambiental en la Colonia Javier Rojo Gómez (JRG), que constituye el asentamiento más importante de la reserva desde una perspectiva demográfica. La RBSK es conocida por mantener en un buen estado de conservación la biodiversidad que alberga y por contar con procesos socio-económicos sólidos, basados en la comercialización de langosta y en el turismo basado en naturaleza (TBN). Al mismo tiempo, se ha reconocido que las dinámicas del turismo masivo en Cancún y Playa del Carmen en el norte de la reserva y en Mahahual y Bacalar en el sur, son potenciales amenazas para la integridad del área natural protegida (ANP). Por otra parte, resulta interesante observar que a pesar de los altos ingresos que representan las actividades económicas en JRG, prevalecen algunas condiciones de pobreza en el asentamiento y en la población. Partiendo de estas circunstancias, el análisis de los procesos productivos, desarrollo y protección ambiental se llevó a cabo a través del enfoque de los modos de vida sustentable (MVS).

Palabras clave: JRG/RBSK - Desarrollo sustentable - Reserva de biosfera - Modos de vida sustentables - CONANP

## **1. Introduction**

This research project seeks to analyze the influence of Sian Ka'an biosphere reserve (SKBR), located in the state of Quintana Roo and decreed in 1986, in the generation of

processes of sustainable development, based on the case of Colonia Javier Rojo Gómez (JRG) (Also known as Punta Allen), the main settlement in the reserve.

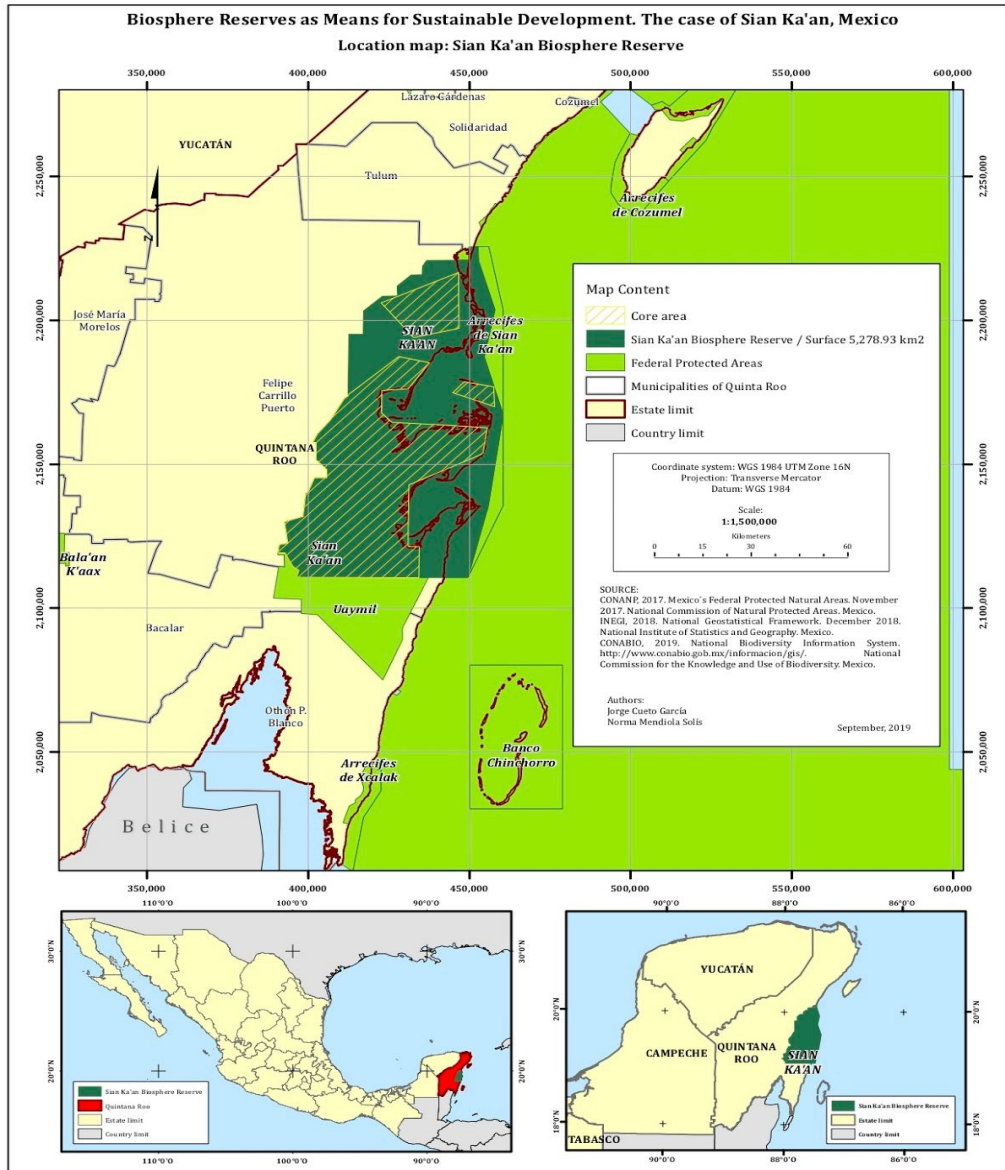
Biosphere reserves were designed in the early 70's as instruments to foster processes of environmental conservation and social development (Battisse, 1993). The latest document available on the goals that BR pursuit, the Lima Action Plan (LAP), is clearly stated that BR are meant to foster the restoration of environmental services, the sustainable use of natural resources, sustainable, equal and healthy societies with strong economies and adequate settlements (LAP, 2016).

SKBR and the PA complex to which it belongs, protect vast extensions of ecosystems representative of Yucatan peninsula. Within its polygon is possible to find medium semi-deciduous forest, flood forest, petenes, mangroves, wetlands, coastal dunes, cenotes and coral reefs -It is worth to mention that some of these ecosystems are rare in the world and exist only in two other places apart from Sian Ka'an- it also hosts endemic and threatened species (CONANP, 2014).

Furthermore, SKBR is home of about 582 people according to the last national census (2010) (CONANP, 2014), although the figures vary depending on the sources. This population is mostly divided into three settlements, being Colonia Javier Rojo Gómez the most important in demographic terms (Vargas del Río, 2010).

SKBR is one of the most important biosphere reserves (BR) in México due to its environmental and political relevance. Soon after its decree, the PA was incorporated to numerous international programs: Man and the Biosphere (UN), Natural Human Heritage (UN), the Marine Protected Areas Network (CEC), among others (Brenner, 2010; Brenner & Vargas del Río, 2010).

The number of national and international organizations interested in the reserve as well as the investments destined to the conservation and protection of natural resources and productive activities are of great significance (Vargas del Río, 2010). Among the most active NGOs working in SKBR are Amigos de Sian Ka'an A.C., Biocenosis A.C., Pronatura Península de Yucatán A.C., The Nature Conservancy (TNC) and Oceanus A.C. (CONANP, 2014).



**Map 1. Localization SKBR**  
**Source: Own elaboration, 2019**

Colonia Javier Rojo Gómez is the main settlement within the PA, a settlement originated in the decade of 1970 with a fluctuant population officially estimated in 469 inhabitants (INEGI, 2010). It started as a seasonal campsite for fishermen coming from nearby cities such as Cozumel and Cancún and also for the inhabitants of copra ranches located along the coast. As the copra production started its decay due to the plague known as Amarillamiento Letal, the economic interest started focusing on the fishery, especially on the capture of lobster (*Panulirus Ague*) which had an attractive market at the regional level (Flores, 2013). The latter, gave place to the establishment of the Fishery Cooperative Society Vigía Chico (Sociedad Cooperativa de Producción Pesquera Vigía Chico) in 1968 which, regardless



some periods of crises, has been successful and prosper (Vargas del Río, 2012; CONANP, 2014).

The decree of the reserve and the impacts caused by hurricane Gilbert in 1989, greatly reshaped the productive dynamic in the town. On another hand, nature based tourism (NBT) emerged during this period as an important economic alternative with as well relevant proceeds for the local population (Flores, 2013; CONANP, 2014). In present days, both fishery and NBT are the main productive activities (Vargas del Río, 2010).

Unlike the majority of the PA and BR in low income countries, the conditions in SKBR are favorable in environmental and economic terms. The local inhabitants observe relevant income flows that allow them to have important financial resources, even above the regional standards (Brenner & Vargas del Río, 2010, Solares & Álvarez Gil, 2005). On another hand, it is widely accepted that the conditions of the natural assets in the PA are satisfactory (CONANP, 2014; Brenner & Vargas del Río, 2010; Flores, 2013).

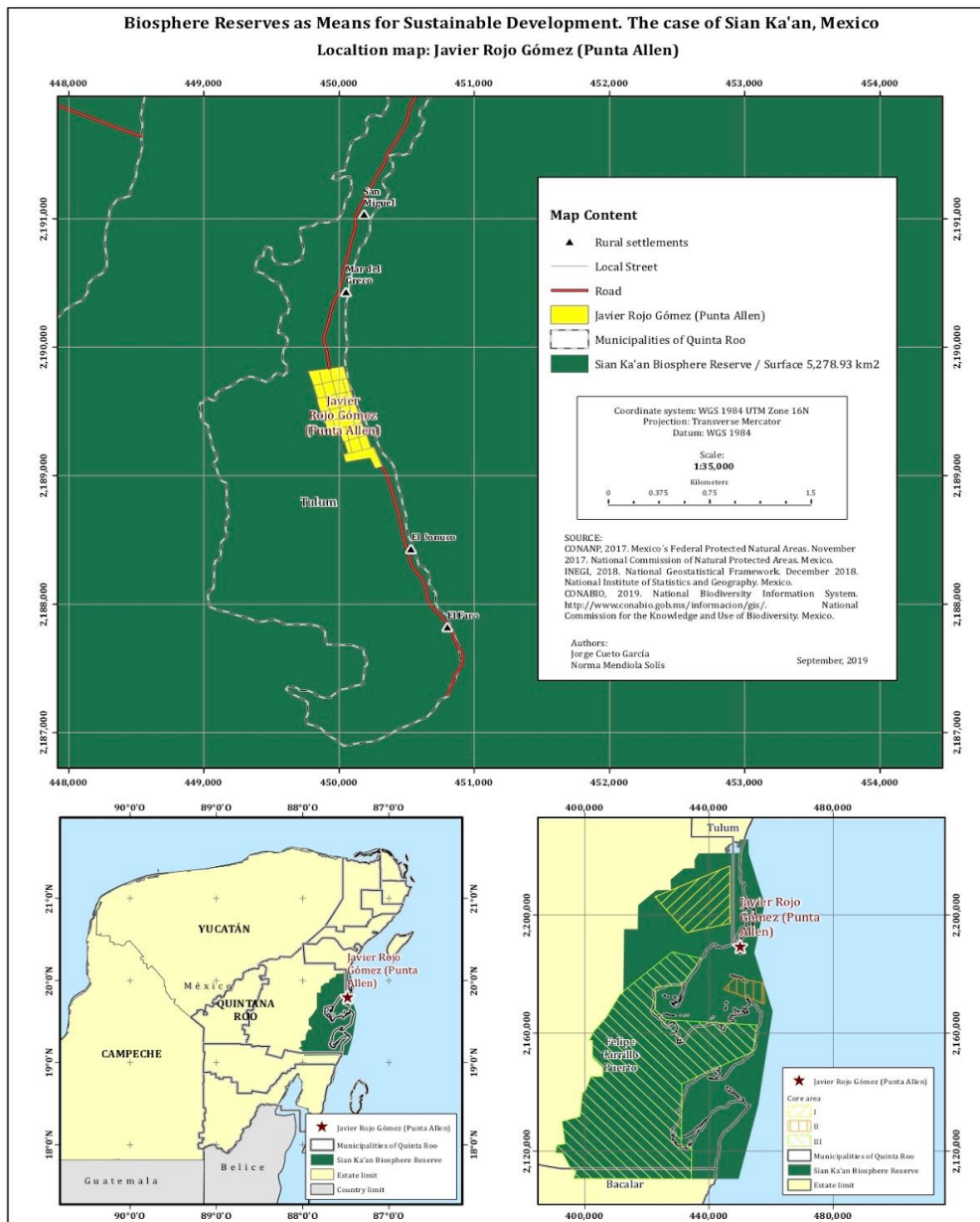
The latter environmental and socio-economic conditions served as a starting point for this research project, they contrast greatly with the general observation of socio-economic problematics as well as constant process of environmental deterioration in biosphere reserves in low income countries such as Mexico. In this context results interesting to inquire whether Sian Ka'an biosphere reserve represents an effective means for sustainable development. From an integral understanding of sustainable development, the following questions come to mind.

General questions:

1. Is SKBR an effective means for local sustainable development?
2. In what way does the reserve contribute to achieving sustainable development at the local scale?

Specific questions:

1. What have been the direct contributions of CONANP in the improvement of each of the capitals of the sustainable livelihood approach in JRG?
2. How is the reserve contributing to the continuity of natural assets and processes in SKBR?
3. How does the reserve contribute to the improvement of the life quality of the local inhabitants?



The analysis for this research is carried out through the conceptual framework of sustainable livelihoods (SL), a theoretical approach developed to assess sustainable development processes in rural contexts that was elaborated during the early 90's. From this perspective is possible to better comprehend the rural realities of households and communities in their procurement of well-being as a complex and integral process (Ávila, 2014). The sustainable livelihood approach integrates in its base a perspective on poverty and development that takes distance from the classic economic view and incorporates a series of elements that

along with the monetary component create opportunities for individuals and communities to access well-being conditions (Zavala-Robles, 2014).

In order to properly contextualize this research, in the first section, an explanation of the concept of sustainable development is elaborated. This is a concept that despite being frequently used and referred to in many different fields, it still appears elusive and most of the time inoperable (Drexhage & Murphy, 2010). In this scenario, an overview on the concept is first elaborated followed by a section devoted to its origins, in an attempt to provide clarity to its meaning, stressing out the contextual elements in which it was coined. After this, another section is focused on how the concept was developed and the forces that influence its excessive use, which in extension have diluted its prescriptive and analytical potential. Finally, some interesting perspectives on the concept are presented from authors such as Palmer, Cooper and van der Vorst (1997) and Hopwood, Mellor and O'brien (2005).

After the latter, section 3 is devoted to explain the role of biosphere reserves within the sustainable development discussion. In a similar way as the previous section, the intellectual and environmental context from which the concept was coined is depicted attempting to provide insights in its core objectives and adherence to the SD thinking. It is also described how the concept evolved in time, incorporating new principles that are now considered key principles within the development reconceptualization, as it can be observed in the Lima Action Plan (LAP). The section closes by pointing out the strong relation between BR objectives according to LAP and the sustainable livelihood approach.

Section 4 presents the theoretical approach of sustainable livelihoods. The section is divided into different subsections that present diverse aspects of this approach. It starts with an overview and after this, it is described what makes sustainable livelihoods a different and more adequate approach to poverty and development. In the following, the operability of this analytical perspective is explained and each one of the five capitals involved in SL is explored, with the objective of showing the aspects that constitute them. The section is closed with an explanation of how these capitals operate analytically and the most common variables analyzed for each one of them.

Section 5 is devoted to the description of SKBR. Aspects related to its decree, the physical characteristics, the conditions of the natural assets and the social components are included. Furthermore, a detailed description of Colonia Javier Rojo Gómez is elaborated emphasizing aspects of its foundation and the development of economic activities.

Section 6 explains the methodology. First, a brief description of qualitative methods, the objectives and analytical instruments used in this approach is elaborated. After this, details on the fieldwork for this research are presented as well as a table showing information on the interviews. Furthermore, a description of the treatment of the information for the analytical process is presented, including the analytical matrix with the conceptual categories.

in section 7 the results are presented in a narrative way. The information from the interviews held during fieldwork was organized in chronological order, procuring to show the most relevant aspects of life in town, organization of economic activities, social relations, cooperation with institutions and organizations, the role of CONANP in the life of the local population from their own perspective, among others.

Section 8 is dedicated to the analysis of the results. This is organized according to the perspective of sustainable livelihoods, in subsections that correspond to each of the capitals involved. Finally, in section 9 the conclusions are exposed following the order suggested by the research questions.

## **2. Theoretical and Conceptual Framework**

### **2.1. Sustainable development: An Overview**

The idea of sustainable development (SD), as it is known in present days, was coined after the inform *Our Common Future* was released to the public in London in 1987 and soon after this event the influence of the recommendations contained in the inform was widespread in many different circles: politics, science, business, daily life and others (McNeill, 2006). By 1992, in the frame of the Rio Summit, the concept appeared to be well installed in everyone's thinking and discourse, and in this scenario was, once for all, institutionalized at the international level (Drexhage & Murphy, 2010).

The most popular definition of sustainable development: Development that "meets the needs of the present without compromising the ability of future generations to meet their own" (WCED, 1987: 16) has stressed out an intergenerational compromise in the concept but informs very superficially or not at all on other core components of it. It is rather a general notion that has given space to free interpretations (Kates, Parris & Leiserowitz, 2016). In addition to this, the use of similar terminology such as sustainable or sustainability has contributed to increase ever more the poor understanding of the term (Waas, 2011).

In this context, SD has become very flexible and this has led to a not necessarily positive wide acceptance and endorsement worldwide. On one hand, among the agencies and institutions that have promoted and adopted the concept are the United Nations (UN), the World Bank (WB), the International Monetary Fund (IMF) and the World Trade Organization (WTO) and many others, including several governments around the world at all scales. On another hand, some of the initiatives or policies derived from SD are the Millennium Development Goals (UN), the Sustainable Development Goals (UN), Sustainable Globalization (WB), Sustainable Economic Growth (IMF), the commitment to foster international trade by opening borders (WTO) and within the private sector Corporate Social Responsibility (CSR), again, among many others. (Drexhage & Murphy, 2010).

Such endorsement of SD has resulted counterproductive in many occasions because some of the parties adopting the concept, do so to justify policies and practices that by no means are in consonance with the principles of this development approach (McNeill, 2006). To briefly show how different the interpretations of sustainable development can be, the following examples can be used: The Sustainable Development Goals of the 2030 Agenda (2015), which is a United Nations interpretation and policy adopted by all UN Estate members; the ideas of Herman E. Daly (1990), former Senior Economist in the Environment Department of the World Bank and the initiative of Sustainable Globalization advanced by this institution.

The Sustainable Development Goals of the Agenda 2030 is a set of 17 goals defined in 2015 through an evolutive process, since they derived from former similar initiatives (The Millennium Development Goals). It is understandable that from the perspective of the United Nations, SD is a process desired for human and planetary well-being for today and for the future, possible via the accomplishment of these interwoven objectives (Goals). The overarching goal is peace and prosperity for human society and the environment, as explicitly recognized by the UN and in short, in order to achieve this, poverty eradication, adequate health, social equity, adequate education, environmentally respectful lifestyle and global cooperation are needed (UN, no date). As it will be noticed further on, these aspects tend to be ever more included in the new perspectives of sustainable development.

Daly's Comment on SD (1990) is another example of a rather unique understanding of the concept. In the beginning, he shows a convincing understanding of it, making an accurate distinction between sustainable growth and sustainable development and stressing that development is a conceptual category associated with a qualitative component whereas that

of growth is linked to a quantitative perspective. It is not possible to have continued growth in a finite system (Earth), thus, to sustain growth is simply not possible, it is, in his own words, an oxymoron. Furthermore, Daly criticized Brundtland's position because, on one hand, the former Prime Minister of Norway and Chairwoman of the World Commission on Environment and Development (1983) was advocating for a sustainable development in the Report, but on the other hand urging economy to grow by a factor of 5 or 10, which again, is simply contradictory. Nonetheless, after this in further developing his ideas, Daly shows a very economic point of view on his understanding of sustainable development, advocating for maximum yields in production with yes, an undeniably environmental component but also with an arguable perspective on equity.

Closely to the latter view, that of the World Bank and its now Inclusive and Sustainable Globalisation, also shows a very economic perspective. They celebrate the fact that poverty has been partially alleviated via export-led growth and that these trades begin to be South-South as well, although the main flows of supplies continue to be South-North, they recognize as well that there is still a lot to do in this matter. They show a strong concern and commitment towards the environment as well as adherence to the Millennium Development Goals, they also acknowledge that achieving development is not entirely relying on the role of money but also on strong institutions, zero corruption, eradicating hunger and other aspects related to social justice. Nonetheless, the strategy advanced by the institution is, naturally, enhancing economic growth (Zoellick, 2007).

The last paragraphs show a general view on the differences in understanding the SD concept and the policy or action each produce, but it is important not only to note such differences but also the position of the stakeholders who promote those particular understandings and policies and the historical moment in which they do so. In the following, the origins of the concept will be explain to gain insights on the essence of its meaning.

## **2.2. Sustainable Development: Origins and Development of the Concept**

During the second half of the 17th Century and the first of the 18th, widespread wood shortages in central Europe, and the impacts these represented in the incipient industrial activities and urbanization processes served as the breeding ground for searching for techniques of resources management. The goal of using resources in accordance with natural limits, social well being, and adequate economic performance was at the core of this pioneer ideas. In this context, the concept of sustainability was first used by Hanns Carl von Carlowitz in his work titled *Sylvicultura Oeconomica oder Hauswirthliches Nachricht und*

*Naturmässige Anweisung zur Wilden Baum-Zucht* (1713). In the following years, not only the concept experimented a remarkable endorsement in forestry science, the field from which it emerged, but also it was further developed in other areas (Vehkamäki, 2005).

The latter provides evidence that the problematic interactions between economic activities and the protection of natural resources have been subject to theorization for a long time now. However, the modern conceptualization of this old problem can be traced back to the 50's and at a global scale (Waas et al. 2011). The modern version of the concept was furnished in a context in which an environmental crisis was ever more evident. Crisis that was itself the consequence of a historical process propelled by the idea of progress and economic growth. The Industrial Revolution, the economic system of capitalism and modern science, supported and fostered this process (Du Pisani, 2007).

The end of World War II brought about major changes in the economy, making possible to reach levels of growth not seen yet before. Along with this, the human population also increased and in parallel the intensity on natural resources exploitation. Under these dynamics, the limits of the environment began to be trespassed and as the global community became aware of it, a call for a shift in how progress was being conceived and achieved was made (Wass et al. 2011)

As it has been pointed out "The development economists' tool kit in the fifties contained such theories and concepts as the 'big push' (Rosenstein-Rodan 1943), 'balanced growth' (Nurkse 1953), 'take-off into sustained growth' (Rostow 1956) and 'critical minimum effort thesis' (Leibenstein 1957)" (Thorbecke, 2000: 31). All these views considered development as a direct consequence of economic growth, and growth was in turn seen as the panacea for it would generate an infallible upward movement for everyone in the ladder of progress and well-being, and what is more, it was thought that once the mechanism of growth was started, it would automatically become self-sufficient and self-reinforcing (Hettne, 1983). Under this logic, industrialization was seen as the solution and motor for growth and income increase, particularly in underdeveloped countries (Chenery, 1955).

Events such as the creation of the atomic bomb and the demonstrations of its destructive power, allow humankind for the first time to realize that it had achieved the means and power to destroy nature entirely. This, together with the impacts of industrialization causing inedit damage in the environment, shaped greatly environmental awareness. The nocive effects of the radioactive pollution became a serious preoccupation for scientific circles

around 1958; some years later, the consequences of the use of pesticides became also an environmental alarm “activated” in 1962 with the publication of the *Silent Spring* by Rachel Carson; and in 1968 *The Population Bomb* by Paul Ehrlich warned the demographic growth stood as a new serious threat. To the latter, other preoccupations appeared also in the list: the oil industry with eventual oil spills, car industry and the emissions for the use of fossil fuel, the generation of solid waste and others, all became problems seriously threatening humankind and the planet stability (Worster, 2008).

To worsen the situation, whereas these negative effects were putting at risk the well-being of the human community as a whole, the benefits that industrialization was bringing were more discrete. Only fewer countries in the world were keeping for themselves the proceeds of industrial capitalism and a gap between these and the rest started becoming deeper and deeper. In this way, the uneven distribution of wealth became also another international concern (Du Pisani, 2007).

The publication on *The Limits of Growth* (1972) became a cornerstone for environmental thinking in this context of growth. The objective of such publication was clear, and aimed at advertising the global society of the wrong path development had taken by equalizing it to the idea of growth. It was stated that if the planet was to be preserved for the well-being of the present and afore generations, action should take place immediately to stop the destructive process that development was causing (Watts, 1972). Five major concerns motivated The Club of Rome to make a call (*The Limits of Growth*) on the threatening situation: accelerating industrialization, rapid population growth, widespread malnutrition, depletion of nonrenewable resources and deteriorating environment (Meadows et al. 1972).

The first international political and scientific cooperation attempt to conceptualize and try to give solution to the problems described above was the UN Conference on Human Environment in 1972. This was an international gathering held in Stockholm. From this, the United Nations Environmental Programme was established (UNEP). Later on, in 1980, the World Conservation Strategy was held to further elaborate the outcomes achieved in Stockholm. In this occasion UNEP, World Wild Fund (WWF) and the International Union for Conservation of Nature (IUCN) participated. In 1983, the UN organized the World Commission on Environment and Development (WCED) aiming at creating awareness on the constraints that environmental deterioration represented for economic and social development and after four years of work, the Commission elaborated and delivered the report *Our Common Future* (1987) (Drexhage & Murphy, 2010).



