UNIVERSIDAD NACIONAL AUTÓNOMA DE MEXICO
PROGRAMA DE MAESTRÍA Y DOCTORADO EN GEOGRAFÍA

The Significance of NTFPs for Contemporary Rural Livelihoods: A Study of Policies, Social Organization and Markets in Non-Timber Forest Product Management in Two Communities in Michoacán

TESIS
QUE PARA OPTAR POR EL GRADO DE:
DOCTORA EN GEOGRAFÍA

PRESENTA:
TZITZI SHARHÍ DELGADO LEMUS

DR. MICHAEL K. MCCALL, TUTOR PRINCIPAL
CIGA-UNAM

CITLALLÍ LÓPEZ-BINQÜIST
Universidad Veracruzana
ADRIÁN GHILARDI
CIGA-UNAM
MIEMBROS DEL COMITÉ TUTOR

MORELIA, MICHOACÁN, ABRIL DE 2018

Acknowlegements and thanks to:

To my tutors, Michael K. McCall, Citlalli López-Binqüist and Adrián Ghilardi

For their help in so many research aspects: Antonio Navarrete, MSc. Mabel Sánchez, MSc. Janik Granados, Dr. Ignacio Torres, María Isabel Ramírez, Pablo Jaramillo, Dra. Minerva Campos.

To Habinabet Hernández, María Isabel Maldonado and Andrea Coss for getting their noses full of dust at the newspaper archive.

To Adrián Ortega Iturriaga, for being an excellent work partner, funny and interesting to talk to.

To Tacho and Gerardo from Alternare, for being so kind and helful and for sharing so much knowledge and experience.

To the Villaseñor Family in Nieves: to Lety, Doña Joba, Don Jose Luis, and Toñito

To Mtro. Joel Rojas and the students of the Colegio de Telebachillerato Bachilleres, of Nieves *ejido*, Acuitzio, Michoacán.

To Dr. Ernesto Vega, for his help with the Index of Intensity of Use and his cheering in general.

To Dr. Alejandro Casas, for being an example of compromise and hard work.

To friends from the PhD program at CIGA: Sandra, Casael, Abe, Jimena, Andrés, Mabel, Irene, Frida, Karine and many others who were kind enough to talk to me.

To my family, for their unconditional support: Mizael, Zazil, Shanin, my sisters, mother and brother.

To don David Barkin, for all those times he asked if I was done yet. And for all the other excellent questions and food for thought.

To life, and so many other things that crossed my way: Bicivilízate, Cactux, Gil, Pedro, Adriana, Toño, el otro Toño, Juan, Osvaldo, Brisia, Taby, Exon, Virginia, Violencia, Lolita y muchos otros que quiero y no alcanzo a mencionar. Thanks to all those other things and people I was not expecting.

Thanks to me, for bearing with me, for cheering me, for convincing me of the value of finishing this thesis, for thinking of the future without a thesis to finish, for being here, and for moving forward, and for holding on to my ideals and dreams.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION. The Sustainability of NTFP Management: NTFPs and Their Importance to Rural Livelihoods.

Summary

Non-timber forest products (NTFPs) have been harvested by human populations for thousands of years. Their use represents currently an alternative and important source for subsistence and income generation for a great number of families and inhabitants who dwell in or about the world´s forests (Ticktin 2004) and particularly, for the poorest sectors of the rural population (Batagoda et al. 2006; Vedeld et al. 2004). Many authors have proposed that the use of NTFPs can generate greater income than other productive options, such as timber extraction or cattle herding (Mahapatra & Shackleton 2011; Peters et al. 1989; Rodríguez et al. 2011), and estimate that around 25% of the income of about 1,000 million people around the world comes from NTFPs (Marshall et al. 2006). Several studies have refuted Peters´ proposal, arguing that NTFPs by themselves do not represent a sufficient source of income for rural families (Southgate et al. 1996), and that they must be contemplated as part of a wider spectrum of strategies to generate economic benefits in these populations (Arnold & Ruiz-Pérez 2001; Batagoda et al. 2006; Vedeld et al. 2004; Vedeld et al. 2007). Current discussions focus on the importance of NTFPs for rural livelihoods as part of this spectrum of strategies to generate income and subsistence, and as important elements of cultural life. Rural livelihoods are under strong pressure from social, economic, political and environmental dynamics and changes which affect directly their management and relevant importance to rural communities. This introductory chapter offers a review of the literature on the subject, highlighting the most important issues, and arriving at a discussion of the difficulty of integrating a general framework for the study of NTFP management, their importance for rural livelihoods, and the implications for forest policy.