The problematics discussed in the frame of the WCED had already been discussed before in one way or another, either in individual publications or in the frame of the conferences mentioned above, and by this moment, the term itself was no longer a complete novelty. It was evident that economic growth was causing negative impacts on the environment and that society was achieving uneven levels of wealth. Thus, the Report emphasized the importance of promoting global equity, a redistribution of resources and the economic growth particularly in non-industrialized countries. It stated that it was possible to reconcile and merge into a single goal the need of continue to grow economically, attending social inequity and protect the environment (Du Pisani, 2007).

As it was stated before, the endorsement of the concept did not represent any problem. It became a *hit* right after it was released in Our Common Future (1987) and ratified its success as a political and popular trend worldwide after the Rio Summit (1992). The problem has been to achieve operability and this remains valid till our days. By 1997, in the frame of the Earth Summit +5 in New York, the UN General Assembly established that the general global trends represented a bigger challenge of those in the Rio Summit and that there was still much to do in regard to achieving sustainable development (Agenda 21 objectives). Five years later, during the World Summit on Sustainable Development held in Johannesburg, again, the pronouncement of the UN was not very optimistic. The UN Secretary-General, Kofi Annan, announced that the process for achieving the goals was slower due to a gap in implementation (Drexhage & Murphy, 2010).

The latter paragraphs show the scenario in which the concept of SD was furnished and from which it evolved. This allows us to see from a general perspective what is the goal behind this development paradigm and thus, it allows us to begin to elaborate a characterization of it. In the following, the aspects that have hampered the clarity and operability of SD will be explained, followed by the exposition of those aspects that better depict it.

### **2.3. Aspects Constraining Conceptual Clarity and Operability of the Concept**

As has been observed, one of the main reasons making difficult to implement sustainable development is the fact that it is interpreted in so many different ways. This generates outcomes pointing at not only different but sometimes even opposite directions (Giovannoni & Fabietti, 2014).

From a formal perspective, the use of similar terminology in scientific papers can contribute to explaining such ambiguity in its interpretation: *sustainable development*, *sustainable* and

*sustainability*. These three different terms are frequently used in different context and even when there are slight differences in the use of the terms, for instance some authors considering marginally the environmental component, give a more economic connotation to the term sustainable development whereas to that of sustainability give a broader connotation associated to the notion of human well-being within the limits of the natural base of life. However, there is no agreement on the matter and the proximity of both terms and the also indiscriminate use of them in other papers gives the possibility to have them as perfect synonyms. Furthermore, the use of *sustainable* as a complementary adjective to denote sectoral activities such as education, transportation, agriculture, livelihoods, and others, also refers to the applicable principles of sustainable development. Finally, sustainability can also be another way to refer to SD without changing the meaning of it (Waas, 2011).

Furthermore, according to Drexhage and Murphy (2010) the implementation of sustainable development has been a constraint because of the different tendencies within. This refers to the difficulty of merging in practice the three elements of SD: economic, social and environmental. Normally, either one or another is privileged in the detriment of the others. This has been a problem manifested mostly at the international level, in negotiations and in attempts to coordinate the efforts for implementation of strategies. As the authors explain, the convening power of the UN Commission on Sustainable Development (CSD) has reached, above all, the attendance of environmental agencies from the Estate members and this, on one hand, shows how sustainable development is being understood by the Members, mostly as an environmental concern. On another hand, it makes it difficult to achieve actual progress because such agencies, the environmental ministries, are those that tend to have less decision making power in their respective countries. This means that the seeds fall on the less fertile soil.

Similarly, others have stated that the big problem constraining substantial achievements on sustainable development has been the failure in merging the environmental and economic components in decision making in all sectors, but particularly in the governmental sector where environmental ministries have been given the task of repairing the consequences of the traditional sectoral policies at the time that they do not really have the means to do so because they are generally the weakest ministries in terms of budget and influence power (McNeil, 2006).

Also it has been identified that at the domestic level, several governments adopting SD as part of their goals have linked this development mode to continued growth. For them, the

change has consisted only in adding to their growth preoccupations an environmental component. Or in other words, a sort of green conscience now figures along the growth agendas, materialized in destining budgets for covering the traditional way of making business with a green curtain. Developed economies have done this and also some of the more advanced developing ones have followed this tendency too (Drexhage & Murphy, 2010).

This kind of tensions among the three elements of the concept have been also evident in the frame of international conferences. For instance, during the Rio Summit the focus was mainly on the environmental challenges, whereas during the Johannesburg Summit, the focus was placed on the economic and growing concerns. It was also evident after these events that in defining SD agendas, the historic moment in which negotiations take place is of high influence as well as the stakeholders taking part in the negotiations (Drexhage & Murphy, 2010).

An eloquent example of the latter, though only one among many others, is the case of the sustainability tendencies advanced from the ecological trench in which there is no consideration or very little to humankind neither in the present nor in the future (Palmer, Cooper & van der Vorst, 1997).

#### **2.4. Towards an operative characterization of the concept**

As has been pointed out, the most popular definition of the concept not necessarily accounts for an exhaustive characterization of it. In the same document (Brundtland Report) the concept was broader defined (McNeil, 2006; Kate et al. 2006). Jim McNeil -Former Secretary-General of the WCED and lead author of Our Common Future- years after the Report was published, stated that beyond that sole definition that became popular, the concept deeply contested the system of values on which growth and progress had been based on, as well as the way humankind had related to nature within that frame of progress. The concept, he added, was released as a call for a radical change and defined in a comprehensive way that included ethical, social and environmental aspects (McNeil, 2006).

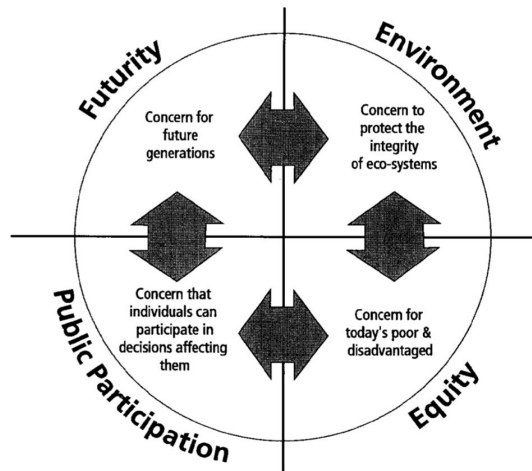
Indeed, sustainable development aims at much more than that intergenerational compromise that has become the flag of the concept. The ambiguity may be due to the absence of a formal explicit definition of it in the Report. In the section referred directly to Sustainable Development is possible to identify references to yes, future generations, but also to the environment and its limits, to adequate population size, to technology, to social

organization, to a new way of economic growth and equity, to political action and social participation. It makes a call for a change in consumption regimes and very importantly, it stresses out that SD is not a fixed state of harmony but a process of constant change aiming always at providing the necessary adjustments in the System, to ensure the well-being of humankind (WCED, 1987).

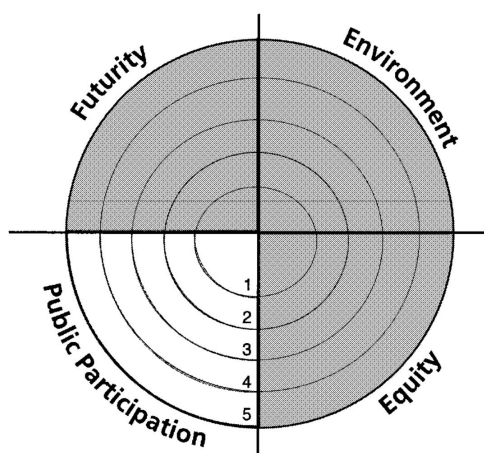
In the following sections of the Report (WCED, 1987), many other aspects regarding the concept are discussed. Nonetheless, it is true that is always possible to read between lines and interpret what is written there in many ways. To avoid this and to step away from arbitrary interpretations it may result useful to review the work of some scholars that have attempted to put clarity in the discussion.

In an attempt to systematize the principles that define SD according to scientific literature, Palmer and colleagues (1997) designed a graphic instrument that allows identifying in which position lies the different social actors advocating for sustainable development. This is a very useful strategy because regardless of the varying interpretations of the concept made by such actors, it is possible to place them in the graphic according to their tendencies and determine what sort of SD they practice: weak or strong (Palmer et al. 1997).

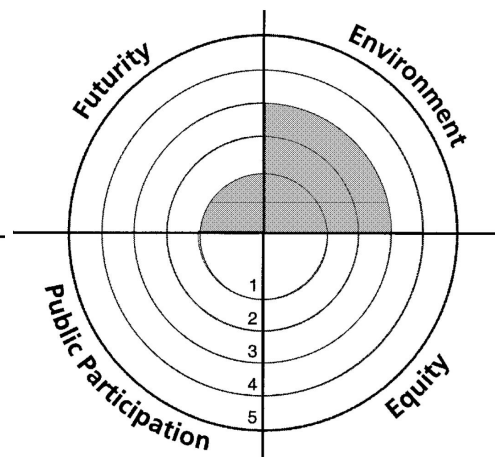
Such weak and strong perspectives of sustainable development are defined in accordance with what is postulated from each position. In this way, weak sustainability represents an understanding and practice of SD that does not aim at making major changes. It maintains the idea that economic growth as it has been fostered is the main means for development and in many occasions relies on technology as the key for the solution for environmental problems; it makes no distinction between natural capital and human-made capital and also gives place to uneven benefit of the proceeds of development. On the contrary, in the strong version of sustainability, actors are concerned with distributing quality of life and resources among all members of society and perform within the limits of ecosystems. The notions of eco-efficiency and eco-justice figure as important references in this position (Palmer et al. 1997).



**Strong Sustainability**



**Weak Sustainability**

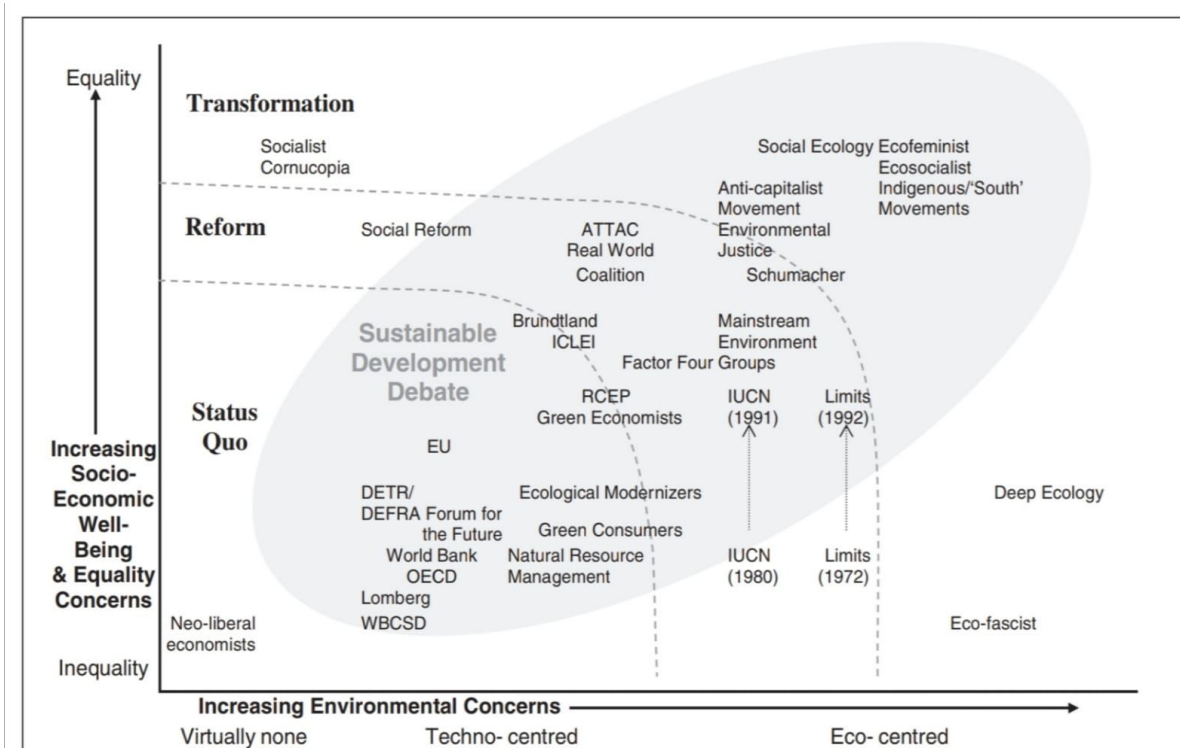


**Graphics 1., 2. and 3. of sustainability**  
**Source: Palmer et al. 1997**

In another attempt to illustrate different positions within the sustainable development discourse, Hopwood and colleagues mapped three different positions in an interesting graphic. They refer to these positions as Status Quo, Reform and Transformation. Each of these positions entails different levels of action to achieve the corresponding goal according to what is perceived as problematic from each position.

The idea in the first position (Status Quo) is that certain adjustments are needed but despite such need, there are no major problems constraining development for humanity nor unbeatable threats to the environment. From this point of view development still has a strong link with economic growth and business, market, privatization, among others alike are the

means to reach sustainable development. No changes regarding power relations, decision making nor social justice are of relevant consequences (Hopwood, Mellor & O'brien, 2005).



**Graphic 4. Understanding and positions of sustainable development**  
**Source: Hopwood, Mellor & O'brien, 2005**

The second position (Reform) seeks changes due to the increasing problems but a structural change in the social and economic systems is not thought as necessary, even when some deep changes in lifestyle and policy are seen as beneficial in the long term. Technology, scientific knowledge, informed decision-makers, green economy and markets figure as drivers for the desired change. It is worth to mention that from this viewpoint the role of government and governance have major consequences in reshaping the system towards sustainable development (Hopwood, Mellor & O'brien, 2005).

The third position (Transformation) corresponds to a lobby that believes that there is no other way to stop the mounting problems in today's global society but a radical shift, from the roots, in the way individuals and social groups interrelate among each other and the way they relate to nature, because to them most people, as well as the environment, is being exploited by a minority. In this lobby, economic and power structures of society are generating the problems, thus the removal of such structures is mandatory. Among the supporters in this position, some focus on the environmental problems and because of that their concerns have to do specifically with it -even from a very anti-human approach in some

cases-, others on socioeconomic aspects and some pay attention to both components (Hopwood, Mellor & O'brien, 2005).

The latter attempts to characterize SD result very useful as an assessment tool, both of them allow to weight conceptions and actions of SD without reducing the concept to a unique fixed definition. As has been observed, sustainable development can, in fact, have different meanings. It is a remarkably broad concept that has been used to refer to aspects related to environment and socioeconomic issues (Hopwood, Mellor & O'brien, 2005). The delimitation of the term, as pointed out by Drexhage & Murphy (2010), depends largely on the historical moment in which a discussion for such purpose takes place and on the power of influence of the participants too. On another hand, it has been argued that this flexibility should not be regarded as a weakness but rather as the characteristic that provides it with an important analytical capacity. Like this, it remains open to different times, open to different societies, open to different ecosystems, to different contexts. It is fundamental, however, that such openness of the concept remains in constant dialogue with a series of core fixed principles (Kate et al. 2016). And this is what the concept offers, it provides critical thinking on traditional conceptions of development and the actions supported by these conceptions, and it provides a set of values for a positive shift (Waas et al. 2011).

### **3. Biosphere Reserves: An Overview**

In 1968, the United Nation Educational Scientific and Cultural Organization (UNESCO) celebrated in Paris the Conference on Rational Use and Conservation of the Resources of the Biosphere. This conference served as the breeding ground for both the Man and the Biosphere Program (MaB) and the biosphere reserves (BR) as its conceptual and empirical instrument, which figures as an innovative type of protected area (Batisse, 1993).

MaB (1970) was launched with the objective of establishing from a scientific and multidisciplinary perspective the basis to improve the relationship between people and their environments and it explicitly seeks to promote innovative forms of economic development that are socially and culturally appropriate, as well as environmentally sustainable (UNESCO, 2017). As Michael Batisse, former vice general director of UNESCO stated, the title of the 1968 conference had a strong articulation with what in present days is called sustainable development and therefore, MaB could represent the first international effort to find pathways for sustainable development and biosphere reserves the means to achieve such goal (Batisse, 1993).

The biosphere reserve concept was coined in 1974 and the philosophy behind it was to look after people first when dealing with protecting nature (Vernhes, 1993). Today, UNESCO refers to BR as areas where terrestrial, coastal and marine ecosystems are protected from a perspective in which the interests on the social and on the natural are brought together, “(...) reconciling the conservation of biodiversity with its sustainable use” (UNESCO, 2017).

The founding reasons of BR were to “adequately protecting world’s biodiversity, ensuring that local communities truly benefit from protected areas as part of rural development, providing facilities for co-ordinated research and monitoring, and training and capacity building” (Vernhes, 1993). Thus, the three main goals of BR are biodiversity conservation, ecological research, and experimentation of different forms of sustainable development, which are implemented through a specific zoning arrangement (Batisse, 1993).

Such zoning has the objective of contributing to the achievement of the goals of these PA. There can be one or more core zones in which a strong restriction of consumptive use of natural resources is implemented, then the buffer zone where adequate and sustainable use of resources takes place. Finally the transition zone, from which the sustainable use of resources is promoted to the surrounding areas (De la Vega-Leinert & Stoll-Kleemann, 2012).

### **3.1. Biosphere Reserves and Sustainable Development**

The implementation of biosphere reserves has gone through different phases. The first BR were devoted more to the conservation and restoration of ecosystems as well as research and monitoring. Most of the reserves during this first phase were created in developed countries. From 1984, the focus of BR broadened more explicitly to the sustainable use of natural resources within the buffer and transition zones. Finally, from 1995 to these functions, the mandatory participation of local communities in decision-making processes was added as well as goals like fostering new ways of adequate and sustainable use of natural resources and alternative income sources for the local population (De la Vega-Leinert & Stoll-Kleemann, 2012).

According to the Lima Action Plan, the goal of biosphere reserves around the world is to concentrate efforts to contribute to build a global society concern with the protection and restoration of natural resources and their environmental services, with the sustainable use of natural resources, fostering equality, healthy and sustainable communities and prosper



human settlements and economies in accordance to the limits and capacities of the biosphere (LAP, 2016).

However, it is relevant to consider that even when there exists an institutionalized effort (The MaB and the World Network of biosphere reserves) to standardize how BR are meant to be managed, the institutional and legislative context of each reserve has a strong influence in how such management results in reality (De la Vega-Leinert & Stoll-Kleemann, 2012). In this sense, one of the problematics identified by many researchers in these PA is their management. This is related to the fact that the interests of different social actors converge in these sites, especially in non-developed countries where the livelihoods of local populations depend directly on the natural resources that are to be protected (Brenner, 2012) and It cannot be denied that PA undergo a large number of pressures, for instance, demographic growth and encroaching of ecological vulnerable zones through settlements, agriculture and cattle, mass tourism, natural resources exploitation, weak institutional presence, among others (Brenner, 2008).

On another hand, the influence of a biosphere reserve can serve as a melting pot for diverse positive processes in which the expertise of different NGO, researchers, businesses, and the financial support of international and national institutions can converge (Brenner, 2012). In this scenario to some researchers is clear that the model of biosphere reserves has proved to have high potential in the pursuit of sustainable development in different socioeconomic context around the world (Brenner & Job, 2012).

Up to date, there are 669 biosphere reserves in 120 countries around the world (UNESCO, 2017) and the surface covered by these is of 680 million ha among terrestrial, coastal and marine areas (UNESCO, 2017). Mexico is one of the countries with higher numbers of BR decreed and in the national territory, such reserves cover more than 6% of its surface and also account for more than 50% of the PA under federal jurisdiction. Finally, 4 of these reserves have been recognized as Natural Human Heritage (Brenner, 2012).

### **3.2. Biosphere Reserves and Sustainable Livelihoods**

As it will be seen after section 4, BR and SL observe close coincidences in their objectives. However, it can be advanced that United Nations, through the implementation of the Man and Biosphere program (2015-2025), aims at managing biosphere reserves in a way that by means of their adequate environmental functioning and sound administrative operations, Sustainable Development Goals (SDG) of Agenda 2030 can be achieved (LAP, 2016).

LAP emphasizes the importance of standardizing from a prescriptive approach and with concrete actions, specific ways of management that contribute to the generation of the necessary processes and conditions in biosphere reserves, capable of fostering prosper societies in harmony with the biosphere. LAP is constituted by a series of general objectives disaggregated into a wider number of them but representing concrete actions (LAP, 2016).

For instance, in order to contribute to achieve general objective A1, on supporting the recognition of BR as models for environmental management aiming at achieving SDG in the frame of multilateral environmental agreements, one of the concrete actions stipulated is, action A1.3, to establish alliances at local, regional and international level to support environmental conservation and development processes for local populations. This, as it will be seen, has a strong relationships with the notion of Social Capital in the sustainable livelihood approach. Similarly, action B1.2 on the organization of programs for the development of knowledge, capacities, and skills, observes a close relation with the notion of Human Capital (LAP, 2016).

#### **4. Sustainable livelihoods**

##### **4.1. An Overview**

The emergence of the sustainable livelihood approach corresponds to the acknowledgment of the limitations of viewpoints like the agricultural economy and rural development to understand processes of development in rural contexts (Ávila, 2014). As it has been recognized, rural populations tend to be less benefited or have less access to social benefits like education services, health, and sanitation, especially in low-income countries (Carney, 1999). For this reason, the indicators designed to measure development in industrialized societies are not pertinent for the rural ones (Chambers and Gordon, 1991).

The sustainable livelihood approach opens space for a broader analysis of the causes of poverty, whereas perspectives such as the dependency theory and neo-Marxism settled the boundaries of this problematic within structuralism. In so doing, the action of individuals and the relevance of specific local dynamics and assets become active variables in fostering or constraining processes of development. Furthermore, the way in which development is understood also experimented a shift (de Haan and Zoomers, 2005). The Sustainable livelihood approach incorporates theoretical constructs from poverty studies and considers different ways of household diversification strategies which allow transcending the economic bias of other theoretical perspectives (Ávila, 2014).

The SL approach makes possible to focus on the actual potential of communities from a local perspective, in the dynamics of natural resources management stressing out the possible pathways to development and assessing the economic, natural and social challenges in the present and for the future (Sánchez & García-Frapolli, 2014). It is an approach centered on the potential of people and communities, their context, aspirations and the local institutional structures (Carney, 1999).

Livelihoods rely on human, environmental, economic, social and institutional factors, and is possible to consider a livelihood sustainable when there is capacity to resist internal and external perturbations, when there is not dependency on external support or if so, such support can be constant and sustain throughout the time, when the livelihood itself does not compromise the natural resources reproduction in quantity and quality, and when they do not constraint the livelihood of others (See Ávila, 2014).

#### **4.2. Sustainable Livelihoods: A Renewed Approach to Development**

In this train of thought, some authors (Chambers and Gordon, 1991) have criticized the statism of conceptual instruments with which poverty and development have been analyzed and tried to be alleviated and fostered respectively. They refer to this as conventional conservatism in values, concepts and methods and explain that such scientific and professional attitudes are based on narrow conceptual assumptions and measurement generalizations. Production, employment, and income are, as the authors argue, indicators for industrialized societies and are unable to capture the dynamics of rural ones.

The sustainable livelihood approach incorporates the elements of the new conceptualization of poverty. On this, the publication of *The New Poverty Agenda* in the 90's contributed greatly by broadening the traditional approach in which the poverty phenomenon was understood as a linear consequence of money scarcity. Further on, the renovated understanding of poverty and development was connected with the ideas of Amartya Sen on capabilities and entitlements and the inclusion of new conceptual categories such as participation and empowerment in development studies (Robles-Zavala, 2014).

The contributions made by the New Poverty Agenda provided elements to revitalize the debate on poverty in many respects. The understanding and the measurement of the phenomenon were at the core of this renewed debate as well as the strategies to alleviate such conditions (Baulch, 1996).

Based on a six-level pyramid, Baulch (1996) illustrates the aspects included in the different approaches to poverty. The top layer constitutes a focus centered on private consumption (PC) and it is the most commonly adopted approach to poverty in empirical studies. The second layer integrates common property resources (CPR) and the third one includes also state-provided commodities (SPC). These other two layers are also included in the traditional approach to poverty, however, in practical terms are more difficult to measure and therefore frequently ignored.

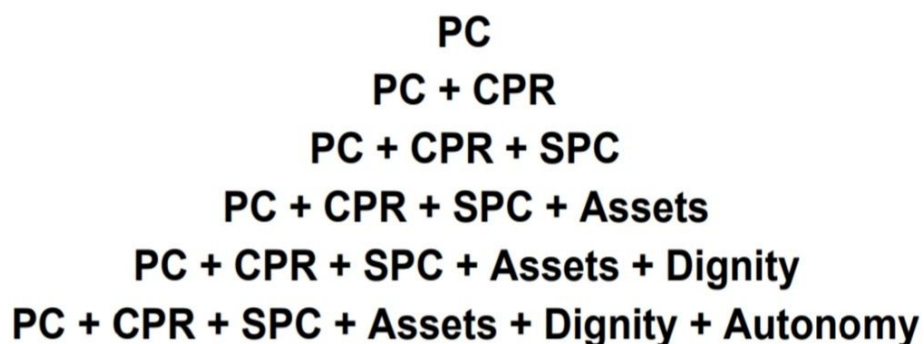


Image 1. Elements in different poverty conceptions

Source: Baulch, 1996

As the author explains, the focus of the revitalized poverty conception pays attention on the aspects included from the fourth layer down. However, as the attention goes down in the pyramid, the methodological constraints scale up (Baulch, 1996).

On his turn, Amartya Sen gave the discussion of the development a new direction. He defined development in opposition to the negative impacts on individuals' lives and societies, originated in systemic deprivations of social welfare, bad conditions of social services such as health and education, and scarcity of economic opportunities among others. Within the development discussion, he gave individual freedom a great relevance because it is precisely freedom what allows people to procure, by self-determination, their well-being (Sen, 2000). Following this line, Sen coined the concept of capabilities, stressing out these as the actual vehicle for achieving well-being and a positive and successful life (Ávila, 2014).

Capabilities figure as one of the three fundamental elements for SL, along with equity and sustainability. In Sen's thinking such capabilities appear as a broad idea, as a broad conceptual category, that refers to the access to a diversity of basic but very important

situations in individuals' lives, such as being adequately nourished, being healthy, participate actively in social circuits and many others alike. These enhance capabilities, thus allowing individuals to make a profit of the context that surrounds them, to take advantage of livelihood opportunities and thus to develop (Chambers and Gordon, 1991).

From an empirical perspective, the identification of success in livelihood strategies has been observed, indeed, to be related to the access that people have to different assets such as credits, skills, land, contact, and support with and from institutions, etc. The specificities in these are highly contextual but there is enough evidence to say that successful livelihoods are highly dependent on the possibilities to gain access to those assets and to combine them adequately (Bebbington, 1999).

Before continuing it is important to take some space to clarify the use of the terminology in the literature on SL. The concept of capabilities is a key element within this discussion and so are the terms of capitals, assets, endowments or entitlements. Thus, it is important to mention that in some cases, depending on the authors and schools of thought, the use of the terminology can be somehow ambiguous. On this, Amartya Sen explains the connection and the contrast of the terms human capital and human capability (Capabilities). Skills, knowledge, and effort are categories associated with the human capital term, as it will be explained further on. These contribute to enhance production possibilities, whereas human capability refers to a series of broader possibilities that can be included in the ability to live a positive and satisfactory life according to people's values. Human capital is possible to accumulate whereas human capability is possible to expand (Sen, 1997).

In this way, the expansion of capabilities relies not only on the accumulation of human capital but also on the accumulation of other kinds of capital or assets as mentioned before (Bebbington, 1999). From the SL approach the concept of wellbeing -notion associated with that of development- is not necessarily based on monetary variables, it is rather related to the capacity of societies and individuals to acquire benefits from different sorts of capitals. In this train of thoughts, the role of culture, nature, institutions, governance, markets among many others are of high relevance (Ávila, 2014)

#### **4.2. Sustainable Livelihoods: An Analytical Tool**

The idea of capitals lays at the core of this approach. According to the literature specialized on SL, the capitals on which households and communities depend are human capital, natural capital, material capital, financial capital, and social capital. Some of these are

relatively easy to distinguish but some others are more complex and very context and case dependent (Ávila, Saad & Fierros, 2014).

Furthermore, according to each research case some variables of these capitals are considered in different categories. For instance, livestock in some cases is considered in the category of material capital (Also denominated physical capital) and in some others in that of natural capital (See for instance: Ávila, Saad & Fierros, 2014 and Róbles-Zavala, 2014). It is also possible to note that the labeling of some capitals coincides or varies from one author to another although the relevant aspects are usually included. For instance, human and cultural capital share many characteristics but still are referred to by different terminology, which is absolutely pertinent, as some authors have explained (Thorsby, 1999). In the same way, material capital tends to be referred to as infrastructural capital to emphasize the aspects of interest according to the objectives of the authors (Sánchez & García-Frapolli, 2014).

It is also relevant to mention that the emphasis on the importance of these capitals varies according to the objectives and perspectives of each study. For instance, some studies pay attention to the outcomes in generating human capital in afore generations in the mixed of previous human capital and financial capital at the household level and the interaction of those two with social capital. In this case social capital figures as the determinant variable (Teachman, Paasch & Carver, 1997). From some others perspective, it is argued that natural capital is the main factor for achieving progress in life because human ingenuity will never suffice to create human-made capital without a natural base, but on the other hand it is acknowledged that in order to reach sustainability, cultural capital is the determinant factor (Berkes & Folke, 1991). Finally, some others argue that human capital is the base for all trajectories of development for humans are the force behind such trajectories (Olaniyan & Okemakinde, 2008).

Despite the latter, an aspect that is possible to find in all papers is the interrelation among capitals. This is always stressed out in the literature, notwithstanding the schools of thought and disciplines (See Sánchez & García-Frapolli, 2014; Teachman, Paasch & Carver, 1997; Schultz, 1961; among others).

Now, it is relevant to say that access to all these capitals is highly influenced by different elements such as history, politics, geography, gender, among others (Sánchez, 2014). In this, the local institutional context constitutes a relevant element for the analysis, as well as the context of vulnerability, as drivers for change.

In the following, each of these 5 capitals is explained and after, at the end of the section it is described how these capitals play their respective role in the sustainable livelihood framework.

#### **4.2.1. Human Capital**

To some authors, human capital is what ultimately defines society's economic and social development processes and not other kinds of capital. They argue that unlike natural capital or financial capital, human capital is dynamic, active, thus, the force behind the whole machinery of development. Even social organization and institutions are derived from human capital (Cited in Olaniyan & Okemakinde, 2008). Other authors provide evidence of the latter by stating that weak economies struggle to absorb transferred capital from outside and put it into productive use. They explain that even when this is an unexpected outcome since it is generally assumed that capital is what such countries need to make their economies take off, this capital is usually constituted by productive goods or consumer stock and disregarding the material capital available, if human resources are not in conditions to make the most profit of the resources available little progress can be achieved (Schultz, 1961).

Human capital is related to the capacities of the people at the household, community or national level to carry out productive activities. Thus, it has a strong relation with education, training, health situation and other elements contributing to the adequate performance of individuals in productive activities and decision making (Robles-Zavala, 2014).

The aspects at stake in the accumulation of human capital vary from one author to another as well as the terminology used to refer to equivalent phenomena, however It is important to make an effort to distinguish the different elements. According to some authors, there are three important elements in human capital: 1) early ability, which can be innate or acquired at a very early stage of a person life, 2) qualifications and knowledge, which is acquired through formal education and 3) skills, competences and expertise, which are obtained in situ, while performing productive activities (Blundell et al. 1999)

In human capital theory, formal education figures as a cornerstone. Within this frame and from an economic point of view education is seen as a productive good that contributes to generating valuable societies. In this sense, higher standards of living are strongly associated with more educated people (Olaniyan & Okemakinde, 2008). As recognized from the beginnings of this conceptualization, back in the decade of 1960, higher earnings in the

labor and productive market were strongly correlated with better health conditions and better education, usually measured by the number of schooling years (Schultz, 1961). Nonetheless, others argue that schooling years not necessarily guarantee access to better job opportunities or better labor markets because more specific criteria are at stake to reach such an outcome. For instance, the field of knowledge in which people get an education, because, in a market economy four years of Engineering are more likely to generate more substantial proceeds than four years of Philosophy (Blundell et al. 1999).

Despite the dominance of formal education as the main driver in building human capital, other inputs have been stressed out as well. On-the-job training is another important form of input in human capital formation. Many workers acquire and improve their productive capacities while carrying out their job. This kind of human capital investment is more productive in terms of cost/benefits because the productive process is being supplied by human resources generating and accumulating human capital (skills) as they work (Becker, 1962). This can occur through workshops and courses or informal training (Blundell et al. 1999).

In relation to the process of formation of human capital, some authors stress out three important elements: 1) transfer of productive and valuable knowledge to forthcoming generations, 2) cultivating in new generations the skills to develop new products, new productive processes, and methods (Applied knowledge), and 3) Innovative knowledge to develop brand new ideas, products, services, etc. (Cited in Olaniyan & Okemakinde, 2008).

Besides education and skills, health is another aspect frequently included in the human capital theory. This is based on the assumption that better health conditions in workers represent more adequate mental and physical aptitudes to perform their labor, thus, to be more productive. The condition of health is assessed in different ways, for instance, using anthropometric data such as weight, height, and body mass index, life expectancy, but also data from self-assessed health condition surveys, the presence of chronic illnesses in the populations studied, observed health-related impediments in performing productive tasks, and others alike are also commonly used for this purpose (López-Casanovas, Rivera & Currais, 2005)

Health problems such as alcoholism, smoking, obesity, drug consumption, sedentarism, have been identified to reduce productivity by promoting absenteeism and degrading human capital. This is frequently observed in developing economies (López-Casanovas, Rivera &



Currais, 2005). Similarly, it has been found out from case studies that in the Mexican rural context alcoholism is a common condition mining human capital and constraining possibilities for development at the household and community level and that it affects youngsters too (Robles-Zavala, 2014).

Finally, the availability of food is also an important aspect affecting health conditions and thus human capital. In this sense, scarcity of proteins in the regular intake has been identified to mine human capital, especially during childhood (Robles-Zavala, 2014).

#### **4.2.2. Natural capital**

In short, the concept of natural capital (NC) refers to “the living and nonliving components of ecosystems -other than people and what they manufacture- that contribute to the generation of goods and services of value for people” (Guerry et al. 2015: 7349). It is constituted by renewable and non-renewable resources such as water, land, soil, wildlife, and biodiversity in general (Ávila, Saad & Fierros, 2014).

To some authors, natural capital includes all natural assets from which households and communities obtain different benefits with or without human intervention. For instance, the presence of forest constitutes an element of the natural capital concept because it provides environmental benefits such as carbon sequestration, supports the water cycle and contributes to the availability of such resources. Also, the availability of fertile soils for agriculture constitutes an important natural capital (Robles-Zavala, 2014). Aquatic habitats supporting fish population and other species of human interest and the existence of aesthetic mountains and landscapes or marinescapes are as well part of this concept (Guerry et al. 2015).

As the literature on natural capital is reviewed, it can be noticed that some authors make no clear distinction among the terms of natural capital, natural goods, and ecosystem services. For instance, Berkes and Folke (1991) define natural capital as an aggregate of three main components: 1) nonrenewable resources such as minerals and oil, 2) renewable resources such as freshwater, fish stocks, and wood and 3) environmental services such as the generation of soils, waste assimilation, and climate regulation. Other authors state that the concept of natural capital refers to a stock of natural resources or environmental assets, providing a flow of useful goods or services in the present and into the future, and that frequently the capacity of the atmosphere to absorb pollution and other life support functions are as well included in the concept (McDonald, Hanley & Moffat, 1999).

For analytical purposes, it results useful to make a clear distinction between the concept of natural capital itself and the series of benefits from such capital derive. On this, Constanza and Daly (1992: 38) offer an example: "(...) a stock or population of trees or fish provides a flow or annual yield of new trees or fish, a flow that can be sustainable year after year. The sustainable flow is "natural income"; the stock that yields the sustainable flow is "natural capital".

From the latter, it can be said that natural capital is composed by a series of natural elements, capable to produce natural goods or services (Natural income) and/or reproduce themselves in a substitutive manner, generating in this reproductive process a consumable lot of stock (Natural income). in this train of thought, at the core of the concept lies the productive capacity of any given natural asset.

There are two types of natural capital, renewable or active and nonrenewable or inactive. The first kind is self-maintaining only with the input of solar energy and yields a constant flow of ecosystem services without human intervention. Nonetheless, this kind of capital can also be managed or harvested to obtain ecosystem goods. In both cases, harvested or not, it can derived in depreciation, either for inadequate management or for extreme natural stressors. The second type of capital requires human intervention in order to produce natural goods or services and is subject to permanent liquidation. It is important to note that any consumption that requires the running down of natural capital cannot be considered as income (Constanza & Daly, 1992).

Yields or natural incomes are distinct and therefore referred to in different ways. Some authors use the terminology of ecosystem services (ES), and for them, these can be final or intermediate. The first case refers, for instance, to the stock of fish available at any given lake or water body. The second case refers, for instance, to the biophysical conditions that support the habitats that make possible the existence of such stock (Guerry et al. 2015). Similarly, other authors refer to environmental services classification as direct, indirect or mixed. According to this classification, fishery constitutes a direct natural asset because fish can be consumed right after catching them. Timber would be an indirect asset, as it represents the input for manufactured products, such as furniture or input in the construction industry. Finally, freshwater can be both direct or indirect because is a consumable good as drinking water or input for industrial activities or product-manufacturing (Dasgupta, 2010).

Another classification of environmental services, frequently used, can be found in the Millennium Ecosystem Assessment. Here, four types of ecosystem services are identified: 1) supporting, 2) regulating, 3) provisioning and 4) cultural (Robinson et al. 2010)

Finally, it is important to mention that the yields of this capital are highly dependent on macro-environmental dynamics, such as climate change, as well as local ones such as the characteristics of soils or harvesting regimes, for instance. Furthermore, it can also be seasonal, which can constitute a constraint for livelihoods, as documented in some case studies (Robles-Zavala, 2014).

#### **4.2.3. Physical Capital**

Physical capital comprises all the basic public infrastructure and different kinds of means of production (Elizondo et al. 2017). Elements such as roads, buildings, vehicles for transportation, freshwater distribution, work tools, electricity, housing, domestic goods, etc. (Robles-Zavala, 2014).

Physical capital observes a relevant role in people's quality of life. For instance, access to basic public services plays an important role in the creation of conditions of poverty or conditions of development. In the same line, though it is not entirely defined by it, health is as well an important outcome of appropriate physical capital. For instance, lack of adequate sanitation services can derive in bad health conditions, which in turn, reduces the productivity of people and also affects their financial capital (Elizondo et al. 2017).

From the sustainable livelihoods perspective, some of the most commonly assessed elements of physical capital are infrastructure: access to roads and transport; housing and safe buildings, access to water and sanitation, clean and affordable energy and communication (Elizondo et al. 2017).

On the other hand, the case of productive goods or tools for work is absolutely contextual. In this sense, some studies have found that in the context of fishing communities, having fishing equipment figures as a characteristic of well being. This includes boats and fishing nets, for instance. And having less sophisticated equipment or not having it at all is, of course, an indicator of precarity (Robles-Zavala, 2014).

#### **4.2.4. Financial Capital**

The concept of financial capital, in general, is related to monetary resources (Teachman, Paasch & Carver, 1997). To some authors, these resources are represented by flows of income, expenses and savings, and other financial alternatives to procuring their wellbeing, such as credits (Robles-Zavala, 2014).

Access to financial capital is highly relevant because it may constrain or foster acquisition of productive goods to improve productivity or to adapt to market demands. Its availability represents the ability for action in productivity and in other aspects as well, such as access to medical services (Curtiss, 2012).

The consequences of lacking financial capital are highly negative because it is very likely that the productive units enter a negative spiral in these cases. Lack of financial capital hampers acquisition or maintenance of productive goods, generates low levels of labor use, promotes underemployment and under productivity and all these together delay returns, which again, makes it very difficult to reinvest. It is frequent to find cases like this in productive units in rural societies (Curtiss, 2012).

According to some authors, financial capital is usually observed in two general forms: 1) available stock, which includes savings or credit. In turn, savings can be observed in different ways. For instance, cash savings, bank or similar institutions deposits, jewelry livestock or others similar, and 2) regular inflows of money, which include wages or other constant income from productive activities, pensions, federal programs for assistance, payments for environmental services and other alike (Elizondo et al. 2017).

There are some characteristics making financial capital highly important in the frame of livelihoods: its versatility, which means that it is remarkably easy to exchange or to convert, in normal market conditions, into other kinds of capital. And the fact that it makes possible to access directly consumer goods. Nonetheless, it is at the same time the more scarce capital in disadvantaged societies (Elizondo et al. 2017).

#### **4.2.5. Social Capital**

In the same way that occurs with other capitals such as human capital, social capital lacks a universally accepted definition; it also lacks a precise way of measurement. Nonetheless, its analytical usefulness across many fields and disciplines remain factual. Social capital embraces a wide variety of (Naturally) social phenomena. The conceptualization of it

constitutes a statement on the importance of relations for their intrinsic value and for their long reach possibilities on valuable aspects of life (López, 2014).

Regardless of the problematic of consensus on a definition, that one advanced by Pierre Bourdieu is thought to be a benchmark in the matter. The French sociologist defined this capital as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition” (Portes, 1998: 3. Textual reference also in the article cited).

Social capital is related to social networks, trust, reciprocity, collective actions, organization and more (Robles-Zavala, 2014). Family, friends, colleagues, these networks are the ones that contribute with the individuals to achieve goals through formal but also through informal action. Collective actions is the force making possible to build and sustain communities (López, 2014).

Not only tangible elements such as families or sport clubs constitute social capital, also intangible ones. Thus it also related to rules, ideas, information, it contributes to the transfer of knowledge, trade, it reduces the cost of transactions and fosters cooperation, among many others (Yuheng, 2015). Social capital refers also to the participation in decision making, thus, with horizontal management or governmental arrangements (Bebbington, 1999).

Involvement and participation in groups has high potential for leading to positive consequences. This is not a novelty within sociological thinking nor to other disciplines, but the relevance of conceptualizing social relations into the term of social capital resides in the fact that such relations at some given circumstances can become more important, have more influence and be more powerful than money availability or any other kind of material stock. This explains why social capital has become an attractive feature in many circles and disciplines, because it is a non-monetary capital capable of solving problems that from a traditional perspective would require high amounts of monetary investments (Portes, 1998).

On the other hand, it can also be said that (Inadequate or weak) social capital can produce and reproduce negative consequences. On this, some authors argue that the effect that social capital makes on human capital is of high relevance. They establish that even when a family with well-educated parents invest in the education of their children if the social context

within which such children develop is not adequate, the investments in human capital for the children will not necessarily fall on fertile soil. It is clear that social capital has the potential to enhance or dilute the values of human capital in a certain context (Teachman, Paasch & Carver, 1997).

From a similar perspective, it is also argued that a generation of individuals with predecessors from poorer backgrounds, will observe poorer assets than a generation with better background predecessors. The former will not have the same reach in their capabilities even when sharing the same platform of opportunities. This is referred to as inherited poverty (Portes, 1998).

Again, for the latter reasons the potential malleability of social capital presents itself before the eyes of scholars and policy makers as highly attractive, because it can be managed for the pursuit of positive outcomes (Lin et al. 2008).

There are some characteristics that can help to better distinguish social capital from other kinds of capitals because it shares in some cases elements or it is intertwined with other capitals. For instance, the case of information, which essentially is a human capital asset, becomes an outcome of social capital when it is possible to access through interaction with others. In other words, social capital is possible only through the interaction between at least two persons (López, 2014). Furthermore, outcomes of possession of social capital can be converted into economic goods. Nonetheless the processes that make possible the transactions through social capital cannot be traduced into economic outcomes, otherwise it would be merely a traditional market transaction. For the same reason, these processes tend to be characterized by uncertainty because a transaction occurred through social capital usually lacks specific obligations, delimited time frames and uncertain reciprocity terms (Bourdieu cited in Portes, 1998).

Another characteristic is that social capital tends to be function specific; this means that the social capital that is useful for a cause, may not be useful for a different cause (Teachman, Paasch & Carver, 1997). For instance, the networks that can help an individual to obtain a place in a training course may not be useful to help the same individual to obtain a job position after the course.

According to Bourdieu, two elements compose social capital: 1) the social relation itself which allows individuals to access certain goods or benefits and 2) the quality and amount of those goods or benefits (Cited in Portes, 1998). From a similar perspective, other authors find that the elements most commonly assessed from the social capital perspective are: 1) trust, 2) rules and regulations shaping social action, 3) Types of social interaction, 4) Resources obtained from networks and 5) Characteristics of the networks (López, 2014).

Through social capital, individuals can access economic capital in the form of protected markets, subsidized loans, investment tips, to human capital in the way of information, new skills, or more formal stocks such as certificates (Portes, 1998).

From case studies, it has been found that the social networks established at a household level are essential to overcome obstacles. This social links are established with family members, friends and other community members. This represents possibilities for obtaining money as loans or remittances, for instance. Accessing job opportunities also figures as a possibility of these social networks (Robles-Zavala, 2014).

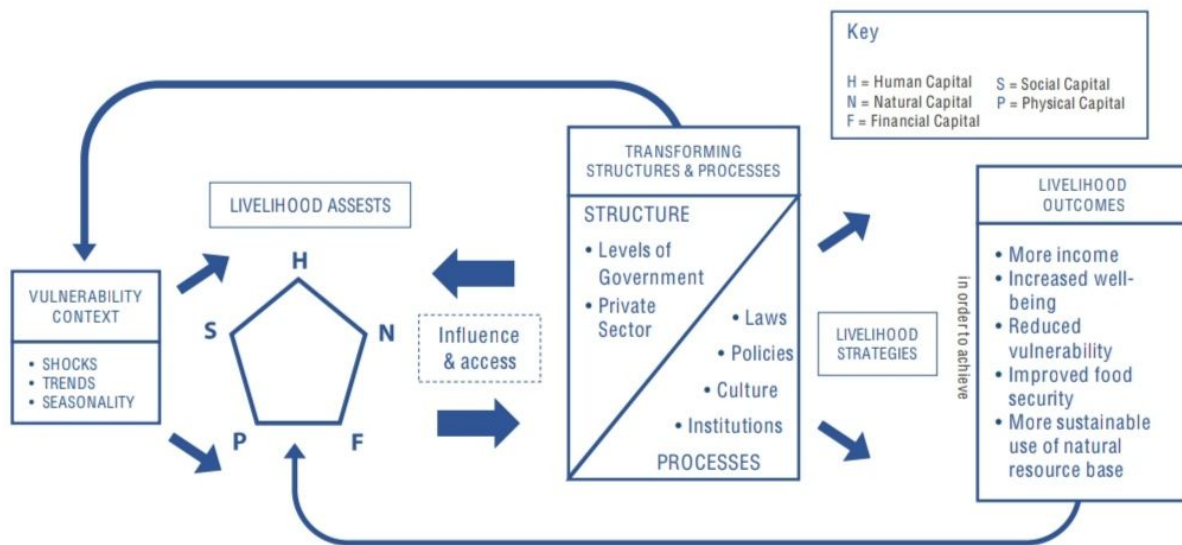
#### **4.3. Operativity of the Sustainable Livelihood Approach**

There exists a dynamic relationship among these 5 capitals. For instance, as it has been observed, it is possible to convert a productive good into financial capital through its commercialization. Or to satisfy the need of labor force with informal agreements with other community members. There are many different possible combinations for this and again, are highly contextual (Robles-Zavala, 2014).

There is also an influence on these 5 assets from a wide variety of elements and the feasibility of social groups to make them effective. For instance, some social factors such as gender, ethnicity or class (Social relations); land ownership, local practices (Institutions); the presence and work of certain NGOs or governmental agencies (Organizations) can modify the processes through which individuals and communities make profit of those assets. Furthermore, these processes can also be influenced by the occurrence of different events such as hurricanes, floods and plagues, among others (Impacts); demographic changes, migration, policies or technology (Tendencies). What comes out of the dynamics of all of the later can be considered as a livelihood (Robles-Zavala, 2014).

Throughout the literature specialized in this approach is possible to find different schemes on the dynamics of each of these capitals and the external factors acting upon them.

Nonetheless, the following is one of the most used schemes and can be found in different studies and in different adapted versions (See for instance Elizondo et al. 2017; Ávila et al. 2014).



**Graphic 5. Dynamics of the Sustainable Livelihoods**  
**Source: Elizondo et al. 2017**

Each of the capitals considered in this approach has different variables that make possible to assess them. Based on different studies using the sustainable livelihoods perspective, Ávila and colleagues found the following among the most commonly used variables for each capital (Ávila, Saad & Fierros, 2014).