Non-timber forest products: small matters, big significance

Although NTFPs managed and utilized in the world are very important for local subsistence, when it comes to income generation they occupy different degrees of importance. The economic importance of NTFPs to rural communities depends not only on the type of the resources available and managed or on the knowledge that people have about their management and marketing opportunities, but it also depends on issues associated with governance of forest resource use, such as the capacity for communities to organize around management and marketing of a resource, and to distribute the benefits and costs of resource management.

Most NTFPs used by rural communities as part of their livelihood strategies appear in very small quantities. Those NTFPs of relevant economic importance have usually passed through a domestication-to-intensive production process which not only implies higher ecological impacts, but also carries social impacts that have to do with the exclusion of the poorest sectors of the rural populations from the benefits of intensive NTFP production. The conditions that contribute to the exclusion of these populations from these highly profitable systems are associated with how natural resources are distributed among the population –a distribution that is mostly historical and which strongly excludes those who lack land tenure from benefitting from highly profitable systems that depend on intensive land uses. Exclusion also touches on other factors, such as the gender, age and ethnicity of sectors of rural populations.

Developing markets for NTFPs has been proposed as an alternative income-generation system, however, marketing itself faces many obstacles, and very few policies exist around the world that promote sustainable production and marketing of these resources. Moreover, policies that support NTFP marketing usually have limited benefits, since most government policies are implemented through local benefit-distribution channels, which in turn are dictated by land tenure and resource access rights which exclude large sectors of the population.

Another topic that is associated with NTFP use and production are the ecological impacts that NTFP extraction poses on ecosystems. When market demand rises, the implications for local ecosystems may be highly negative; however in some instances, and depending on the type of resource and the type of management necessary to produce it, market demand can in fact contribute to natural resource conservation.

Although a great array of studies on the environmental impacts of NTFP extraction have been performed around the world (Boot & Gullison 1995; Godoy & Bawa 1993; Marshall et al. 2003; Peters et al. 1989), there has been until recently an overall lack of attention paid to NTFPs, regardless of their importance to rural livelihoods worldwide (Shackleton et al. 2007). According to Shackleton et al. (*Ibidem*), this was due partly to a sustained assumption that timber was the most valuable forest product and a research bias towards internationally traded commodities. Moreover, the invisibility of goods important for subsistence uses and local trade (Campbell & Luckert 2002; Shackleton et al. 2011), the political marginalization of communities that rely on forests (Dove 1994) and a prevailing underestimation of the socioeconomic and cultural importance of NTFPs to rural and urban households, all add complexity to the present-day perspectives on the sustainable use of

these products (Rist et al. 2012). Thus, it continues to be necessary to perform studies that focus on multiple ecological levels, as well as the services and functions offered by ecosystems (Batagoda et al. 2006; Ticktin 2004), with an important emphasis on the *socio-cultural* components that determine resource management (Belcher 2003; Illsley-Granich et al. 2001; López et al. 2005).

All these issues, and many other more specific and controversial ones, come into the discussion about the importance of NTFPs for rural livelihoods, as income generation alternatives, and for forest conservation strategies. The aim of this work is to research the opportunities that NTFPs represent for improving natural resource management and conservation, while supporting local and often traditional subsistence, knowledge and culture at the same time that they are used as an opportunity to generate income. The hope is that a better understanding of the importance of these resources within their ecological and socio-cultural context can potentially improve policies aimed at improving rural livelihoods, particularly of the most vulnerable sectors of the population, and at the same time, conserve forest resources.