Type of capital	Most Frequent variables
Natural	Water availability Renewable natural resources Non-renewable natural resources Biodiversity
Physical	Production inputs Livestock Infrastructure Public services Roads and communication Work tools and machinery
Human	Demographic characteristics Educational level Skills Health conditions Religion and cultural practices



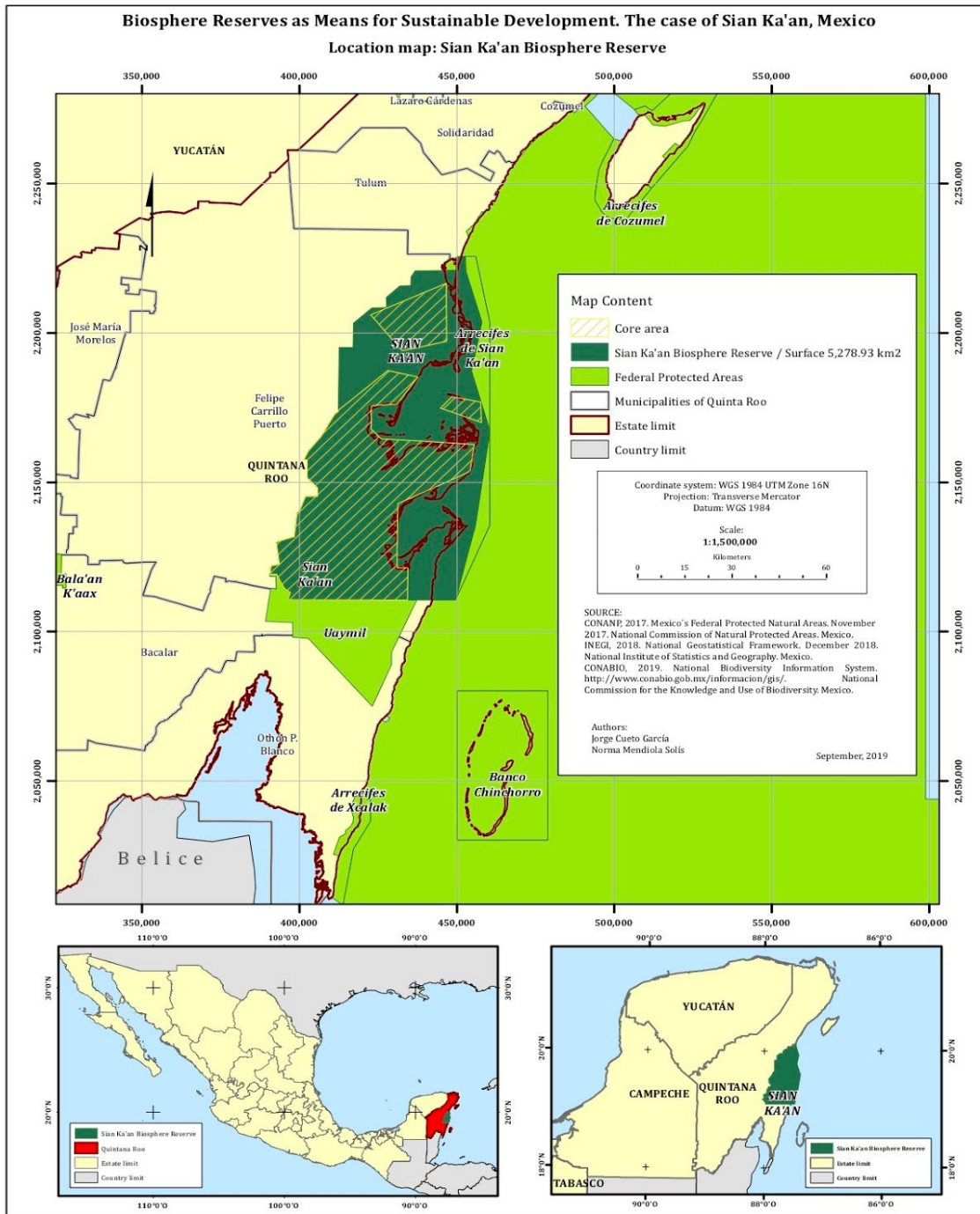
	Migration Learning and adaptive capabilities Ethnicity
Social	Land/property entitlements Social groups (clubs, religious) Rules, codes Reciprocity Personal connections Horizontal networks NGO's/Governmental institutions
Financial	Income Savings Credit (Formal and Informal) Governmental financial support Remittances

**Table 1. Sustainable livelihood capitals and their variables**  
Source: Based on Ávila, Saad & Fierros, 2014

### 5. Sian Ka'an Biosphere Reserve

The reserve is located on a flat orogenic zone denominated Plataforma Yucateca (INECOL, 2007). It lies along the Mexican Caribbean, in the central coastal line of the estate of Quintana Roo. In present days, the reserve is part of a bigger PA complex denominated Sian Ka'an Complex and it includes two other PA: Uaymil Flora and Fauna Protection Area and the biosphere reserve Arrecifes de Sian Ka'an (CONANP, 2014).

Three core areas have been established within the reserve: Muyil, which covers a terrestrial surface of 33,418 ha and is located in the North of the PA close to Tulum. Cayo Culebras, covering 6,105 ha of marine surface and located at the East side of the PA and Uaimil, the biggest core area with 240,180 ha of mainly terrestrial surface but also aquatic, located in the middle and southern part of the reserve (CONABIO, no date).



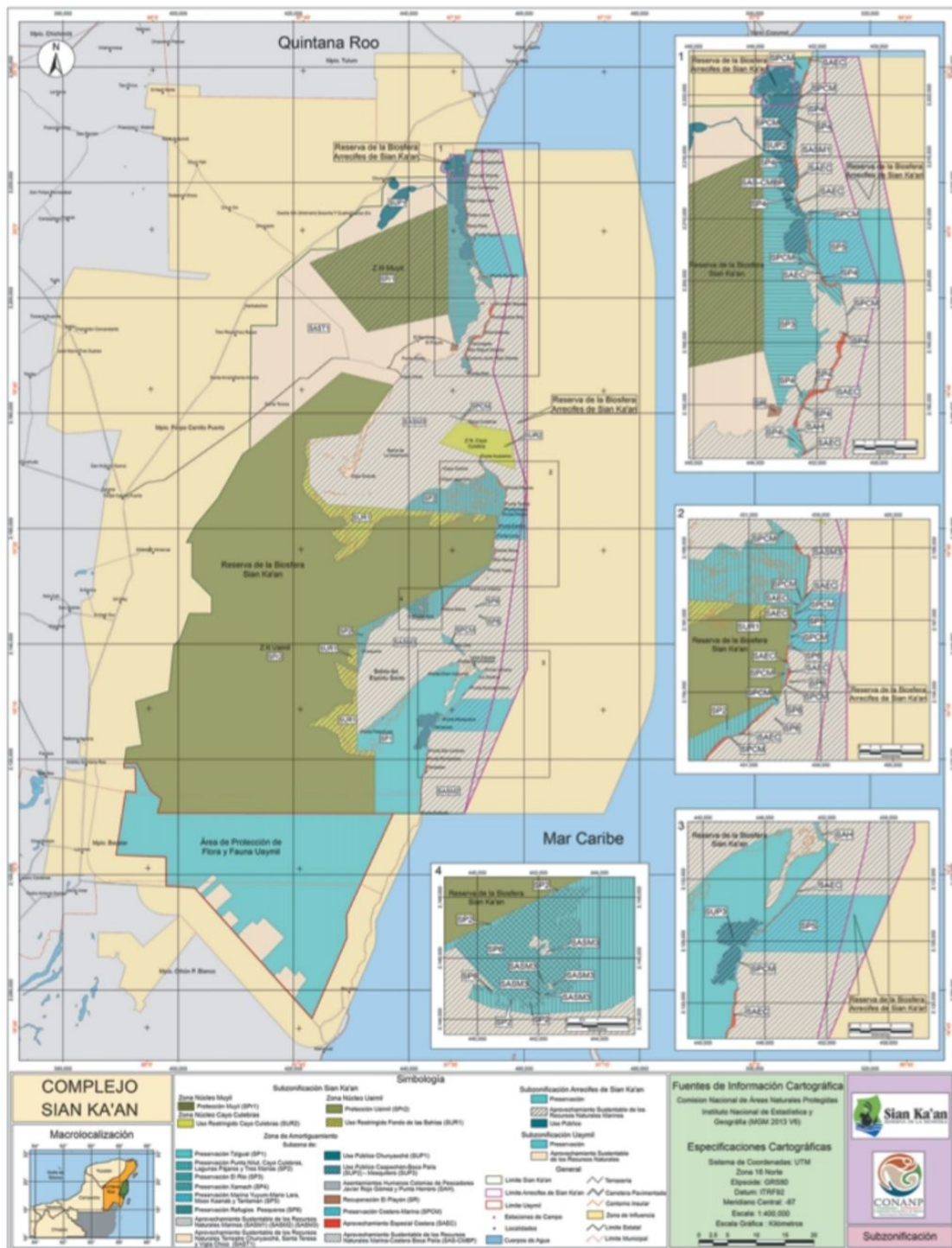
**Map 1. Core areas SKBR**  
 Source: Own elaboration, 2019

The initiatives for protecting this region first started in 1982 at the estate level, when the Scientific Research Center of Quintana Roo (CIQRO in Spanish) initiated the studies with the objective of protecting the natural assets of the region and one year later presented the project to the institution in charge of urban development and ecology (The former SEDUE in Spanish). Along the process, many other institutions and NGOs took part in the project and among these, the Council of Felipe Carrillo Puerto was included. Finally, aiming at protecting

a well preserved transitional zone of continental and coastal ecosystems, on a surface of 158,147 hectares, in 1986 by federal decree Sian Ka'an biosphere reserve was created (CONANP, 2014) and included in the list of International Biosphere Reserves by UNESCO; one year after it was also included in the list of Natural World Heritage (UNEP, 2011).

In the present, SKBR represents a focus of interest for many social actors worldwide. From its decree, as a biosphere reserve it was included in the MaB program (United Nations), in the list of natural World Heritage (United Nations) and it was also considered in the Network of Marine Protected Areas (Commission on Environmental Cooperation) (Vargas del Río, 2010).

The number of national and international organizations interested in the reserve as well as the investments destined to the conservation and protection of natural resources and productive activities are of great significance in SKBR (Vargas del Río, 2010). Among the most active NGOs working in the reserve are: Amigos de Sian Ka'an A.C., Biocenosis A.C., Pronatura Península de Yucatán A.C., The Nature Conservancy (TNC) and Oceanus A.C. (CONANP, 2014).



Map 3. Sian Ka'an Complex  
Source: CONANP, 2014

### 5.1. Physical Characteristics

The coastline in the reserve accounts for more than 200 km with the particular characteristic that it is separated from the continental part by a mangrove area. Two bays are located along this coastline: Ascensión Bay and Espíritu Santo Bay (Vargas del Río, 2010). There is

a slight elevational gradient from the coast to the forest with combined, dry and seasonal flooded areas (Mazzoti et al. 2005).

SKBR territory lies on a limestone plain with maximum altitudes reaching 10 m above sea level. The majority of the land in the reserve has its origins in the recent Pleistocene (Quaternary) but also from the late Tertiary age in the more elevated parts. The topography and hydrology of this territory are highly influenced by three geological faults displayed in diagonal from south-west to north-east (UNEP, 2011). There are no superficial rivers in the reserve, the water from the rain is rapidly absorbed and runs under the surface towards the sea, however, there are some lentic bodies in the lower parts, shallow lagoons and flooded lands, particularly during the raining season (INECOL, 2007). The flooded lands remain even during the dry season because the water table is close to the surface in all the territory with a maximum depth of 8 meters. It is estimated that 20% of the terrestrial marshes remain flooded during the dry season and this portion increases to 70% during the wet season (UNEP, 2011).

At the beginning of the Miocene, the south-east region of the current Mexican territory experimented a subsidence process and the sea covered bigger areas of land. This process originated the present characteristics of the Peninsula de Yucatan as a rather shallow bay with many coastal lagoons and water bodies (CONANP, 2014). Today, the reserve host a wide variety of marine ecosystem, representative of the coastal areas of the state of Quintana Roo. Among these is possible to find sand and rocky beaches, mangroves, marshlands and coral reefs, all of them with a high diversity of species (INECOL, 2007)

The soils in the Sian Ka'an complex are inadequate for agriculture, they are of a rather recent formation and with an incipient evolutive process. It is possible to find two kinds of soils, litosol and rendzina. In the areas with longer formation processes is possible to find a clay layer, more evident after the removal of the dark soil, richer in organic matter, due to the effect of fires and weathering. Because of the topography, only along the lower parts is possible to find deeper layers of soil but with a considerably fine texture and prone to floods (CONANP, 2014).

The climate is tropical with rainy summer and a cyclone period between June and October (Mazzoti et al. 2005). The mean annual rainfall accounts for 1,300 mm, being May-October the rainiest period. September has been identified as the wettest month and on the contrary, March figures as the driest (UNEP, 2011).

## 5.2. Natural Assets and Threats

In general terms, the marine and terrestrial ecosystems are well preserved. SKBR is considered among the 39 sites with more value in terms of wetlands and marine resources worldwide (Vargas del Rió, 2010). The well-preserved state of the forest in Sian Ka'an has been highlighted as an important source for ecosystem services, particularly in carbon sequestration, oxygen generation, and photosynthetic activity. In the same line, it is recognized the important offer that the reserve represents in terms of its extraordinary scenic beauty (CONANP, 2014).

SKBR is representative of the floristic inventory of the region. From the 1,970 species reported in Peninsula de Yucatán, 859 can be found within the the reserve's polygon (CONABIO, no date). Most of the territory in the reserve is populated by medium altitude semi-evergreen forest, well preserved except in the accessible areas. The maximum height in the arboreal layer is 14 meters, however, it is more common to find trees from 10 to 12 meters height (UNEP, 2011).

Approximately 12,000 ha in the reserve are populated by middle altitude semi-deciduous forest. Here is possible to find species such as *Bursera Simaruba*, *Metopium Brownei* and *Caesalpinia Gaumeri*, which are highly dominant and also *Coccothrinax Readii* is common. There are different cases of endemisms (CONABIO, no date). There is also an important presence of flood forest, petenes, mangroves, wetlands, coastal dunes, cenotes and coral reefs. It is interesting to mention that some of these ecosystems are rare in the world and exist only in two other places apart from Sian Ka'an (CONANP, 2014).

The diversity of ecosystems make possible to host a wide variety of fauna. Among the avifauna with presence in the reserve can be mentioned *Jabiru Mycteria*, *Columba Leucocephala*, *Crax Rubra*, *Agriocharis Ocellata* and some others endemic from the region such as *Thryothorus Albinucha*, *Cyanocorax Yucatanica* and *Meanoptila Glabrirostris*. In regard to Herpetofauna, it can be mentioned that the reserve hosts one of the biggest and better preserved populations of *Crocodylus Moreletti*, with also presence of *Crocodylus Acutus*. Finally among the most representative and charismatic species of Mastofauna can be mentioned *Tursiops Truncatus* and *Rhincodon Typus* for the marine part and *Felis Concolor*, *Leopardus Pardalis*, *Panthera Onca* and *Ateles Geoffroyi* for the terrestrial part (CONABIO, no date).

### **5.3. Social Characteristics**

In the reserve, the land is almost entirely owned by the federal estate, although this has slightly changed in time. By 2011 only 1 percent was private (UNEP, 2011) and by 2014, the proportion of national lands was reduced to 94.7 and 5.3 was distributed between the communal and private property (CONANP, 2014). The main settlements in the reserve are Punta Allen, Punta Herrero and María Elena, however except for Punta Allen the others observe important fluctuations in their population according to the season and what is more, the size of such populations is remarkably small (Vargas del Río, 2010).

Throughout the time, SKBR has gone from being an isolated space with very low pressure on the natural resources and lack of external interest to be a more complex ambit with different interests of a variety of social actors from diverse sectors using and regulating the natural assets. In this sense, 4 groups of social actors have been identified: Institutions, from the governmental sector and from the supranational level; environmental NGOs; local inhabitants, and the tourist sector (Brenner, 2010).

Each of the latter groups clusters actors pursuing different goals, some support directly or indirectly the productive activities, for instance, the Ministry of Agriculture and Rural Development (Sagarpa in Spanish) fosters the fishery, the National Found for Tourism (FONATUR in Spanish) supports the touristic activity at the regional level affecting the flows in the reserve as well; the local productive cooperatives, on the fishery and tourism sectors which naturally aim at being economically prosper; the governmental institutions advocated to the protections of the natural resources: CONANP and the National Forestry Commission (CONAFOR in Spanish), the National Commission for Environmental Protection (PROFEPA in Spanish). Nonetheless, according to the Mexican law CONANP is the institution that ultimately regulates the activities in the reserve. Furthermore, there are several environmental NGO, nationals and internationals, carrying out activities of both, environmental protection and social and economic development (Brenner, 2010).

In all the PA complex, are approximately 1,800 inhabitants (CONABIO, no date) and from these, approximately 1000 depend for their livelihoods on lobster fishing and nature-based tourism (NBT) services. This kind of tourism constitutes a productive activity that has gained relevance approximately from the decade of the 90's. In present days there are 7 NBT associations (Cooperativas) managed by local inhabitants, 4 of them are based in Javier Rojo Gómez, 2 in Muyil and the last one in Punta Herrero, which represents the only one in the southern part of the reserve (Vargas del Río, 2010).

In this scenario, mass tourism is considered an important threat to the natural assets in the reserve, since it is immersed in an area of highly intense tourist flows (CONABIO, no date). The northern part of SKBR is exposed to the regional touristic pressures intrinsic to the development model of Cancún, Playa del Carmen, and Tulum (Riviera Maya). In the southern extreme, a similar phenomenon occurs with the federal project known as Costa Maya, which is a hybrid development strategy of mass and alternative tourism. In the reserve, mass tourism could also be a threat, especially in the part where private property is concentrated (Vargas del Río, 2010). In this sense, what worries the authorities of the reserve and the stakeholders aiming at protecting the natural resources is the development of infrastructure, which would attract more investments and intensify the use of the protected resources. This, in a political context that tends to be favorable to the industry interests (Brenner, 2010).

Other pressures are the fires generated for agricultural purposes in the surrounding areas, which have already consumed 14,000 hectares of forest (UNEP, 2011). There is also the presence of illegal hunting for commercial and auto consumption purposes. This is a practice carried out by some of the local people and also by some of the population from the surrounding settlements (Vargas del Río, 2010).

In contrast to the latter, as a strategy to regulate the use of natural resources, CONANP has worked from a multi-actor approach in the management of the reserve and this resulted in the elaboration of an Ecological Management of the Territory for the coast of the PA (OET in Spanish) (Vargas del Río, 2010). Furthermore, the potential of NBT as a means for dissemination of environmental information has been explicitly recognized by the institution in charge (CONANP, 2014).

#### **5.4. Colonia Javier Rojo Gómez**

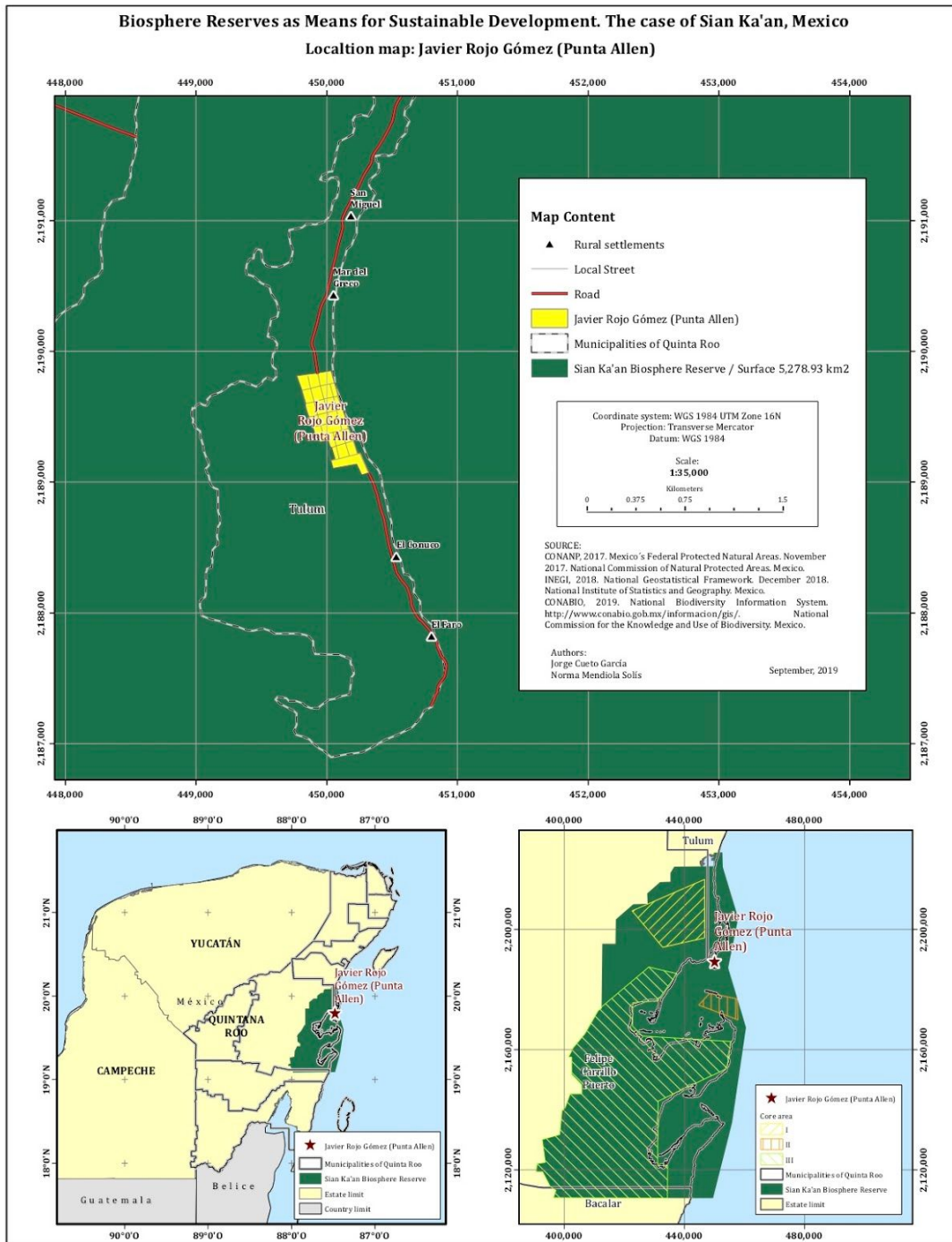
Colonia Javier Rojo Gómez is located in the northern part of the biosphere reserve, at the north of Ascensión Bay. The first establishments in this area were originated due to the copra production from the 1930's on (Vargas del Río, 2010). Many copra ranches were settled in this area, from the current main entrance of the reserve (Tulum) to the place where today is settled JRG, and after the decline of copra production due to a plague known as Amarillamiento Letal, in the 60's, the importance of the fishery increased considerably to the point it gave place to the Fishing Cooperative Vigía Chico, which consequently originated the foundation of Colonia Javier Rojo Gómez in 1970. This was the only settlement in the area



previous to the decree of SKBR. The location of JRG corresponds to the existence of freshwater sources (Flores, 2013).

Up to the decade of 1980, JRG had the status of a fishermen campsite, rather than a town. The infrastructure of this settlement was characterized for being precarious because it was developed in a rather spontaneous way with little support from governmental institutions (Flores, 2013). Up to date, public services in the reserve are scarce. Javier Rojo Gómez is the only settlement with electricity and provision of running freshwater. This resource is obtained from shallow wells from the surroundings. Public infrastructure is lacking as well as adequate housing conditions. In relation to its connectivity with nearby cities, apart from the federal roads communicating Cancún-Tulum and Tulum-Felipe Carrillo Puerto, there are only dirt roads and aquatic channels communicating different points of the reserve and the latter with the exterior (CONABIO, no date).

Javier Rojo Gómez and the other two settlements, located along the coast, are controlled by the Ecological Territorial Management (2002) and so the economic activities: fishery and tourism. The rest of the PA's surface is free of any productive activity with eventual and isolated cases of illegal hunting and logging which are a minor problem (CONANP, 2014).



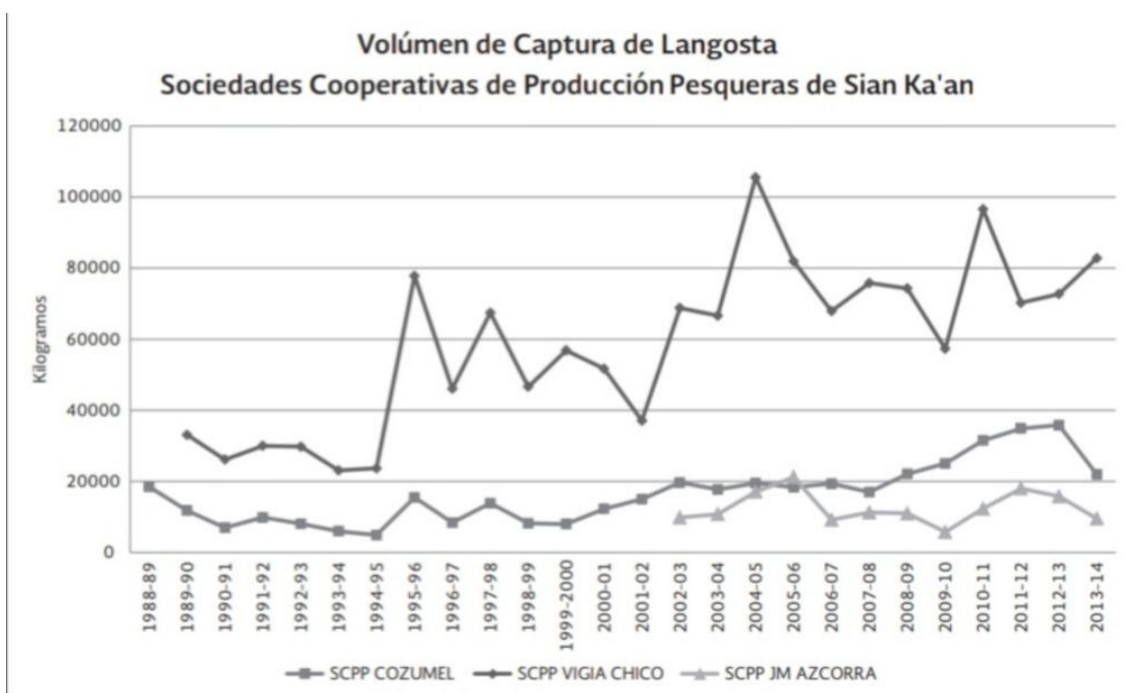
### 5.4.1. Economic Activities

From 1968, Vigía Chico Cooperative (Sociedad Cooperativa de Producción Pesquera Vigía Chico in Spanish) officially started its activities in Javier Rojo Gómez. The production has always been outstanding and this explains the progress of the organization. This also explains in part how other traditional rural productive activities have not been prosper in the

town, because the interest of the inhabitants has been focused mainly on the fishery (Flores, 2013).

The fishery consists mainly on the capture of lobster (*Panulirus argus*) but apart from this flake fishing and crab capture are also commonly part of the productivity. Vigía Chico was granted with an exclusive fishing concession that goes from Punta Xamach to Punta Pajaros and includes all the area of Ascensión bay. Such concession is divided among the cooperative members into 109 aquatic parcels. The production takes place between the first of July and the 28th of February, after this the closed season starts (CONANP, 2014).

The lobster capture is carried out with nets (Jamos) that freedivers use to collect the exemplars “trapped” in artificial shelters locally known as Cuban Houses or Shades. The boats used for the production are propelled by outboard engines. The organization of the activity characterized for the distribution of parcels among the members, has been pointed out as an outstanding case in Latin America. In present days, the capture of lobster continues to be a cornerstone in the economic life of the town (CONANP, 2014). The following figures show the productivity of Vigía Chico in comparison with other cooperatives in the region from the year 1989 to 2014.

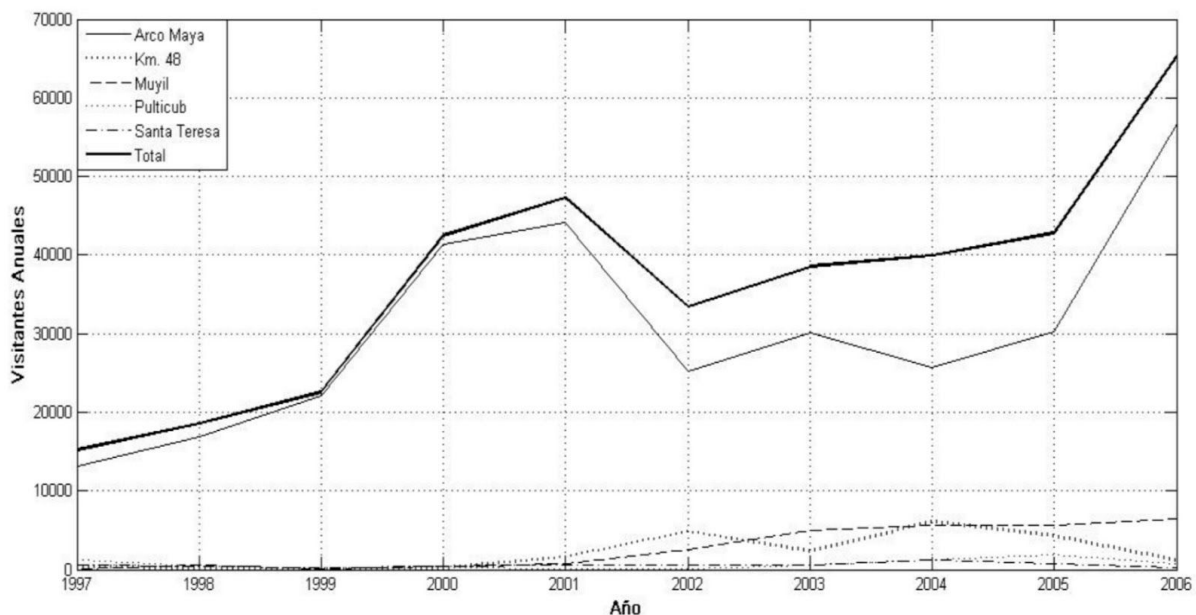


Graphic 6. Vigía Chico lobster productivity per kilogram per year 1988-2014

Source: Retrieved from CONANP, 2014

On another hand, tourism has emerged in the reserve as an important economic source from the decade of 1990, influenced by the location of the PA, particularly the northern part, in the corridor of intense flows of the tourist poles of Cancún, Playa del Carmen and Tulum (Brenner & Hüttl, 2009). In this scenario, tourism became an important economic activity with an outstanding transformative force of the productive life. From 1996, a record on the tourists visiting SKBR has been kept and it has been identified that 90 percent of them come to JRG. The origins of these tourists, from the highest to lowest numbers of visitants are: USA, Germany, France and lastly national tourists (CONANP, 2014).

The following graphic shows the increase in the number of tourists arriving in SKBR from 1997 to 2006. As it can be observed, the importance of the northern access of the reserve known as Arco Maya in the tourist activity is evident and considering the environmental problems associated to this, the authorities have already shown concerns and have carried out actions to control the potential threats without compromising the economic benefits of the tourism for the local population. It is explicitly recognized that restrictions on the use of natural resources applied for environmental protection purposes, can represent livelihood constraints for the local inhabitants (Vargas del Río, 2010).



**Graphic 7. Number of visitors per year in Sian Ka'an**  
**Source: Retrieved from Vargas del Río, 2010**

Because of the latter, NBT has been a productive alternative in which CONANP has put a lot of efforts. NBT has been supported as a strategy capable of meeting both economic and

environmental aspects. With this alternative, they not only pretend to protect such resources but also to distribute adequately the benefits of environmental protection and sustainable activities (Vargas del Río, 2010).

It has been identified that even when most of the population in the town take part in the productive activities of tourism and fishery, a minority of them remain independent, However, all of them have remarkable financial resources. Furthermore, since they are well organized in cooperatives, they also constitute a lobby in a considerable power position (Brenner, 2010).

As it is observed, in general terms the conditions of Sian Ka'an biosphere reserve seem to be adequate. The natural assets in the PA are well preserved and the economic activities are rather prosper. These conditions called the attention for a research project because they contrast greatly with the general observation of socio-economic problematics as well as constant process of environmental deterioration in biosphere reserves in low-income countries such as Mexico. In this context results interesting to inquire whether Sian Ka'an biosphere reserve is being an effective means for sustainable development.

## **6. Methodology**

The current research project seeks to analyze from a qualitative perspective the role of SKBR in the local processes of sustainable development. This is referred to processes related to the protection of natural assets and with the development of the local population in terms of the sustainable livelihood approach.

Qualitative research, unlike quantitative research, seeks to understand the particularity of different social realities. Thus, among the main characteristics of this kind of research, the generation of data and information in situ figures as an aspect of high relevance because the context from which such data derives contains relevant elements of analytic importance. In this sense, opinions, actions and the interpretations that people make of their own context and social reality are aspect of high interest, as well as the immersion of the researcher in such context. Furthermore, the interpretative analytical process constitutes another relevant characteristic in qualitative research (Vasilachis, 2006).

In order to access the subjectivity, the logic and the reasons behind the actions of the people shaping social reality studied, aspects that constitute the objective of qualitative social

research (Quintana, 2006), the use of biographic methods is very common. Through these methods is possible to obtain first-hand impressions of the realities studied and from the social actors producing such realities. Among the most commonly used instruments from biographic methods to produce qualitative data figures the interview. Through the interview is possible to gain insights of the social life and context of individuals, their connections with other individuals and groups and their rules and institutions (Mallimaci & Giménez, 2006).

In qualitative research, interviews are conceived as a process of two phases, The first one, known as correspondence phase, is that in which the researcher meets the interviewee and throughout a series of questions data is produced and compiled. The second phase, known as analytical phase, is that in which the content of the interviews is assessed according to analytical categories defined through to the theoretical and conceptual approach (Robles, 2011).

Based on the environmental and socio-economic characteristics of SKBR and the postulates of the sustainable livelihoods theory, the following questions derived:

General questions:

1. Is SKBR an effective means for local sustainable development?
2. In what way does the reserve contributes to achieve sustainable development at the local scale?

Specific questions:

1. What have been the direct contributions of CONANP in the improvement of each of the capitals of the sustainable livelihood approach in JRG?
2. How is the reserve contributing to the continuity of natural assets and processes in SKBR?
3. How does the reserve contribute to the improvement of the life quality of the local inhabitants?

In order to gain insights into the aspects of interest for this research, a visit to Sian Ka'an biosphere reserve was planned. The purpose of such a visit was to carry out interviews with the main social actors involved in the local life, social, economic activities in the reserve and the processes of environmental protection.

Seeking at gathering relevant information on the local life in JRG/SKBR a questionnaire for interviews was prepared, see Annex 1. The questions are divided in sections, each one aiming at generating the information necessary to answer the research questions.

Fieldwork took place between the months of April and May 2019. In total 8 interviews were hold and digitally recorded. Table 4 shows the details of interviews and interviewees. It is important to mention that an interview with SKBR authorities was intended because the perspective of the institution in charge of the reserve was considered of high value. Unfortunately, despite many attempts to carry out such an interview it was impossible to contact CONANP personnel for this purpose.

Nr. of Interview	Stakeholder	Audio file duration
1	Private Touristic Operator/Lobster Coop. Member	01:13:00
2	"Las Boyas" Turistic Cooperative leader	00:44:09
3	"Los Gaytanes" Turistic Cooperative leader	01:07:26
4	Vigía Chico Cooperative. Member	00:56:03
5	Touristic Coop. Member	00:53:55
6	Vigía Chico Cooperative employee	00:37:31
7	Expert - PhD student (UNAM) researching in SKBR	02:14:31
8	NGO Amigos de Sian Ka'an	00:46:55

**Table 2. Interviews from fieldwork**

**Source: Own elaboration**

After fieldwork, interviews were transcribed using software for qualitative research F4 and the text files with the content of the interviews were imported and analyzed using qualitative research software Atlas Ti. For this, it was necessary to define analytical categories to organize and assess the information. Analytical categories were organized based on the sustainable livelihood approach, as shown in Table 5. The analysis of the result was carried out having as a framework reference the postulates of sustainable development theory.

	Human Capital	Demographic	Cohorts
			Origins
		Education	Early skills
			Formal education
			Courses
			Training/On-the-job training

SD/SL		Health	Self assessment
			Access to public services
			Access to food
	Natural Capital	Active	Stressors
			Continuity
		Inactive	Stressors
			Continuity
		Environmental services	Stressors
			Continuity
	Financial Capital	Income sources	Regular
			Seasonal
		Available stock	Traditional credits
			Financial support
			Other funds
		Expenses	Inputs
	Maintenance		
	Physical Capital	Productive goods	Lack
			Covered
		Work tools	Lack
			Covered
		Infrastructure	Roads
			Education facilities
			Medical facilities
		Public services	Education
			Electricity
	Drainage system		
	Social Capital	Institutions	Governmental
NGO			
Informal/Informal			
Networks (Interactions)		Characteristics of the networks	
		Resources obtained from networks	
		Characteristics and quality of goods and benefits	
Rules and regulations		Formal	
		Informal	

**Table 3. Analytical Categories**  
**Source: Own elaboration**



## **7. Results**

In the following, the empirical information obtained during the fieldwork through interviews and field notes, is presented in a narrative format. Using such information it has been intended to reconstruct the “story” of the case study, describing from the perspective of the local inhabitants and other relevant actors, the processes of conservation and development occurring in Colonia Javier Rojo Gómez. After this, the analysis is carried out using the conceptual-analytical categories of the sustainable livelihoods approach.

### **7.1. Colonia Javier Rojo Gómez: General Context**

During the very first stage of the territory colonization, copra producers complemented their activities with autoconsumption fishery. This was the beginning of what would derive in a vibrant productive activity. However, it didn't occur alone. An aspect that contributed for this, as one of the interviewees commented, was the contact that fishermen in Punta Allen had with Cuban sailors, as these use to come to the Mexican Caribbean coasts with commercial purposes and more precisely looking for lobster. This promoted the organization of the locals around the lobster stocks in Asención Bay. Not only the Cuban sailors were the first market for the lobster by exchanging the captures for other goods such as cigars, sugar cane, rum and canned food, but also they taught the locals the technique to catch lobsters with traps (Interview 1).

The population in Javier Rojo Gómez was constituted by people from other Mexican states, such as Yucatán and Campeche and also from other nearby cities such as Felipe Carrillo Puerto and Chetumal. They had very different backgrounds and experience in different fields. In this sense, the first generations were constituted by people with skills in construction, agriculture, industry (workers), fishery and naturally, copra producers (Interviews 1, 2 and 4).

It was in 1968 when the Cooperative Vigía Chico was formally established. By this time, the regional market was already demanding high flows of lobster and trading took place with intermediaries established in Cancún, Puerto Morelos and Cozumel. This intermediaries were groups of families that use to buy all the production from Vigía Chico (Interview 1)

Some years after the formal establishment of Vigía Chico Cooperative, the business became prosper and the number of members quickly increased. The society even became a source of employment at the regional level and attracted more population. Vigía Chico had become

a reliable institution in economic and social terms. On this, one of the interviewees commented:

“I came here because my brother, who arrived before, left his position as the cooperative’s truck driver to become a partner and I took his place as driver. But unfortunately one year later he died, he drowned, and all the benefits he had as a Cooperative partner, were passed on to my mother, who decided to pass them on to me. This is how I became member as well” (Fragment from interview 1).

The latter happened at the beginning of the 80’s, nonetheless, after the occurrence of Hurricane Gilbert in 1988, Vigía Chico entered a strong crisis period. Not only did the devastating extreme meteorological events caused damage and losses of equipment and facilities but also it revealed a mismanagement in the organization’s funds, fact that impeded the members to recover easily after Gilbert, but that also constituted a seed for a better internal governance for the future (Interviews 1, 4 and 7).

Lobster productivity was never the same since Hurricane Gilbert struck the coast, according to the information from the interviews. Nonetheless, as also stated, the new leaders of the association had the vision to make of it a prosper organization and with countless efforts it became a strong and reliable institution one more time (Interviews 1 and 7).

During this years, the studies for the feasibility for the establishment of the biosphere reserve had began. This generated the participation of different groups from civil society as well as the involvement of local inhabitants, according to what was explained in the interviews. With the participation of local population and regional institutions, Sian Ka’an Biosphere Reserve was finally established in 1986 (Interview 1)

Two years after the establishment of the PA and in the context of crises, the authorities of the reserve (CONANP) looked for alternatives for livelihoods, since the economic pillar in the settlement had collapsed. This gave place to the promotion of NBT as a new productive activity that not only could offer economic support to the local population but that also could be carried out within the frame of the environmental regulations of the Reserve, at least in the case of the recreational tours in the ocean (Interview 2)

NBT was not an entire novelty for the locals since fly fishing was an activity carried out for some people in the town and in the region, although mostly foreigners. Some of the locals eventually join the fly fishing lodges to perform auxiliar activities, but afterwards it also became a serious alternative for them. Evidence of this can be found in the interviews:

“After the great impact of Hurricane Gilbert, many people left the town and right behind them it was me the next one. But in those days a person I knew, who happened to own a fly fishing lodge, called me and offered me to assist him in the job and I immediately accepted” (Fragment from Interview 1).

The same person added that with the time he learned all about this activity and he decided to become independent and to start his own fly fishing lodge, which has become his main income source.

In present days, this kind of nature based tourism is not necessarily accepted as a legitimate activity in the reserve due to the contact with the marine fauna it implies (Interview 1), however it constitutes one of the three main productive activities, aside with the recreational tours in the ocean and the lobster production. These tours have become the main income source for the population and different NBT cooperatives derived from this alternative (Interviews 2 and 3)

## **7.2. Economic Activities in Javier Rojo Gómez, Sian Ka'an**

As mentioned, nowadays the three main economic activities in the reserve are, in order of importance according to the income flows they represent to the local inhabitants: 1) recreational tours, 2) lobster production and 3) fly fishing. To some of the inhabitants more than one of these activities constitute their livelihoods. For instance, some members of Vigía Chico Cooperative are at the same time members of one of the NBT cooperatives or manage their own fly fishing lodge. Or some of the employees of NBT cooperatives, particularly tour guides or boat captains, work also for some Vigía Chico partners or even are partners themselves as well. Details on this come in the following (Interviews 1, 2 and 3)

Apart from these, other common livelihoods in the town are supported by grocery shops, mechanic shops, restaurants, coffee shops and rooms for rent. In JRG the economic perspectives are rather favorable, as some of the interviewees affirmed:

“There are different options to generate income here, and if people don't take them is because they don't want or because they are living a life of bad habits” (Fragment from interview 2).

As an evidence of the wide capacity of the labor market to absorb labor force, others also mentioned that since labor force is always needed, many of the employees of the NBT cooperatives are very irregular in their jobs and that rates of absenteeism are high (Fieldwork notes).

### **7.2.1. Lobster Commercialization**

The abundance of lobster in the bay made possible the blooming of what in former years was the main productive activity in the settlement. In present days even when the productivity of Vigía Chico Cooperative has decreased, the importance of the activity and the institution derived from it remain valid. In fact, it is a fundamental part of the history of JRG (Interview 4 and 7).

Ascención Bay has been characterized for having good sized juvenile lobster exemplars that are of great value in the market. It is relatively simple to catch the lobsters in the bay because these waters are rather quiet and shallow.

“The production from this area has always been attractive and it is due to the size of the juvenile lobster from here, these have better price in the market (...). This is something that occurs in a natural way, it doesn't have to do with the fishery management we make, and as the lobster grow older, they go to deeper water by the reef” (Fragment from interview 1).

On the lobster market can be said that regardless the upheavals, it has always been active. According to the information from the interviews around 1980 the cooperative had roughly 130 members and it was well known in the region:

“The existence of the cooperative was well known in the surroundings, it was rapidly consolidated. People from everywhere was coming to buy lobster. During the time I became part of the organization, we were selling the product to a trader from Cozumel who later on established in Puerto Morelos. We use to deliver the product there in Puerto Morelos. Some time after that, we also started selling to another trader in Isla Mujeres. They were exporting the lobster” (Fragment from Interview 3).

The productive activity was going through an excellent phase during those years. The cooperative Vigía Chico was becoming an important and solid enterprise at the regional level. However, due to the establishment of the biosphere reserve and also due to the unexpected impact of hurricane Gilbert in 1988, it experienced new challenges. Nonetheless, new market possibilities came to perspective as well (Interviews 1 and 7).

By the time the reserve was created, the cooperative was prosper. With support from the estate of Quintana Roo, the federation and credits from banks, they had access to financial capital and built a storage and processing plant:

“The cooperative had given a significant step forward, from being fishermen we were becoming entrepreneurs. We had a processing plant and we had the capacity to store tons of products: lobster, shark, fish, everything. We were ready to work with all the nearby cooperatives: Tulúm, Hol-Box, Cozumel, Tam Balam, X-calak. But in those years the reserve was created and it stopped everything, it stopped all investment possibilities (...)” (Fragment from interview 1).

During this time fishermen used a fishing gear locally denominated “Gancho” (Hook). This was the traditional fishing gear but it was of high environmental impact, thus, it started being forbidden. On this, one of them commented:

“we were so used to use the hook that we didn’t want any change. We were the kings with the hook. We used to dive, find the lobster and get it with the hook, but we were also affecting our resources because once you get a lobster with the hook it dies, and if it doesn’t have the right size it is worthless in the market. You just throw it away, but it dies” (Fragment from interview 1).

Another fishing art widely used in the area was the fishing net, but according to the interviews, this was forbidden through self regulations in the cooperative because they acknowledged that its use was depleting a high number of species, including lobster itself. An interesting aspect of this is the emphasis locals make on the fact that it was not the Reserve who forbid this fishing art but the internal regulations.

“During those years (After the establishment of the reserve) the capturing of lobster near the coral reef was forbidden because the lobster population that tends to live in the reef area is that in reproductive process. Thus, capturing these exemplars implies the interruption of the reproductive cycle” (Fragment from interview 3).

The latter was one of the environmental regulations the Reserve established in order to pursue the objective of protecting the environment in the PA. In parallel to this, the market played an important role as well, incentivizing a shift to a more sustainable fishing technique. In this way, a transition occurred from a consumptive regime in which no care was taken for ensuring the continuity of the resource to a more sustainable one in which a selective fishing was performed.

“After 1988, when the fishery was in crisis, a person from Cancún came to see us and offered to buy all our production but it implied to change our fishing technique because this person wanted the lobster alive. She said it was more convenient for us because it would represent less processing after capturing the lobsters and that it would also increase the price” (Fragment from interview 5).

The cooperative worked in partnership with this trader who was exporting the production to the USA, and roughly, during three years the business went well. The price of live lobster, indeed, was more convenient. Even the fishermen who did not accept changing the fishing technique at the beginning, were convinced of doing so after confirming that in this way better prices for their catchments were possible.

“there was a group of stubborn people who didn’t want to quit the hook. It was a process of about 3 or 4 years but when they realised all the money they were losing, they decided to change” (Fragment from interview 1).

The commercial agreement with the exporter ended because during an inspection in aduana in the USA, lobster was detected with melanosis. For this reason the trader did not cover fully the payment for the cargo and the commercial agreement was broken. However, as commented in the interviews, local markets were demanding lobster and the production was again destined to these markets, always through intermediaries (Interview 1).

“By this time other markets in the area were already active, particularly in Cancún and they started visiting us and we started selling the production to them. Nowadays we have around 5 traders from Quintana Roo and they are buying all the production” (Fragment from interview 1).

Another aspect that contributed to generate and consolidate sustainable practices was participating in processes of certification. The cooperative decided to take part in this kind of initiatives because they considered it was a good way to add value to their product. Good, sustainable practices were required by the companies providing the “green labels” through a certification process. Even when the cooperative decided to stop taking part of those strategies, the skills and practices such as capturing only the appropriate size of lobster and putting back those in reproductive phases remain constant among the fishermen:

“After some time of being part of that labeling process we decided to stop because we never really saw the proceeds of it. It was much what we had to pay to get the certification and the price increase that we were told about never occurred, but the good practices remain, now we all catch lobster with the jamo” (Fragment from Interview 1).

Whereas lobster production remains an important economic activity, the productivity is decreasing year after year, as stated by some of the interviewees and some of them have lost the interest in it as NBT became more relevant in economic terms. Some of the hypothesis for this fall in lobster productivity is the presence of sargasso. According to one of

the interviewees the accumulation and decomposition of this alga releases toxic substances that kill the lobster in the bay, thus, the population of this crustacean has decreased.

“Sargasso is seriously affecting the availability of lobster, productivity is not as it used to be years before” (Fragment from interview 3).

“We haven’t seen any increase in the productivity. Actually this year (2019) has been one of the worst years. It is because of meteorological events. You know about the hurricanes Wilma and Gilbert, and we also had a very heavy rain lately and one thing that is really affecting is sargasso. On one hand it is positive because a lot of lobster larvae comes along with it but when it starts getting rot, a toxic gas is realised and this kills all kinds of animals” (Fragment from interview 1).

“This year the production decreased in about 10 tons. We believe this is caused for the presence of sargasso” (Fragment from interview 6).

Another hypothesis on why the availability of the lobster is decreasing is that the capture practices in the south, Belice, Guatemala and Honduras, are making impossible to the lobsters to come all the way to Ascensión Bay, thus, it is important to establish adequate regimes of production among the agencies dedicated to lobster production.

“Many people here think that we have less and less lobster but that is not true. Actually I believe we have more but the problem has been caused by ourselves and other institutions because they take us with other cooperatives in the south, here in Mexico and other countries, all the way to Honduras. We have been spreading our technique in all these places and now the lobster stays there because with the traps the natural flow of the lobster is interrupted and they don’t come all the way up here anymore” (Fragment from rinterview 4).

While it is reasonable to question the accuracy of the latter hypothesis, the fact is that the lobster availability has been decreasing. And this represents an important change in one of the natural assets of the settlement. On the other hand the integrity of the landscape and other natural assets used as productive means remain out of danger, in the opinion of some of the interviewees, because the location of JRG makes it difficult for massive tourism to arrive.

“To be isolated is also an advantage because nobody comes to destroy our natural resources like it happened in Cancún. We still have the forest, the mangrove (...)” (Fragment from interview 3).

### **7.2.1.1. Organizational aspects**

In JRG, the lobster association figures as one of the most important organizations in the community and it was thanks to it that the settlement was possible in first place. It not only provided livelihood for the local population, but also constitutes an organization that provided its members with certain guaranties. Evidence of this is the fact that the partner entitlements of one of the members, as explained above, were respected after he passed away and another member of his family was recognized as the new holder of these entitlements. This is unquestionably an aspect of social security (Inteview 1).

On how the people started organizing themselves to exploit lobster stocks an interviewee mentioned:

“You know different people has visited the area and I believe some fishermen from the USA came and these fishermen brought the technology of using metallic barrels with cement in the bottom, and open holes in the barrels to allow the lobsters to go in. Then with a rope tied to the barrels, pull them out to the surface and catch the lobsters. Some locals started using this technique and started setting these traps in different areas of the bay, some of them threw 10, 20, 30 traps and realized that this new technique was more productive than accidental catchment, as it was traditionally done” (Fragment from interview 1).

Soon, this new and more effective technique became popular among all fishermen in the area, not only the fishermen from JRG but also from other groups established in Cozumel, Espiritu Santo Bay and some others. Fishermen began to use this technique in an extensive way, using up to 200 of them distributed in the zones they had identified to be more productive, but since no regulations existed at this point, it became problematic. After negotiations with Cozumel cooperative an agreement on productive areas for each cooperative was reached and Vigía Chico had a concession for an exclusive productive area, from Punta Pájaros to Ascensión Bay (Interview 1).

Internally, the productive areas of this concession were distributed according to the productive capacity of each member. Those who had the necessary equipment and tools to carry out the activity were granted with as much parcels as they could exploit, whereas the ones who did not have such equipment were given less parcels or none at all. On this it was stated that:

“the cooperative gave to each member the freedom to use the productive areas that could exploit. As the concession zone was completely covered, the possibilities for other members to make use of a parcel were simply unavailable,



as these were definitively assigned to those who used them first. This happened according to the efforts of each member” (Fragment from Interview 1).

The uneven access to the maritime parcels has led to define in a fixed way types of members of the cooperative that can be called big and small members. The small members have the alternative to work for the big ones, helping in different productive activities. On this, one of the interviewees stated that even when the dynamic becomes somehow capitalist, all members still get benefits:

“Well, yeah you can call them big and small members in the sense that some had the vision of throwing more traps, of looking for more productive areas within the concession. Those are the big ones, because they had the vision of working well and effectively. The others, they are the ones who are always sleeping, they didn’t progress” (Fragment of interview 3).

Many members of the cooperative do not have neither parcels nor boats to be productive. Then the alternative for these members is to work for a big one:

“The benefits of the cooperative are for everyone. Everyone needs from everyone, If you don’t have parcels or boats you work with someone who has them and by doing that you make your living because you get part of the production anyways” (Fragment of interview 3).

On the other hand, another benefit of being member of the cooperative, even if there are no parcels available anymore, is the opportunity of having access to credits for investing in productive tools and equipment such as fishing boats, boat engines and fishing arts. this works in two different ways:

“The cooperative member saves a fund individually but administered by the cooperative and during the closed season is available. That is an option, the other option are the credits through Fideicomiso Pesquero (Fishery Stewardship)” (Fragment of interview 1).

The first option is also available for credits administered internally in the cooperative and it is normally used for individual investments. The second option is feasible with the intervention of other institutions and it is normally used for investments and the acquisition of common goods for the institution as a whole, as personnel from the cooperative commented:

“This year (2019) we requested a credit from the Stewardship to buy a refrigerated lorry to transport the production. That was the last credit we had” (Fragment from interview 6).

Finally, another benefit for the members of Vigía Chico, is the access to federal programs for productive activities from the Ministry of Rural Development (SAGARPA in Mexico). These consist in annual individual economic support for each member and the cooperative administration provides support for the paperwork and assumes responsibility for sending applications (Interview 6).

Another interesting organizational fact is that the cooperative do not offer job positions nor opens memberships for external people. This is only for descendents of the current members. However, as one of the interviewees commented, in former years the members were more active and interested in the well-being of the association:

“The new generation of cooperative members are not interested in doing things right as it happened at the beginning. They are the descendants of old members and don't really care about continuing working hard. Many of them is people with studies and because of that working here is not interesting for them” (Entrevista 4).

### **7.2.2. Nature Based Tourism**

The reserve has been an important pillar in the livelihoods for many people in JRG. Particularly in those related with the recreational tours offered by different NBT cooperatives. After hurricane Gilbert, CONANP through the central office of the reserve, fostered an alternative economic source: ecotourism. However, by this time another NBT activity had been going on for years in the region, fly fishing. In the following both activities and their respective development are described according to the empirical information gathered during the fieldwork.

Many of the members of the NBT cooperative belong or did to Vigía Chico Cooperative. However firstly Fly fishing and after NBT, became alternatives for many of them because lobster production has a short active season and has also been decreasing. Touristic activities do not interrupt during the year, they only have low seasons. Tourism provides most of the job positions in the town (Fragment from interview 3)

#### **7.2.2.1. Fly Fishing**

The activity of fly fishing has been present in the region for a long time now. In fact, one of the reasons why fishermen decided to forbid the use of nets was because this was depleting species of interest for those carrying out the activity, as one of the interviews commented:

“Before the creation of the reserve we had already forbidden the use of fishing nets, because there were some colleagues that had already started with the fly fishing, very few of them, and with the nets we used to pull out lots of fish that were worthless for us but of good use for them. So we decided to stop that and other arts such as palangres (long lines)” (Fragment from interview 4).

However, fly fishing was not necessarily an important alternative for livelihood for the locals. It was more an activity carry out by foreigners established seasonally in JRG, with low intervention of some locals. After the 1988 local economic crisis, new livelihoods were needed to overcome such crisis. In this context NBT started gaining importance and to some fly fishing was a good alternative. This was possible not only as a direct labor market as commented by one of the interviewees but also as a sector in which productive goods from the lobster sector could be put to produce:

“The people I started working with, the very same people, sometimes needed more boats because sometimes they had too many tourists and didn’t have enough boats. I had my concessions from the cooperative (Vigía Chico), so I started renting my boats for tourism. In that time you could use the same boats there were not so many regulation because the reserve was starting, you only had to clean properly the boats ant to arrange them in a nice way for the tourists” (Free translation from interview 1)

With the time, as the interviewee commented, he learnt the job and most importantly for him, he had make good contacts for potential clients and, as he realized this was a very good opportunity for him, decided to invest more in it.

“I made sure of improving my english, I bought three other boats and since the reserve was giving the concessions in that time I was lucky because I got three. So I started offering my own services independently and by this time some of the clients were very satisfied with my work so they started coming with me”

From that time, fly fishing became his main productive activity and his small company has now achieved considerable progress. He manages the company with support of his daughter, who received university studies to administer tourism enterprises and who currently resides in Cancún. According to what the interviewee commented, they open a web-page for their company and in this way they attract new clients. This has become his main source of income:

“Yeah, currently I don’t really want to go work with the lobsters, I am doing only fly fishing” (Fragment from interview 1).

“We believe this activity fits within the reserve’s objective because even when there is a contact with the fish, we release them after and they don’t die. So we believe it is a sustainable activity even if the reserve doesn’t agree, but this remains open for debate. Plus fly fishing started way before the reserve and it brings a lost of economic benefits to the community”.

Apart from the latter, it was possible to gain insights from another similar case. One of a familiar cooperative that combines fly fishing with recreational tours. The leaders of this enterprise had been involved in the touristic sector during a long time, according to what was explained in the interview, and for different reasons decided to start their NBT project:

“I had 30 years of experience as a tourist guide, before starting with my family and one friend an independent project. Before this we all struggled for different reasons. My father was part of one of the first NBT cooperatives in town and he had his own concession (Boat concession). Me and my brother as well were part of this cooperative and also had our concessions each, so he put the concession in that cooperative’s assets and after some time we had problems with them and decided to quit but they didn’t want to give the concessions back and at the end my brother and I had to give our concessions up in order to get my dad’s concession back. Also in my case, as I was a tourist guide in Cozumel I used to drink a lot and since I had the money I would never stop drinking. I lost my family for this and my job. I quit alcohol years ago and now we are doing good, as a family” (Fragment from interview 2)

To start this project was not an easy enterprise, as explained in the interview. But through a lot of effort and an effective organization, they made possible to progress:

“We obtained credits to buy the boats and the engines and we worked very hard. Each one of us had to give a corresponding weekly payment to a fund we made to credit back the credit. We organized among us to share all the daily expenses for the family. We all were eating the same food here in my dad’s house, I mean, the families of each one of the cooperative’s members” (Fragment from interview 2)

The business went well for them and soon they decided to built rooms for rent. For this, they made use of the expertise of the family members:

“We started seeing the proceeds of our efforts and then we came up with the idea of building that little hotel right there (He points at it). Working with the three boats (tours and fly fishing), we managed to buy all the building material and since my dad in his youth times was a master-builder as well as my older brother, among them and me, my younger brother and a friend who was also part of the cooperative at that time, helped with the construction” (Fragment from interview 2).

With the time they had access to other two concession but this was very hard because as the interviewee explained the reserve was by the time, full of concessions. Conanp is the institution in charge of granting this concessions and after they get them, Capitanía de Puerto authorized all nautic activities.

The process of capitalizing this family cooperative, as described, required of years of hard work and even when more credit opportunities were available for them, is not always possible to take these opportunities:

“We have been offered to participate in federal mechanisms to obtain financial credits, but to be honest we can't. We have very low formal studies and we cannot go through the paperwork process. To start, it implies to use computers and all that and then there is no one who can take care of that because we are only 5 and we are busy taking care of the business here” (Free translation of fragment from Interview 2).

This lack of qualifications constitutes an obstacle for further activities because in the occasions when they have participated in training courses, even when they complete the course they do not get certificated when such certification requires them to read and write a test for instance:

“We have received different training courses. Conanp provides support with this because they obtain the funds to take this courses and they pay for it or some times, let's say they pay 50 percent or the first sessions and the rest is on us. But as I told you, for us this is very difficult because we have very low studies. I can barely read and write ” (Fragment from interview 2)

According to the interview, among the topics addressed in these courses can be mentioned: At-sea survival, first aid, and also different ones related to environment. On this last topic the interviewee comment:

“Actually this is clear to us, we don't need courses to understand that we have to protect the environment. We live here, we have been here for more than 30 years so for us this is more than clear. But the courses that have been very useful are the ones about the ecological functions, mangroves, dolphins, turtles, the fauna in general because in this way we are well informed and we can give interesting information to our visitants, so they can go satisfied. These courses help us to provide a better service”

The family has diversified their income sources. Some of them have their own rooms for rent individually, one of them established a grocery shop in the town, another one also established a mechanic shop and the interviewee himself commented that he started a business of nautic clothing, stressing out that all the capital for these investments comes from their NBT cooperative.

The latter constitutes a case of countless efforts but also of success in the seek for livelihoods in the reserve:

“We don’t really face any obstacle to carry out our productive activities. We have accumulated years of experience now and I can tell you that if you take care of your business, you won’t have any problems with the money”

#### **7.2.2.2. Recreational Tours**

Another case of nature based tourism can be represented by one of the most consolidated NBT cooperatives in JRG. This cooperative was formally constituted in 1998 and according to what was commented in the interviews, by this time there were some NBT cooperatives already operating and for the people who started this one, there was no possibilities to join any of the others, so they decided to organize and start their own cooperative. Is relevant to mention that the reason to look for an alternative activity was the decrease of lobster production.

“We wanted to work with the cooperatives that existed at that time and that was simply not possible. So in order to work and obtain the concessions that we now have, we have 12 concessions, it was necessary to become formally cooperative. At the beginning, just like everything, it was complicated. Like any other enterprise, we started from scratch, we didn’t have money to buy the equipment so we had to request credits because they (CONANP) told us that if we didn’t use the concession by certain date, they could take them back from us” (Fragment from interview 3)

With these credits they also acquired all the elements needed to equipped the boats and have them ready for service, however, the challenge did not end at this point because it was not easy to credit back those credits. The interviewee mentioned that the total costs for having a boat ready to work is of around 13,990 USD (280 thousand MX). This represented high investments and the returns did not come as quick as they would have expected because the flow of tourist in the reserve is rather low due to the difficult accessibility.

“A place like the reserve represents a limited market, firstly because it is a reserve and secondly, because of the access, it is in terrible conditions. Only because we work in partnership with tour operators that bring the tourists to us because otherwise we would have very few people coming” (Fragment from interview 3)

Initially these credits were obtained individually by each member and after they were better established they had access to financial support from other institutions.

“We had access to credits from the Fishery Stewardship but this is was very complicated because this institution is for the fishery only. But fortunately because we have a very good relation with the institution we could access these credits”

Apart from the latter, in 2005 the cooperative also received financial support from the UN, through the United Nation Development Program (UNDP), to obtain ecological engines for the boats. For this, the contact with a particular actor was crucial:

“In present days is part of the regulations of the reserve to use ecological engines but we were the first cooperative in the reserve using ecological engines. We received financial support to obtain this engines from the UNDP, they provided with the funds to buy 4 of these engines and we made the compromise to get other 4 by our own means but for this again, we obtained a credit from the Stewardship”

To credit back this credits was possible without many difficulties because once they were established and had agreements with the tour operators the income flows were constant.

### **7.2.2.3. Organizational aspects**

According to what was told in the interviews, the emergence of NBT as an important livelihood in JRG occurred in a spontaneous way. Before 1998, three other NBT cooperatives were operating and the activities carried out by all these were somehow unregulated. It was common to have negative interactions among cooperatives and unfair competition.

“At the beginning there was a big disorganization. There were three cooperatives before us and then another one was registered. At the beginning there was unfair competition to obtain deals with the tour operators. This was affecting us all because the tour operators used to take advantage of this situation and play with us. For example, they come to me and ask me to give them certain price for the tours speculating with the prices offered by the others, etc. And sometimes that wasn't even true but you know how this people is, they are traders. From this the

idea of establishing an Alliance of Cooperatives came out and through this we could regulate the situation “ (Fragment from interview 3).

On the same subject another NBT cooperative leader commented that for them is relevant to make partnership with external tour operators, even when they try to get their clients directly, without intermediaries. But since the latter is not always possible, the organization among cooperatives in JRG is very important because only by being organized they can become strong against the big tourism companies from the region who speculate and sometimes commit frauds against small tourist service providers.

“We now have enough experience to know how things work here. Before they could come and offer anything and we would accept just because we wanted to have clients, we wanted to work. But with the time we identify that these tour operators sell our tours for a lot of money to the foreigner tourist and only give a little money to us. Now with the Alliance we set our own prices and we rate these companies. We share information about them not only among us but also with other cooperatives in the region so when they don't respect an agreement with any of us, we deny the service to them definitely or temporarily until they pay the money agreed upon” (Fragment from interview 2)

According to the interviewees, some tour operators used to request service from the cooperatives under the figure of tour companies created to commit frauds and after having done it with different cooperatives they would just declare these companies in bankruptcy and not respond for the debts acquired with the cooperatives. Then they would just create another company and repeat the modus operandi.

Despite the risks, some cooperatives prefer to work with the external tour operators because even when they don't control the pricing process entirely, by setting a minimum price they assure for themselves constant flows of income. On this, it can be mentioned that an initiative to provide support to NBT cooperatives in the region has been launched by Amigos de Sian Ka'an by the name of MAYAKAN. Through this initiative NBT cooperatives not only are benefit because of the diffusion of their services but also through experience exchange with other cooperatives

Another option for the tour service providers is what they call “La Caseta”. This is a stand located in one of the main streets in town, in a strategic corner and every morning those who do not have any tours booked, come to this stand and wait for the tourists to come. Cooperatives take turns to provide service to the tourists gathered here. These of course,



are the ones who come by car or public transportation and not with a tour operator, thus, the flow varies considerably day by day, except during the high season.

Regardless these inconvenients, the touristic activity in the reserve is stable. In present days it represents the main source of livelihood for the local population. In the opinion of one of the cooperative leaders, around 80 percent of the population is directly involved in the tour services and from what could be observed in field, another important proportion of them is participating indirectly, either by offering mechanic services and general maintenance for the boats or by offering restaurant services.

Another relevant aspect important to mention is that the touristic activity in the reserve is somehow regulated by CONANP. But this is not necessarily something that the members of the cooperatives agree with and in some cases is interpreted as a form of institutional mismanagement.

“We would like to be more productive, to work more, but the reserve limits us a lot. There are no concessions anymore so we can't have more boats working. And some concessions belong to people that is not even from here. Sometimes we request concessions and they say that it is not possible anymore but after some time you see that the people that comes from other places can get them, and then they (CONANP) don't want us to think bad about them” (Fragment from interview 2)

Apart from the latter, there are some rumors that CONANP is planning to limit the number of tours per boat per day and this is seen as unfair. From the tour service providers perspective, because for them more tourists flows do not represent more pressure on the natural resources:

“Dolphins are not going to leave because more people come to see them, we don't allow people to have physical contact with the coral reef, we have been doing this for a long time now. The engines we use in the boats are ecological, I don't see what would the problem be” (Fragment from interview 3)

Finally, another constraint for those who work as tour providers is the lack of the basic services such as electric energy, fresh water running regularly, an adequate road to communicate the town with Tulúm. In their opinion, this is the cause of having low flows of tourists coming independently and besides that, the lack of infrastructure in the town impedes the tourist to stay overnight.

### **7.3. Local People and the Life in Town**

Local inhabitants in JRG are highly diverse in backgrounds and ethnic situation, but there is predominance of native people from Peninsula de Yucatán. The first generations, as it was already mentioned, were constituted by descendants of copra producers established in the surroundings and people from nearby cities and neighbor states, who arrived during the lobster boom.

The first generation of fishermen had experience in a variety of occupations and they developed different kinds of skills by doing their jobs either as fishermen or as NBT service providers. As it could be noticed in many of the fragments from the interview, they learnt and mastered many skills along the years performing their productive activities. But regardless this outstanding capacity to learn new skills, organized themselves and make a success out of their business, in general terms the formal education was not an asset in that generation. The situation in present days has shifted to a different horizon, as some of the interviewees commented:

“In town the formal education offer is limited, we only have coverage till secundaria and the parents that want their kids to continue studying have to send them to Tulúm. Thank god I had the chance to send my children to school and now both of them have a degree in tourism. They studied in Cancún and my daughter went to study also in the Netherlands” (Fragment from interview 1).

“Well, to be honest everyone here has the opportunity to study, at least the descendants of fishermen and the people from the touristic cooperatives. But many of them don't want because they start working here and make money, even more money than that they could make studying and working after. Some of the people from my generation did study, like me, but after finishing they just came back to town and work here” (Fragment from interview 6).

Colonia Javier Rojo Gómez is a town with rural conditions but by no means such conditions fit in the general rural mexican reality. It is a town where livelihoods are prosper and for the locals, access to these livelihoods are rather simple.

“The truth is that only very few people make it to the university. Many here make money, but also many don't have the vision to give their children a good education, they don't care much about it. From what i can see the majority make it to secundaria but that's it. This is sad because a community with no education is a community without knowledge, like this you can't go far, the situation remains mediocre” (Fragment from Interview 1)

It was also possible to know that absenteeism is a frequent situation among the boat captains working for the NBT cooperatives. This is due mainly for the high levels of alcohol consumption, and since they know the activity requires of their labor they are not afraid of losing their jobs (Notes from fieldwork)

“Sometimes they come still drunk or don’t come at all. And we don’t let them work in this conditions, it is a big responsibility. When this happens they received sanctions, either they are not allow to work for some time or at the end of the year they don’t receive their bonus ” (Fragment from interview 2).

During the fieldwork, through the interaction with the local people and from the information in the interviews it was possible to observe that in general terms, life in JRG is satisfactory for the locals. The general opinion on the matter is that for them no other place is as good as this. Some opinions on this:

“Fortunately I had the opportunity to travel a little bit, to see other places, in Europe, in the USA, here in Mexico and to be honest I wouldn’t move out of this town (...)” (Fragment from interview 1)

“To live in the reserve is a privilege. There are some disadvantages such as the lack of electric power 24 hours or the road to access the town, however, I would not change my residence to anywhere else. Sometimes I have to go on commissions to Tulúm, Mexico City, etc. and honestly I can’t be out of here for more than 3 days, it is very stressful, I don’t know how to explain this (...)” (Fragment from interview 3)

“Here in the town many people has the chance to go somewhere else, Tulúm, Playa del Carmen, Cancún. Actually some of the people have tried but they always come back. I don’t know what it is but for us is not the same outside” (Fragment from interview 6).

The latter does not mean that the life conditions in JRG are perfect. In fact, there are many aspects that could improve, for instance, the public infrastructure. The road is one of the first elements of infrastructure that can be mentioned. It is a dirt road connecting Tulúm with JRG in deplorable conditions. By car it takes around 3 hours to complete one way and with bad meteorological conditions this worsens. The consequences of this are not limited to the low tourist flows as mentioned in the previous section, but also to the accessibility of the locals in normal conditions or in emergency cases. It is also related to the provision of different goods in the town.

“We are a very isolated settlement, there are shortages in some goods and services, we don’t have doctors, for instance. If someone gets sick we have to take the person out of town by car to the nearest medical center or by boat to Tulúm. The streets are not paved and during raining season this is particularly problematic. Children go to school in flooded streets. Communication is another problem; there are some illnesses among the population. If this changes in the future life here would be better” (Fragment from interview 3).

The provision of consumer goods such as food come from Tulúm. The people who lack the means to bring these goods by themselves organize among them and when someone goes to Tulúm, this person brings basic articles for the others or, this can also be arranged with the driver of the only public transport communicating Tulúm and JRG. A Van that makes a round trip per day. Also an option to obtain basic need articles such as drinkable water, cans of food, milk, and others alike, are the two grocery shops in town. On the other hand, those who have their own vehicles, can bring their provisions with less complications but still have to make the trip to Tulúm (Fieldwork notes).

In regard to the medical services the situation is also adverse. There is a medical center in JRG but this is not completely reliable because there is an important lack of equipment and personnel. Doctors are not available all the time in this center. Furthermore, no ambulances or vehicles to transport patients are available, this has to be done in private vehicles including boats.

“One time my dad suddenly got sick and we had to take him to Mérida, but we have the means to do that. We drove him to one of the best hospitals there and fortunately they stabilized him. But imagine if we would have taken him here, there is no one, the doctors get paid for 8 hours and after 8 hours they go home, they don’t have medicine, they don’t even have an ambulance to take patients to Tulum. Sometimes the ambulance meets the people half way on the dirt road” (Fragment from interview 2).

The interviewee also explained that the latter was possible only because they created a family fund for emergencies, because they know no one else is there to support them and as owners of the cooperative they don’t have access to certain public services such as social security.

The lack of other public services such as adequate electric power, drainage system and land property entitlements, contributes in conjunction to the latter to make quality of life in JRG less adequate. Many inhabitants complain on the fact that they have not been granted with

property rights and feel completely vulnerable on his family heritage. This, according to their understanding is an obstacle imposed by the reserve.

Electric power in town is only available during some hours per day and this represents limitants for the daily activities at the household level and also for the productive activities. But moreover, the source of electric power constitutes an important pollutant emissor, as recognised for some of the locals:

“The electric power can be better, we are in a reserve and we should use clean energy, not the one we use now. The energy source that we currently use requires high quantities of diesel every day and this is a big source of pollutants. It is inefficient because apart from that, the electrical wiring is old and there are many power leakages” (Fragment from interview 3).

The interviewee explained also that the municipality is in charge with the maintenance of the system and they provide personnel to take care of it. But the fuel is provided by three parties including JRG itself, the municipality and the state. Local people is organized to monthly recollect their proportional part for the provision of fuel and bring it to the municipality. Afterwards the municipality sends a truck with the barrels of diesel.

It was mentioned as well that a project to implement solar panels and substitute the current electric power source had been approved. However, since this was being managed by an NGO (Amigos de Sian ka'an) and the budget to implement such project was going to be federal, the change of federal administration stopped the progress made on that regard.

The lack of an adequate drainage system is another negative situation affecting the local population and the natural assets. People have septic tanks, but as explained in one of the interviews, these are very old and in very bad conditions in present days so they are not properly sealed and have leakages:

“The wastewaters are a serious problem. These are reaching the groundwaters because the septic tanks are very old now and then all goes to the sea. You can see the consequences of this by the coral reef because with these waters many algae start growing there and kill everything” (Fragment from interview 3).

Finally, as mentioned above, the lack of property entitlements is a frequent complaint among the local inhabitants. In addition, it can be mentioned that the housing conditions are in many cases not adequate because certain building materials are not allowed by CONANP and the

houses deteriorate quickly because of the climatic conditions. This plays a relevant role in the safety conditions of the population. On the matter, people commented:

“At the beginning I always participated with the reserve in everything they did. I was happy to collaborate with them because I believed it was for the benefit of many people. But now we started seeing the changes in the way the reserve do things and that is very sad because for example, all the corridor (The corridor along the beach from Tulúm to JRG) is sold now, and the situation in Punta Allen is a bit dramatic in that sense because this community doesn't have property entitlements and the authorities are not cooperating with us to improve the situation. We are truly worried, because in the future when people die, the reserve or CONANP will keep all that and that's not fair (...). We have 42 years living here and we can't have a property entitlement, that is just not fair” (Fragment from interview 1).

“The reserve means a lot of impediments. If you want to improve your house, even if it is with steel sheets, you have to ask their authorization and it is extremely complicated. You have to request this officially and it takes a long time. And for us this is important because during the hurricane season if the house is not in good conditions you are vulnerable. On the other hand you see all the new constructions along the road from Tulúm on the dunes and about that nobody does anything” (Fragment from interview 4).

#### **7.4. The Role of the Reserve in the Perspective of the Locals**

In general terms, the creation of the reserve tends to be perceived as something not entirely positive from the local perspective. On this, it has been possible to know the main complaints of the local population towards the reserve and CONANP. In short, people tend to perceive they are limited in their productive activities and in their life decisions for instance, at improving their houses. Furthermore, the situation they all face of not having property entitlements is aggravated in a context in which the corridor along the beach, portion of the reserve to which the same regulation should apply, it is being “developed”.

“We have some papers from the state but these are not really valid, they are fake. It was just a mechanism to keep us calmed down. The reserve tells us that if we have the entitlements then people will start selling their land, that's why they don't want us to officially own the land” (Fragment from interview 1).

Others argue that it is not fair this situation because Vigía Chico “fought” for the land before the existence of the reserve:

“It was the cooperative to which the land was given and many years after the reserve came. The land is ours and it is not fair that they put so many restrictions on us“ (Fragment from interview 4)

Also the creation of the reserve tends to be seen somehow as an imposition that broke in their organization without any considerations:

“When the reserve came, they forbid the use of wooden traps (To catch lobster), they didn’t give us options or anything, they just said from now on the wooden traps are forbidden and we had to find new ways to do our activities” (Fragment from interview 4).

Despite of the latter, some of the local inhabitants acknowledge the influence of the institution in generating environmental awareness and also contributing with them in some beneficial activities. According to the information from the interviews, among the contributions of the reserve to the interests of the local inhabitants can be mentioned that CONANP provides protection during the closed season for lobster:

“Well, CONANP has participated in many events. Overall they have contributed with the supervision on the use of the natural resources, making sure that no one comes and steals the lobster or also making sure that no one carries out forbidden activities by the coral reef, because people tend to be very destructive. They also have contributed providing environmental information through some NGOs” (Fragment from interview 1).

“We are in a highly fragile area and the contact with the reserve, with científics, biologist and all that has been of great help, because this has contributed to stop the people to come and destroy everything. And also the local people has adopted good ideas and this contributes to carry out our activities in a sustainable way” (Fragment from Interview 5)

Another brief but eloquent statement was that “The only advantage of being in the reserve is the fact that the natural resources are still in good state” (Fragment from interview 2).

The latter arguments allow to observe that the role of the reserve in the life of the local people and in the protection of the natural assets in the region is acknowledged but at the same time is underestimated and perceived as negative to some extent.

## **8. Analysis of the Results and Discussion**

This section is organized according to the approach of capitals derived from the Sustainable Livelihood theory. The results are analyzed according to the variables identified for the category of Human Capital: Demographic characteristics: Cohorts and Origins; Education

and Health; Natural Capital: Active, Inactive and Environmental Services; Financial Capital: Income Sources Available Stock and Expenses; Physical Capital: Productive Goods, Work Tools, Infrastructure and Public Services; and Social Capital: Institutions, Networks, Rules and Regulations. Each of the variables in the five categories is disaggregated as shown in Table 5 in the methodological section.

## **8.1 Human Capital**

### **8.1.1 Demographic Characteristics**

As it was explained, demographic characteristics are an important aspect of the category of Human Capital. From the information that was possible to generate in the frame of the interviews and the field work observation, it can be said that roughly three generations coexist in Javier Rojo Gómez. The first generation is constituted by the compra producers who complimented their productive tasks with auto consumptive fishery and after the decay of copra, made the transition to the fishery. These inhabitants are the same that founded the lobster cooperative.

Among them figured a good proportion of people from nearby states such as Yucatán and Campeche and also from nearby cities such as Chetumal and Felipe Carrillo Puerto. The ethnic situation of the population is diverse, virtually there is no native population, despite being in a region with important presence of Mayan natives. The majority of the population is constituted by mestizo inhabitants whose mother language is Spanish. There are some exceptions but the cases are very rare. It is possible to find English speakers, however, these cases are rather discrete.

The second generation is constituted by the descendants of the first generation or people who arrived during the lobster boom. Even when there are some differences between these two generations, for instance in the formal education, many conditions are generally shared. In present days these two generation are active in productive terms, although the division of labor is notorious between them. The population is dominated by young people but there is an important presence of older people as well.

Finally the third generation is constituted by the youngest members. This is people from 0 to 15 years old, as it was observed during the fieldwork. In comparison with the previous generations, some differences are also identified since they are enjoying the benefits of consolidated productive activities in the town and relatively better public services.



## **8.1.2 Education**

### **8.1.2.1 Early skills**

As it was explained in section 2, early skills are referred to the abilities that individuals acquired in a very early stage of their lives. In this case and for analytical purposes, the abilities individuals possessed previous to the foundation of Vigía Chico cooperative are considered as early skills. In this way, it can be said that in general the population had a very wide portfolio of skills: fishery, agriculture, construction, industry and even in the tourism industry. All in all, these skills did not have a direct impact in productive terms but certainly played an important role in daily life, for instance, in building their houses or manufacturing their own working tools.

Another example of the applicability of those early skills is the case of the familiar cooperative which making use of the expertise some of the members had in other fields, built an hotel and made possible the diversification of their income sources. Furthermore, one of them stated that before starting their familiar project, he had 30 years of experience working in the tourist sector.

The latter is referred to the first generation. The situation for the second generation in JRG is different since many of them learned their job skills hands-on. They also received formal education, at least at a basic level, so the literacy level among them is higher than that among the previous generation. Although, based on the data from the last census, the average schooling years among the populations is 7.48 (INEGI, 2010), which could be considered as a rather low average.

### **8.1.2.2 On-the-job Training and Informal Training**

The pioneers of Vigía Chico cooperative and the other NBT cooperatives developed their skills by carrying out their productive activities. Throughout the years, they learned and mastered many skills. Evidence of the latter are the techniques used to capture lobster. They moved from rudimentary techniques that were undermining the lobster stocks and other species at the beginning of the cooperative activities to a sustainable and selective one that does not interfere with the reproductive cycle of the crustaceans and also protects those exemplars that have no commercial interest.

The transition of techniques occurred in an informal way, as explained in the interviews. The first instructive processes on the lobster capture took place as the activity started, in the interaction with the Cuban sailors. From these events, the use of the hook was established

and the lobster capture was rather incidental than systematic, though the productivity was high. Latter on, the use of traps was introduced. In this new transition the contact local fishermen had with fishermen from the USA, as stated in interviews, was the shifting point. After this, the presence of CONANP and the commercial agreement that Vigía Chico established with an exporter, urged them to shift into a more sustainable technique. In this occasion, it was the exporter who did, informally, demonstrations on how to catch lobster with the *jamo* and such technique was disseminated among all the fisherman from Vigía Chico.

For the case of NBT can be mentioned that along the years they realised that working in an organized way represents more security for all of them and more regular incomes. The creation of the cooperative Alliance is the perfect example of this. They described how before the creation of this alliance, the tourist companies from Riviera Maya had the opportunity to take advantage of their position and control the flows of tourist, thus, the productive potential of the NBT cooperatives. With the time, they realized by themselves that if they organized among cooperatives and shared information on the external companies, they would become stronger and access a better position in negotiations. The latter is perhaps one of the most valuable skills that members of the NBT cooperatives have learned, how to work organized, as a group.

On another hand, it can also be mentioned the case of the member of Vigía Chico who after the shock of hurricane Gilbert, started assisting in a fly fishing lodge and learned how to carry out this job. This experience provided him with the skills to start what in present days is a prosper company offering fly fishing tours. It is relevant to mention that the same person stated that he learned English by own initiative

As it was stated by one of the interviewees, after so many years of carrying out their jobs, they feel confident with their respective duties and know exactly what and how to do them. In his opinion, the only obstacle people in town has to access an adequate well being status is the lack of discipline and

#### **8.1.2.3. Courses**

it was possible to observe that the population of JRG, particularly the inhabitants who participate in the productive activities, are frequently invited to participate in different courses offered by CONANP and other institutions. These initiatives have contributed to raise awareness on the importance of environmental protection and have also contributed to

disseminate knowledge on the ecological functions of different ecosystems as well as knowledge on some particular wild species. This not only creates conscience on the relevance of adequately using the natural resources in general, but also provides the tour guides with useful information to share with the tourist. From the perspective of ecotourism, the latter is a valuable aspect.

The topic of the courses, as it was observed in section 8, are diverse. Some of them are focus in generating skills in the tour guides and the fishermen for their own safety when performing their productive activities, for instance, those related with at-sea survival. Some others are focused on providing administrative knowledge to better managed the cooperatives and others are on subjects related to improve the communication skills of the tour guides, particularly in English.

#### **8.1.2.4 Formal Education**

In terms of formal education, as it was mentioned, the local scenario presents certain variations. The first generation of inhabitants observes very low levels of formal education. This constitutes a significant problem in some cases, as it was described, because for some of them is highly difficult to carry out activities that demand reading and/or writing. This does not constitute an impediment for their livelihoods in general but definitely lowers the potential benefits they could have access to. Example of this is the case of the familiar NBT cooperative, whose members despite having participated in different courses offered by CONANP and other institutions, cannot receive the corresponding certifications at the end of the courses since it implies taking a written exam. This is also problematic when closing deals with clients, since this normally occurs via electronic mail. Nonetheless, the affluence of clients for them is not compromise by this situation, as it was explained in an informal conversation previous to the interview with one of the cooperative members.

The two more recent generations have a different scenario in this sense. They are better prepared. Schooling years in this generation tend to be higher. Even when the educational offer in town is limited, the new generations have the possibility to continue their formal instruction in other cities most frequently in Tulum but also in Cancun and even through international experiences, as it was observed in one case. As stated in some interviews, frequently the members of this generation have university degrees, even when they chose not to get jobs in their professional fields but rather to incorporate themselves into the productive life in town. On another hand, the possibilities of taking part in the productive life

from a young age also plays a negative role since it hampers the academic interest of the youngsters. In these cases, they reach 9 years of schooling years as it was stated in the interviews.

#### **8.1.2.5. Forthcoming Value of Knowledge Transferred**

Regarding the forthcoming value of the skills and knowledge acquired by local inhabitants in the frame of their productive activities, it can be mentioned as something highly relevant the fact that environmental awareness has been raised through the different courses that CONANP and other institutions have provided. It is reasonable to assume that this will contribute to the protection of natural resources at the local level in the future.

On another hand, the administrative skills that some of the members of the new generations have developed have contributed to manage in better terms the different cooperatives. This has given the cooperatives better perspectives for their well being and subsistence.

In some cases, the importance of formal education has proven to be beneficial and has projected some of the private initiatives to better scenarios in commercial terms. Example of this is the private fly fishing company lead by a former lobster fishermen and his daughter, who has implemented her professional knowledge in the tourist sector to promote and manage the company of her father.

### **8.1.3. Health**

#### **8.1.3.1. Self Assessment**

In regard to the health situation, it was possible to obtain comments from the interviewees on their personal assessment in respect to the local population. In general, it can be said that no disease affects the population in a relevant way. Some mentioned the presence of diabetes or hypertension but these cases are not very frequent.

On another hand, what can be considered a regular unhealthy condition among the population is the high levels of alcohol consumption. This, as it was explained in section 8, affects the productive activities and affects the social environment. This is a problem that tends to be observed with more frequency in the young male members of the population.

#### **8.1.3.2. Access to Public Services**

The lack of medical services in town is a situation potentially mining adequate health conditions among the inhabitants. It constraints the possibility of performing regular medical

inspections. The medical center does not offer regular service due to the lack of doctors and medicine is not available neither.

Another factor that can deteriorate the general health conditions in the population is the lack of adequate drainage system and electric power. In the first case, it was told that the deteriorated conditions of the septic tanks is causing environmental contamination evident in the area of the coral reef, which is the habitat for different species of local interest for direct consumption such as fish stocks. Furthermore, the lack of regular electric power, represents a constraint to keep food in good conditions at the household level. However, this was not mentioned as a problem in general.

### **8.1.3.3. Access to food**

In JRG, the lack of fertile soils makes highly difficult to grow food as it is done generally in rural contexts. Food access is limited to the seafood they can obtain directly in the sea and the provisions people bring to town from Tulúm by car or public transport.

Mostly, the provision of food in the household is made by each family with their own means. Also, occasionally food is delivered in town by trucks that bring different products such as fruits, vegetables and tortillas. Apart from this, there are also two grocery shops where is possible to buy some products, but the offer is limited as observed during the fieldwork. Finally, It was also observed that some people have livestock as a source of food, such as chickens, but this is not common.

In general terms, despite the complications that bringing food to town can represent, it cannot be said that people in JRG face serious problems to have access to food. It calls attention though, the environmental cost of bringing these supplies since this is a operation that requires round trips to Tulúm in a regular basis and for each family.

## **8.2. Natural Capital**

### **8.2.1. Active**

In terms of active natural capital, even when it was not directly mentioned as a relevant asset in the interviews, the forest should be considered an important asset. The presence of a vast surface of forest, fosters the processes of carbon sequestration and air purification. It also contributes to the maintenance of the water cycle and to the availability of this resource at the local level.

In a similar way, the vast populations of mangroves play a very important role in the water cycle and the availability of it and in the provision of habitat for different species of touristic interest such as birds and amphibians and direct consumption such as different kinds of fish. The same can be said for the coral barrier which not only represents habitat for many of the commercial species for the population, including lobsters, sea turtles and exotic fish that figured among the main attractives for the the tour services but also functions as a relevant protector against hydrometeorological events.

The existence of the bay figures is as well, a highly relevant natural asset due to its role in the productive life of the town. It is in the bay where the lobster stocks are available and it is here as well where members of Vigía Chico cooperative have their respective work spaces. Furthermore, the bay along with the coral barrier, constitutes the habitat for many species of local interest.

### **8.2.2. Natural Income**

As it was explained in section 8, the natural goods that are produced through autonomous environmental processes or through human intervention are considered within the category of natural income. In this way, natural goods such as pure air and fresh water can be considered for the case of JRG. Nonetheless, beyond the latter, lobster stocks figure perhaps as the most important natural income in JRG. The natural conditions in the region, particularly in the aquatic ambit, have made possible the availability of these lobster stocks. Furthermore, the physical conditions of the bay do not represent an obstacle to carry out the lobster catchment. These are rather favorable and have contributed to increase the productivity without major requirements and efforts.

Different kinds of fish that are of interest for local consumption figure as well in the category of natural income.

### **8.2.3. Environmental Services**

In terms of the services that natural capital offer to human populations, the landscape and marinescape are a remarkable local asset. In the same way this figures as the element for the touristic success in the region, in JRG has made possible the tourist flows at the international scale and along with this has contributed to the outstanding success of the NBT

cooperatives mainly and also for the fly fishing lodges, because it figures as a comparative advantage in regard with other destinations offering the same services.

Also, biodiversity figures in this category. In this sense, different charismatic marine species can be mentioned such as dolphins, sea turtles and exotic fish. All these are part of the attractive offered by NBT and the fly fishing lodges. It is worth to mention that in the case of fly fishing, the exemplars of direct interest are found in high seas, beyond the coral barrier but still within the polygon of Sian Ka'an complex.

#### **8.2.4. Regimes of Use**

Regarding the regime of use of the natural income and environmental services mentioned above, it can be said for the case freshwater and clean air, that it occurs under normal conditions. This means that the use of these resources does not imply alterations on the capitals contributing to make them available, the forest and the mangrove populations, for instance. These ecosystems, observe themselves, very low pressure regarding to human use. As it was mentioned, there are some cases of illegal lodging but the occurrence of this is rather sporadic.

In regard to the lobster stocks, the situation is more complex. As it was explained in previous sections of this document, the regime of use on this natural income has shifted throughout the time and different phases can be distinguished. At the beginning the captures of lobster were carried out using fishing hooks, nets and long lines that were heavily affecting the continuity of the species since this fishing arts do not allow fishermen to select the exemplars of interest. In consequence a depletion of different species was taking place. As it was told in the interviews, the fishermen would only select, after capturing, those exemplars of commercial interest and the others would be return in the bay either dead or with no possibilities of survival. In the case of the lobster, many exemplars with no commercial interest due to their inadequate size would be affected and this was compromising the reproductive cycles of the specie. Furthermore, other species, such as turtles, dolphins, stingrays and exotic fish would also be captured with the same outcome.

During this time, Vigía Chico was going through a very positive phase in terms of their productivity. The cooperative was growing and becoming a referent in the sector within the region. Nonetheless, with the creation of the biosphere reserve, new regulations were established and different investment possibilities were stopped, as stated in interviews. This undoubtedly represented an important regulation in the regime of use because through this

determination, the reserve (CONANP) made sure of keeping the dimensions of the productivity under the convenient environmental limits.

On another hand, through intern regulations and with the presence of CONANP, some fishing arts of high impact, such as the fishing net and the long lines, were forbidden during the late 80's. This constitutes as well a relevant shift towards sustainability in the regime of use of the lobster stocks.

Furthermore, the commercial agreement made with the exporter from the USA represented, again, another important change since from this event on, the use of hooks was finally left behind. Not at once, as it was explained in the interviews, but progressively all fishermen became interested in selling their production at better prices and for this they should keep the lobsters alive. This required them to use another fishing art. In this way, the jamo was established as the common fishing art among Vigía Chico fishermen. Furthermore, for the consolidation of this, participating in certification programs contributed significantly, as commented in the interviews, and even when Vigía Chico decided to abandoned the certification program, the good practices remained among the fishermen.

In present days the capture of lobster is carried out using devises denominated shelters. These are build locally with regular building materials such as concrete, and after they are disposed under the water of the bay. Lobster exemplars gather in this shelters and for the capture, fishermen free-dive in their parcels and using jamos, which are small catching nets, they collect only the lobsters with the adequate commercial characteristics. This allows them to return exemplars in reproductive phases and also those with inadequate commercial sizes. This practice constitutes a very important strategy not only to increase the selling prices but also to protect the continuity of lobsters and other species.

#### **8.2.5. Landscape, Marinescape and Biodiversity**

In the case of the regime of use of the landscape, marinescape and biodiversity, NBT cooperatives are the main actors involved. From the beginning of this activities, with the exception of fly fishing, the measures taken in order to protect the environment have been more explicit. This is not surprising considering that this activity was promoted from the administration of the reserve. However, the regulations on it have indeed gone through different phases.



At the beginning the number of concessions was unlimited and no distinction was made between concessions for fishery and concessions for NBT. Thus, the activity was less regulated. With the time, this changed and special concession for NBT were given, which could not be used for fishery and vice versa. The number of these concession became limited and with this, the number of boats used for the activities are as well limited. Furthermore, CONANP determined that the engines used for the boats had to be ecological and outboard. In present days all boats use this kind of engines and by so doing, emissions from combustion and oil leakages into the water are avoided.

The activities involved in the tours in the ocean include snorkelling by the coral reef, sighting of different charismatic species such as dolphins and sea turtles and swimming in a special part of the beach with a particular scenic attractive. The number of tourist per boat are limited to 6, and it is strictly forbidden to descend from the boat in the coral reef area without life vest. This has the objective of protecting the corals from contact with the tourists. Is also recommended, but not mandatory, not to use sun protector, since it potentially pollutes the ecosystem. This tours do not imply direct contact with the marine fauna, so the impact in the natural assets is rather slow.

On another hand, fly fishing does involve a direct impact with the fish, even when these are released after catching them. It is argued, from the fly fishing service providers, that the damage caused to the exemplars is of no serious consequences for them, thus fly fishing can be considered as a non-threatening activity for the species. Nonetheless, it was also mentioned that CONANP does not entirely agree with this.

Despite of the latter, it can be considered that NBT does not generates relevant impacts in the natural assets on which it depends on.

#### **8.2.6. Stressors and Continuity**

On the factors of stress and continuity for natural assets such as forest and mangroves it can be said that no stressors were detected in the frame of the interviews. In this sense, the fact that the reserve exists and that it is isolated from the massive tourist flows of the region, represents an important condition for environmental protection, as expressed by the local inhabitants. For this reason, is possible to say that the continuity of these communities of the ecosystem and of the environmental processes and goods they provide is feasible if the current conditions remain.

Regarding to the lobster stocks, as it was repeatedly stated in the interviews, availability has been decreasing in the last years. In the opinion of the local people, different factors could be causing this drop in their production:

- a) Hydrometeorological events. It was stated in many occasions that one of the biggest impacts of hurricane Gilbert was precisely the reduction in the lobster stocks. It was mentioned by different interviewees that after this event the abundance of lobster was never as before. Furthermore, the frequent occurrence of hydrometeorological events affects annually the lobster stocks and impedes performing productive activities. Based on this, hydrometeorological events can be considered as an important natural stressor in this case.
- b) Furthermore, according to the information from the interviews, the presence of sargassum in the bay -phenomenon that has been affecting the caribbean coasts since a few years now- generates processes that seriously affects the lobster availability. Based on the information from the interviews, the decomposition of this algae in the surface of the water realises toxic elements that kill lobster larvae and other species too. For the latter, sargassum is considered as well as another natural stressor affecting not only lobster but other marine species.
- c) Dissemination of catching technique. According to some of the interviewees, the reason behind the decrease in lobster catchments is the ever more popular implementation of the technique Vigía Chico fishermen use for their productivity. In this sense, the workshops organized by CONANP with other fishery cooperatives in southern latitudes in which Vigía Chico members disseminate the good practices and techniques implemented by them is causing the interruption of the natural flows of lobster from south to the north. The latter can be considered as an anthropic stressor affecting lobster continuity, at least in Ascensión Bay.

For the latter reasons, it can be stated that lobster, indeed, faces different natural and anthropic stressors that could be threatening its continuity. This merits further scientific inquiries because despite the accuracy of these local hypothesis and the institutional (CONANP) efforts to protect the concessioned area from unsustainable practices through regular surveillance, the general perception indicates a problematic situation.

In regard to possible stressors for the other natural assets included in the productive dynamics in JRG, it can be said that from NBT activities, none was identified. Nonetheless, for the coral barrier the lack of adequate drainage system does represent a stressor. As it was stated in the interviews, the waste waters from the septic tanks infiltrate in the waterbeds and run to the sea. This is becoming evident by the coral barrier where some signs of eutrophication can be perceived. Furthermore, some of the NBT service providers mentioned that corals begin to observe evidence of reef bleaching. All this constitutes a situation that merits more attention, since potentially affects the whole reef ecosystem, threatening not only the natural assets but also the productive activities.

Finally, another situation that does not represent a direct impact for the local assets but it does for the environment in general is the source of emissions that constitutes the electric generator in town. This is an important pollutant considering that it runs with diesel and requires daily important quantities of it.

### **8.3 Financial Capital**

As explained in section 2, the category of Financial Capital can be disaggregated in different variables. For the present project the relevant variables were Income sources, Available stock and Expenses.

#### **8.3.1. Income Sources**

As it was already explained, in JRG the main income sources are constituted by NBT in its two modalities, and lobster commercialization. Furthermore, there are other sources of income such as small bars and restaurants, accommodation for tourists, mechanic shops and grocery shops, however, all these are oriented more towards the household level rather than to the community level.

In terms of the capacity to employ labor force, NBT in its recreational tours modality, constitutes the main income source, because is the activity that generates benefits for a bigger sector of the local population; around 80% of the population is involved in this modality of NBT, according to the local opinion. Subsequently, Vigía Chico cooperative figures as the second source of income for the population in JRG and finally, the fly fishing lodges. The latter, despite of constituting a source of exceptional incomes, tends to use less labor force, reducing the capacity to generate wider community benefits.

### **8.3.1.1 The case of Nature Based Tourism Cooperatives**

Each NBT cooperative works individually organized and regulated by internal rules. The members of the cooperatives and the administrative workers have stable positions within each organization and perceive a salary. In the case of the boat captains and tour guides, the situation is different. According to information gathered in fieldwork notes, they get paid either per day of work or some of them get paid weekly. It is relevant to mention that the workday payments are competent.

As it was indicated in the interviews, recreational tours observe a regularity throughout the year. This means that despite the low and high seasons, there is always a tourist requiring service. This is an important aspect because it gives to all NBT cooperatives participating in recreational tours -which is the majority of them- a key position in the economic life in town. Furthermore, the collaboration with external tour operators provides these NBT cooperatives with regularity and stability in their activities.

In terms of the available stock such cooperatives have access to in order to obtain financial capital, it can be mentioned that different sources were identified. One of the leaders of the first NBT cooperatives explained how difficult was for them to capitalize their organization and to overcome all the obstacles in their initial phases. For them it was difficult to obtain credits from financial institutions to acquire the first boats and their respective engines. The close relationship they have with Vigía Chico leaders was the means through which they were granted a credit from the fishery stewardship. This, as he explained, is not officially allowed since the stewardship provides credits only to organizations in their sector.

Furthermore, the same NBT cooperative also received important financial support from an international organization supporting the logistics and managements of in biosphere reserves. With this, not only did they acquire equipment for their activities but also began an important phase within the sector in the reserve, with the use of ecological engines.

In other cases, the first investments were possible through personal credits obtained with traditional financial institutions. As explained, in these cases the total amount of the credits was used for the acquisition of productive goods for the organization. Only after consolidation as a touristic cooperative, credits from other institutions were possible. Moreover, the cooperative started a fund that remains available for reinvestment and maintenance of the equipment and for personal needs of the cooperative members.

Finally, in regard to the expenses that cooperatives need to assume to reinvest or give maintenance to their productive goods, it was said that once the cooperatives start working regularly, they do not face any problems to generate the necessary incomes for this. Normally, the low season is the period used to perform maintenance procedures. It is very important for them to carry out these procedures during the low season because when the high season starts the amount of work makes virtually impossible to stop.

#### **8.3.1.2. The Case of the Fly Fishing Lodges**

In the case of the fly fishing lodges, the situation is slightly different. The first investments were possible by personal means. In one of the cases, the leader and manager of a fly fishing lodge started capitalizing his enterprise with the proceeds obtained as a Vigía Chico member. Since he already had equipment, he started by renting this equipment to a third party. Afterwards, with the incomes generated, acquired more equipment and then started his enterprise. In this case no credits were needed, investments were realized through personal funds and income flows.

In the latter example, it was possible to learn that even when the low and high seasons are in fact notorious for the activity, the proceeds generated during the high season suffice to face the rest of the year without economic constraints. Regardless the important income source that fly fishing services represent, the scope of benefits among the community is reduced since the labor force employed in this activity is notoriously lower in comparison with the recreational tours.

The other case of a fly fishing lodge is a combination of both NBT activities. They started obtaining credits individually and with the time it was possible to request credits from traditional financial institutions, as an organization. This facilitate the obtention of such credits. In the same way as in other cases the regular income flows allowed the organization, once it properly established, to not depend on more financial support for their activities. In this case, as they offer both, recreational tours and fly fishing ones, the low season is rather busy as well. Thus, income flows are constant.

#### **8.3.1.3. The case of Vigía Chico**

The case of the fishery cooperative is similar to the others. It is an organization strongly consolidated. Furthermore, in present days it has access to different financial sources, such

as the fishery stewardship and the sectoral governmental institutions at the local, regional and national scales. The credits Vigía Chico has access through this institutions are for the acquisition of common goods for the organization. In recent time, for instance, the cooperative used one of this credits to buy a lorry truck to transport their production to Tulum and facilitate the delivery to the buyers.

On another hand, Members also have access to an internal fund and to financial assistance from federal programs in the sector. The idea of this is to provide each member for the individual acquisition of productive goods or for the maintenance of their boats. The fund is available exclusively during the closed season. The maintenance expense do not constitute a problem for the members.

Finally, in a similar way than occurs with the fly fishing seasons, fishery faces a closed season. But again, the proceeds generated during the open season suffice to not compromise the well being of the members. Nonetheless, in this respect has to be pointed out that the small members of Vigía Chico do not have the same proceeds as the big ones. There are important differences in this way among members of the cooperative. In the best scenario, this is a situation palliated by the governmental assistance they receive but it is a fact that the benefits generated from Vigía Chico are unequally distributed.

For the members of Vigía Chico that have no access to parcels and for the employees who work in field during the open season is necessary to complement their income sources. Thus, is very common to find cases of people who work as tour guides for the NBT cooperatives and during the lobster open season work for members of Vigía Chico.

#### **8.4. Physical Capital**

In the category of Physical Capital 4 variables were identified. Productive goods, referred to the equipment necessary to carry out productive activities; working tools, referred to items of relevance for the productive activities and, on another subcategory the public services and infrastructure available for the local inhabitants of JRG.

##### **8.4.1. Productive Goods and Working Tools**

For the case of the productive goods and working tools, it is convenient to separate them by productive activity. In this sense, regarding NBT, productive goods would be represented by boats and engines mainly, and the same applies in the case of fly fishing. In respect to the

working tools, items such as life vests and snorkel equipment can be identified for the recreational tours and in regard to fly fishing, evidently fishing gear figures as the relevant working tool.

In present days, all NBT cooperatives and fly fishing lodges have all the necessary equipment to perform their activities. As already explained, at the beginning resulted somehow problematic for some of the NBT cooperatives to acquire their first boats and engines to start their activities, but after they started operations, the stability of the activity provided them with the means to maintain and renovate the productive goods and working tools without further constraints.

Similarly to the case of NBT, in the fishery sector boats and engines figure as the main productive goods. In regard to the working tools, these are evidently different. In this case the shelters that fishermen use to “trap” the lobsters in their parcels and the jamos to catch them, are the working tools of relevance. As it was explained in the interviews, at the beginning it was relatively difficult to obtain this working tools but in present days they are available in town and to renovate them is not a problematic situation. Many of the fishermen build or repair their own shelters, since these are very basic devises made out of concrete and other building materials. As for the jamos, the situation is similar. These constitute very basic tools and obtaining them does not represent a problem at all.

In regard to the productive goods, it can be said that even when today all members of the cooperative have access to mechanism to acquire productive goods and working tools, at previous stages of Vigía Chico activities, the lack of these among some members did make effects of long term consequences. As it was explained, when Vigía Chico was granted with the fishing concession of Ascención Bay and the parcel system was implemented, some members did not have the material means to make use of the parcels, whereas others had these means in abundance. Since parcels were permanently distributed according to the capacity of making use of them, many members of the cooperative were excluded from their rights to take part directly in the productivity.

#### **8.4.2. Infrastructure and Public Services**

In regard to the public infrastructure included in the category of Physical Capital, different elements can be mentioned. One of the first aspects that interviewees commented in this respect was the bad conditions of the access road from Tulúm to Javier Rojo Gómez. This

represents a constraint in different ways, especially considering that apart from this, no other relevant communication facilities have presence in JRG.

The lack of an adequate road constitutes an obstacle for the productive activities. On one hand it constraints the flow of tourist that could potentially visit the reserve independently, this means beyond the influence of the external tour operators. As stated by the NBT leaders, it represents for them dependency on the tour operators who by controlling the flow of tourist are in a better position to negotiate the price of the services.

On another hand, the conditions of the road make more difficult for the local inhabitants of JRG to have better access to inputs for the household and their productive activities since transportation of goods to JRG implies a round trip of around 5-6 hours. In a similar way, the conditions of the road sharpen the already isolated conditions of the town, which in case of medical emergencies represents a relevant obstacle.

The condition of the streets in the town are also precarious. This worsens during the raining season and affects everyone in town. The dirt streets become intransitable and the daily activities are hampered. Example of this is, as mentioned in interviews, the course that kids make from their houses to school in the flooded streets during the rainy mornings.

The infrastructure of the houses is another aspect compromising the life quality of local inhabitants. As it was mentioned in different occasions, improving the conditions of their houses is a difficult task, even if they have the financial means to carry out such improvements. The obstacle for this is the regulation imposed by CONANP on any building project. This affects the interest of the local inhabitants and, in their opinion, increases the vulnerability of their families and material goods in a context in which hydrometeorological events represent an important threat. As it was observed during the field work, some of the houses in JRG is rather precarious. Dirt floors, walls and roofs made out of local materials or steel sheets. There are also houses in better conditions, but in a general the infrastructure in this regard is a condition that can certainly improve.

In the same line it has to be mentioned that there is no drainage system in JRG. Each house and all the new touristic facilities use septic tanks and as it was stated by the local inhabitants, in many cases these are not in good conditions. Leakages from these tanks to



the waterbed -which as described in section 5.1.1 is very close to the surface- are a problem affecting the marine ecosystem.

In the case of electric power, the situation is adverse. The town has electric power available only during certain hours a day and such energy is produced with a diesel generator. This constitutes an important source of pollutants in the reserve. What is more, the electric system is obsolete and energy leakages are common, as explained in the interviews.

In regard to the educational offer, it was observed that it is limited. JRG has educational coverage corresponding to the first 12 years, which is equivalent to kindergarten, elementary school and secondary school. In Mexico, in regular conditions, the accomplishment of these three levels of basic education is expected by the 15 years of age of the individuals. According to the last census, in JRG the average of schooling years is of 7.48 (INEGI, 2010). In this respect, the situation of JRG is evidently precarious and financial resources, as it was told in the interviews, is not a constraint for accessing formal education.

Finally, the lack of medical services figures as well as an element of precarity. There is a medical center in town with inadequate conditions and the availability of doctors and medicine is a constant problem. Local people prefer to use their own means when they require medical attention, but for this is needed to go to Tulum or other nearby cities. As it was mentioned by one of the interviewees, the lack of doctors, medicine and an ambulance in the town, represents a situation of high risk in case of emergencies.

## **8.5. Social Capital**

For this category the variables identified were Institutions, social interactions, characteristic of the networks, resources obtain from networks, characteristics and quality of the goods and/or benefits obtained from networks and rules and regulations.

It is convenient to start describing the structure of institutions involved in the local dynamics of JRG, followed by the networks established within the institutional structure identified. This will be organized in a chronological order.

### **8.5.1. Fishery institutionalization**

One of the first events that can be identified as relevant in the historic development of JRG is the institutionalization of the fishery as the economic pillar in town. This occurred only

through the contact that local copra producers and occasional fishermen had with the Cuban sailors, as described in the interviews. The historical moment can be referred as institutionalization of the fishery and it occurred in an informal frame.

In regard to the characteristics of the network established with the Cuban sailors it can be said that it corresponds to an eventual or seasonal contact. The informality of the interaction did not allow to have meetings programmed or regulated exchanges of products. However, in terms of the benefits derived from this interaction the proceeds for the local people from JRG were of great significance. From this, locals developed interest and skills to put in productive use the stocks of lobster. Furthermore, this became the catalizer of the local organization and economy.

Apart from the latter, other goods received from the establishment of this network, were the consumer goods obtained directly in the exchange of lobster. As explained in the interviews, locals obtained cans of food, cigars, sugar and rum bottles.

In regard to the rules and regulations at this stage, it can be mentioned that virtually none regulations applied during this period. There was no defined working places in Ascención bay, there was no regulation on the fishing arts or techniques used in the productive activities.

#### **8.5.2. Establishment of Vigía Chico**

The institutionalization of Vigía Chico cooperative in 1968 is another milestone in the historical development of the community and in the social capital expansion as well. This event fits in the category of a formal institution. The complexity of the network established with this event increased because different governmental institutions are involved such as the National Commission on Fishery (CONAPESCA in Spanish), the Fishery Stewardship, different academic institutions among many others.

Being formally established represents a series of benefits and obligations as it was explained in the interviews. For instance, a minimum of productivity is required to maintain the status as a cooperative. On another hand being part of this network provides the institution (Vigía Chico) with a solid network of support. In this sense this could be referred as a network of institutionalized reciprocity.

The benefits obtained from this are, legal status and recognition as a fishery cooperative, formality in their activities and exchange with other institutions or clients, access to a solid and wide network of support with possibilities of access to financial support through traditional or sectoral credits and of course internal organization.

All benefits and goods obtained from this network are long term -in the frame of its affiliation- benefits and subject to formally institutionalized procedures. The benefits are not only for the cooperative as an institution but also for the members individually, as it was possible to observe in the information provided in the interviews. Example of these are the credits obtained to acquire the lorry truck or the federal support that members receive as active members of the sector.

Finally, the rules and regulations are formal and the internal organization reshaped accordingly. Well defined roles are assigned among the members and administrative functions are distributed among them. Internal governance processes were established within the cooperative and a better position in the interaction with other institutions was also a benefit for Vigía Chico after its formal establishment.

### **8.5.3. Sian Ka'an Biosphere Reserve Decree**

The creation of SKBR in 1986, not only represented an interaction with CONANP, the institution responsible for the management of the reserve but also, directly or indirectly, with many other institutions and NGOs. CONANP, naturally, figures as one of the main actors in this phase. It corresponds to the governmental sector and its power of influence within the reserve is relevant.

The interaction established between local population and CONANP could be characterized as a relation of formality and of authority as well. The benefits obtained from this interaction are diverse. For instance, the interviewees mentioned the fact that their surroundings are still in a good state of conservation is because the existence of the reserve. In this sense, one of the first benefits that could be pointed out is the capacity of maintaining the continuity of the natural assets and processes within the reserve.

In the case of the fishery, cooperative members also mentioned that CONANP provides them with assistance in the surveillance actions. This is of high relevance to the Cooperative since is in their direct interest to protect their productive areas from intruders who not only

disrespect the concession but also the closed season. CONANP actions in this way are very useful in terms of environmental protection and in terms of the protection of the productive activities.

Other benefits obtained either from or through CONANP have been the different courses. In this regard it can be said that information from the interviews is limited, since the members of Vigía Chico who participated in the interviews tend to show more the negative aspects of the institution in charge of the reserve. However, from what was possible to be perceived in the frame of the interviews, the involvement of CONANP with the members of Vigía Chico is active and many workshops have been organized in which now not only the members are instructed on sustainable practices but also they instruct their workmates from other cooperatives.

Another interested benefit that can be identified is the attention that Vigía Chico and Sian Ka'an have received for the fact of respectively being in and being a biosphere reserve. This lies beyond the scope of CONANP and their actions and it is focused rather in the fact of the synergies that a protected area of this kind can generate. It is a very interesting fact because it shows the potential of a biosphere reserve as a pole of attraction of positive interests and investments.

In regard to the rules and regulations, it results evident that these are part of the actions expected from an institution in the position of CONANP. In this sense short after the reserve was decreed, the use of some fishing arts such as the nets, long lines and hooks was formally forbidden. In the same way, fishing in the coral reef area was no longer permitted. Some of these regulations were seen as imposed by a sector of fishermen or as unnecessary because some internal regulations had already been applying. However, the presence of CONANP and institutional support in this regard could represent more guarantees, which could be seen as an advantage.

In the case of NBT, the presence of CONANP has been of great significance, since it was this institution who fostered in the first place the realization of the activity, particularly the recreational tours. As explained, this occurred in a context of crises in JRG, after hurricane Gilbert. The kind of interaction is evidently formal and the influence in the organization of the activity is higher than in the case of the fishery, since the latter had already been established long before the reserve.

The characteristic of the network established between NBT cooperatives and CONANP are of support but also of strong regulation from the administration of the reserve, thus it plays a role of authority who implements formal and strict regulations. Evidence of this are the concessions to operate within the reserve. Such concessions not only regulate the number of boats that NBT cooperatives use for their productive activities but also restraints external tour providers of working within the polygon of Sian Ka'an. Thus, these concessions are not only an obstacle to work, as some cooperative members stated but also a protection against external agents.

Other benefits that NBT cooperatives obtained from this network are also of high relevance. It allows them to establish contact with other institutions and organizations and through this, improve their productivity and practices. Evidence of this is the financial support that some of the NBT cooperatives received from the United Nations Program for Development to obtained half of the ecological engines they use for their boats. Furthermore, Amigos de Sian Ka'an through its initiative denominated Mayakan, offers to NBT cooperatives affiliated training in important aspects such as customer service and administrative functions.

In a similar way that occurs with Vigía Chico, other benefits that NBT cooperatives obtained from CONANP are the various training courses. This is a source of useful knowledge that is contributing not only to provide semi-formal instruction to members of NBT sector in JRG, with specific and useful information for their productive activities but also contributes to increase the environmental awareness at the local level.

On another hand, as it was observed, the internal organization of NBT cooperatives, in particular their very own formal establishment, brought them benefits such as access to credits to obtain their productive goods. This, also fits in the category of formal institutions and it provides each of these cooperatives with legal and formal recognition. It gives them a solid figure to interact with other social actors.

Similarly, the Alliance that NBT cooperatives built, figures as a very important element in the scenario of social capital in JRG. This shows an important capacity of coordination in the protection of their own interests beyond the intervention of governmental institutions or NGOs.

It seems that Vigía Chico and NBT cooperatives have solid social structures. CONANP represents a very important actor in terms of the role it can play in the canalization of different types of support and investments from international and national institutions and NGOs. In the same way, local NGOs such as Amigos de Sian Ka'an, have in SKBR an important element for mutual benefit. All in all, the social capital in SKBR constitutes a wide and solid structure in which a variety of private actors, the local cooperatives, CONANP and other governmental institutions and international organizations can focalize their efforts to achieve great objectives in terms of development and environmental protection.

## **9. Conclusions**

After having analyzed the scenario of SKBR through the sustainable livelihoods approach, the conditions of economic success and well preserved natural assets described from the beginning, seem somehow limited to state that the case study is, in fact, a case of local sustainable development. On another hand, the results did not indicate the opposite either.

To give an adequate organization of the ideas expressed in this section, content is structured according to the research questions. In this sense, first, the specific questions are answered and the answers to the general questions serve to close the section.

1. What have been the direct contributions from CONANP in the improvement of each of the capitals of the sustainable livelihood approach in JRG?

In the case of Human Capital, it can be argued that the actions carried out by CONANP that have been of major relevance are the various training courses offered to the members of all NBT cooperatives and Vigía Chico. The cooperation with Vigía Chico has been outstanding in this way because this not only has increased the environmental knowledge and conscience of the cooperative members but also it has exposed them to situations in which they have become instructors for other fishermen.

The interpersonal and communicative skills of the members of Vigía Chico, at least in the frame of the interviews for this project, are notoriously above the average skills of people from the rural context in Mexico. It is also notorious the articulation of ideas and vocabulary related to environmental topics. The latter, in a social context in which the average of schooling years is 7.48, can be considered an important achievement.

In the case of NBT cooperative members, it was stated that also a variety of training courses have been offered. Relevant courses in the frame of the activities carried out by the populations such as first aid, survival skills in the sea and language courses, figured among these. Unquestionably, this is also a plausible effort made by the institution in charge of SKBR.

In regard to Natural Capital, the applicability of the environmental regulations aiming at protecting the natural assets in the reserve are one of the major contributions. This is said in a broad sense and includes the prohibition of certain fishing arts or the closing of certain marine areas for the lobster catchment. It also includes limiting the number of concessions granted to NBT providers and regulations applicable to the services they offer. Furthermore, the regular actions of surveillance within SKBR polygon are another useful contribution in this sense. In general terms, it can be said that CONANP has positively contributed to the adequate use of the natural resources and the protection of the natural assets in the reserve.

In the case of Financial Capital, direct contributions have been more discrete. Interviewees stated that the reserve was of great help in the recovery process after hurricane Gilbert in 1988. It was “the reserve” as explained in the interviews, the institution fostering NBT as an alternative source of income in the crises of the fishery. CONANP, however, is an institution created in the year 2000. In this case, the efforts made to introduce NBT as an income source in JRG do not correspond strictly to CONANP.

The latter does not imply that CONANP has not been playing any role in this regard. However, both the fishery and NBT in JRG were solid economic activities by the time the CONANP assumed responsibility of the PA. For this reason, the role of this institution has been rather indirect but not for that less important. For instance, by supporting the continuity of natural assets on which productive activities rely on. Or by serving as a bridge institution in processes in which NBT resulted benefited.

In respect to Physical Capital, the situation is similar to the latter in what corresponds to the productive activities, because as learned from the interviews, NBT cooperatives organized themselves to acquired by means of different credits their productive goods and work tools.

On another hand, in what respects the public infrastructure and services, few things could be said. CONANP actually has been aggravating the condition of vulnerability of the inhabitants

by hampering improvements in the physical condition of the houses as commented in the interviews. Furthermore, the perception of the local population, that regulations in this way apply unequally, generates an atmosphere of distrust. Moreover, on the provision of adequate electric power, no concrete actions have been carried out.

Finally, in regard to Social Capital, the contributions of CONANP can be more notable. Nonetheless, it can be convenient to distinguish between CONANP and its actions and initiatives and the abstract figure of the biosphere reserve, which by itself implies the involvement of many other institutions. CONANP of course participates, as mentioned before, as a bridge institution in virtually all exchanges in the social network to which SKBR and by extension Vigía Chico and NBT cooperatives belong and take part. However, this not necessarily means that such exchanges are initiative or actively fostered by CONANP.

Unfortunately, in this case, the gap of information due to the lack of CONANP point of view generates an important skew in the general perspective. However, based on the opinion of the interviewees, it can be said that CONANP does collaborate closely with all the cooperatives in JRG. It can be perceived that in general terms and despite some negative perception on the institutional restrictions, CONANP has contributed to increasing the structure of stakeholders aiming at affecting positively the life conditions of the local inhabitants and at protecting the natural assets in SKBR.

Given the panorama depicted in the latter paragraphs, it can be said that CONANP has different opportunity areas to generate bigger impacts on the sustainable development processes in SKBR. The role played so far, is by no means underestimated, but it gives the impression, after analyzing JRG conditions through the sustainable livelihoods approach, that different aspects contributing to the generation of development conditions face a deep lagging status. Important improvements can be made in regard to the Human Capital in pursuit of generating the best possible conditions in human resources for the forthcoming years. Alcoholism, for instance, is a problem that has to be paid attention to and solved. Similarly with the expansion of health services available in town.

2. How is the reserve contributing to the continuity of natural assets and processes in SKBR?



In this case, the abstract category of biosphere reserve and the institution in charge are included in the latter question. According to what was possible to observe, the existence of a biosphere reserve (SKBR), has played a determinant role in controlling the flows of mass tourism and the development of infrastructure that this implies. SKBR and CONANP, of course, have been an effective means to protect the biodiversity hosted within its polygon.

On another hand, the implementation of environmental regulations has been, as it can be observed, an effective tool in reshaping the use of natural resources in Sian Ka'an. In this sense, the prohibition of fishing arts, the permanent closing of fishing zones, the surveillance actions to make sure that the regulations are being observed, the limitation of concessions to the NBT, even under a scenario of high pressure, not only from local cooperatives but also from external agents.

Furthermore, the slow but effective process of generating or consolidating environmental awareness among the local population figures as a very plausible effort in this way.

It can be mentioned that in contrast to other BR in Mexico, the pressure put on the natural resources is less critical since the economic interest in SKBR is focused on resources and natural assets that in present days are well regulated and adequately managed and since the economic condition and the size of the local population differs greatly in comparison to that in other BR. In this sense, it can be said as well that the location of SKBR is a key element as well as its particular scenic features. This shows that SKBR is, in fact, an important element of social and natural capital itself.

### 3. How does the reserve contribute to the improvement of the life quality of the local inhabitants?

It can be said that by providing different conditions of protection. Protection for natural assets. This, for instance, generates environmental processes that generate direct well being for the local population. As mentioned before, the availability of freshwater and clean air are consequence of the latte.

Protection for economic activities. Evidence of this is the limited access to external stakeholders aiming at carrying out economic activities in Sian Ka'an. These are reserved for the local inhabitants only. Also by providing a very dense structure of key social actors.

Finally, to give an answer to the general questions it can be said that SKBR contributes to achieving sustainable development at the local scale by providing concrete support actions, such as offering a variety of training courses or serving as a bridge institution; and by playing protective roles such as safeguarding the integrity of the biodiversity within the polygon and all the processes associated to it. All this, as observed, generates relevant but discrete effects in the conditions of the local population. From the perspective of the SL is possible to say that, substantial incomes and adequate environmental conditions are not exhaustive of all necessary aspects to achieve sustainable development.

Furthermore, it is also valid to question, in a context of external and internal vulnerability and natural stressors, how sustainable in time is the success of Vigía Chico. If as the interviewees mentioned that new generations are less and less interested in working as the first generations did, and if lobster availability is also being compromised by different stressors. The same question could be asked for the case of the NBT as the natural stressors such as the problem with sargassum and meteorological events affect this sector as well. What measures could be taken to avoid impacts from this?

Lastly, in regard to the effectiveness of SKBR as a means for local sustainable development, it can be said that potentially it is. SKBR has in its reach, a vast variety of institutional resources, in terms of relevant stakeholders at various spatial scales with important financial resources, knowledge and social capital among others. Many efforts have been done so far, but as it was shown in the frame of this project, also many aspects remain lacking attention. Furthermore, SKBR has the advantage of enjoying of a radically different condition that most of the biosphere reserves in Mexico. On one hand, pressure on natural resources is not a problem neither the integrity of these. On the other hand, the economic conditions of the population are favorable. This could be used as a solid base to foster the processes that local sustainable development in the case of SKBR is lacking.

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## 11. Annex 1. Interview Questionnaire

- Introducción
- Breve descripción del proyecto

### Preámbulo

1. ¿Cuál es el punto de vista institucional sobre el desarrollo sustentable?
2. ¿De qué forma esa visión podría verse reflejada en la reserva?
3. ¿De qué forma las acciones institucionales se han encaminado hacia el alcance de procesos de desarrollo sustentable?

### Capital Natural

- ¿Cuál es el estado de conservación de los recursos naturales en la reserva?
- ¿La existencia de la reserva implicó o implica limitaciones o restricciones de acceso y uso de los recursos naturales para las poblaciones locales?
- ¿De qué forma se benefician los habitantes de la reserva de estos recursos?
- ¿Qué recursos naturales cumplen con una función productiva o de subsistencia para los habitantes locales?
- ¿Qué presiones naturales y antrópicas existen sobre estos recursos?
- ¿Cómo se controlan esas presiones?

### Capital Social

- ¿Existen regulaciones internas (Ejidales o comunales) para la protección de los recursos naturales?
- ¿Cómo es el contacto que existe entre los habitantes de la reserva y la CONANP? (De qué forma ocurre, con qué frecuencia, en qué términos, etc).
- ¿Cómo han colaborado con los habitantes de la reserva/Ejido Carrillo Puerto?
- ¿Qué proyectos han implementado en conjunto?
- ¿Cómo se han organizado para la implementación de dichos proyectos?
- ¿Qué otras instituciones han colaborado con ustedes y con los habitantes locales?
- ¿Bajo qué términos han colaborado esas otras instituciones?
- ¿Cómo es la organización de los miembros de la cooperativa pesquera?
- ¿Cómo es la organización de los miembros de las cooperativas turísticas?
- ¿Existen conflictos entre cooperativas?

¿todos tienen acceso a los beneficios de estas cooperativas?

### Capital Humano

- ¿Los habitantes de Javier Rojo Gómez tienen acceso a servicios de educación formal? Primarias, Secundarias, etc.
- ¿En promedio hasta qué grado estudian las personas?
- ¿Tienen acceso a servicios médicos?
- ¿Existen enfermedades recurrentes en los habitantes locales? ¿Problemas de alcoholismo o drogadicción severos?

¿Los miembros de las cooperativas tienen capacitaciones que les permitan realizar de manera más adecuada su trabajo?

¿Qué tipo de capacitaciones?

¿Hay migración en la población de la reserva?

### Capital Físico

¿Existen vías de comunicación accesibles?

¿Existen medios de transporte público?

¿De qué forma afecta/beneficia esto a los habitantes?

¿Existen suficientes escuelas?

¿Existen centros de salud en la comunidad?

¿De qué material son las viviendas?

¿Existen servicios de electricidad?

¿Servicio de agua potable?

¿Drenaje? ¿Qué se usa en lugar del drenaje?

¿La reserva representa alguna ventaja para los habitantes locales? (Atrae turistas, atrae inversiones, atrae recursos institucionales)

¿Las personas cuentan con las herramientas necesarias para realizar sus actividades productivas? (Quizás es una pregunta para miembros de la comunidad)

### Capital financiero

¿Cuáles son las fuentes de ingreso para los habitantes locales?

¿Los ingresos generados son suficientes para la satisfacción de las necesidades básicas?

¿La gente recibe remesas?

¿Las cooperativas tienen acceso a créditos para inversión?

¿Existen apoyos institucionales como Oportunidades?

¿Pagos por servicios ambientales?

¿Procampo?

¿Prospera/Oportunidades?

Otros