General objective

Therefore, the **general objective** of this thesis is to develop an understanding of the role of NTFPs as a strategy to achieve livelihood, conservation and cultural goals, with a focus on the impact of conservation policies on community organization around NTFP management, as well as the dynamics of NTFP availability and management in recent decades in relation to changes in market demand, migration, land tenure and forest policies, among other factors.

To achieve this general objective, we have proposed the following specific objectives:

Specific objectives

1. Perform a critical literature review of selected case studies of NTFPs in the State of Michoacan and of the history of NTFP management in the world and in Mexico.
2. Analyze the role played by markets in the management of NTFPs, examining the social, economic and environmental implications of promoting NTFPs as income-generation alternatives.
3. Describe the present status of forest conservation policies regarding NTFPs and their relation to ecological conservation in México, including the changes these policies have been through, and analyze the importance of these policies in explaining changes in NTFP management in the past decades in the selected case studies.
4. Develop an analytical framework for understanding the role of NTFPs in rural livelihoods, concentrating on the Rural Production Unit (RPU), using the results of the selected case studies.
5. Identify what changes have occurred in NTFP extraction, availability and management systems, and explore the impact of these changes on livelihoods and culture in the selected case studies. Consequently, identify the time period in which these changes have been more evident, with a focus on the past 30 years.

6. Offer a discussion and conclusions regarding the relevance of this work, of the analytical framework, the methodology used and the findings, for improving NTFP management, forest conservation and the livelihoods of people who depend the most on these resources in Mexico´s rural communities.

Analytical framework

In the past two decades the theoretical framings used to study NTFPs have gone through deep changes due to the recognition that NTFPs are part of complex socio-environmental systems and therefore should be studied as such. But how can we study resources that are so diverse in their nature and in the way they are managed by humans? The analytical framework proposed in this study sprouts from a review of studies that have attempted to give some sense to the role that NTFPs play in ecological interactions, in human-nature relationships, in rural livelihoods, in people´s cultures, or in public policy around forest conservation or rural development, among others.

Our exploration of how human-plant interactions have changed through time to give rise to such a wide diversity of plant management schemes, started with an examination of the type and degree of plant management that human populations have evolved throughout millennia, giving rise to specific types of plants (wild, weed and domesticated) associated with specific types of management schemes. It was followed by the study of the importance that plant management had for higher levels of complexity, including ecosystem management. The study of ecosystem management gave way to a theoretical framing that considered forest types as a result of explicit ecosystem management by human populations for specific purposes. The diversity in management systems gave rise to a diversity of ecosystems (forests) within a landscape continuum, each associated with a purpose, a type of management and a social and cultural structure that had evolved around management. Recently there has been increased recognition that humans have had an important influence on ecosystems for thousands of years, and that what we now know as our natural world has been the result of our own manipulation. Therefore, studying human-nature interactions has become of great importance for the study of forest resources. As a result of these studies, a "multiple forest management" (Toledo 2003) framework has arisen, which recognizes that rural populations have created ways of managing forests for multiple purposes. Within the nature-culture continuum, multiple forest management explains that forest ecosystems are managed by rural populations in a diversity of ways, throughout space and time, and that this multiple management stems as a reaction to changes in internal and external dynamics, be they environmental, social, economic, cultural, or political.

The human element in the human-nature dialectic has finally been recognized and has been a principal objective of studies on social organization around the management of common pool resources (CPRs). Why CPRs? Because natural resources in most places around the world are still managed as common pool resources, even though policy changes of the past three decades have slowly modified this traditional system and opened up space for privatization. CPR theorists have concentrated on how social organization influences the use of CPRs, and in their study have tried to come up with a set of "enabling conditions" for the sustainable management of CPRs (see Agrawal 2001 and Table 4 below). These conditions include the characteristics of the system, the nature of the product, the type of users and the type of institutions, rules and regulations created by users. Although the

efforts to study CPRs have been very comprehensive in terms of the issues they have included for study, some topics have nonetheless been left out and are just beginning to be included in the study of CPRs, of which NTFPs are a part. These themes have to do with the cultural aspects of NTFPs, and also with the importance of NTFPs for livelihoods.

The most important idea of this analytical framework is that ecosystems -and the useful resources and benefits that we humans take from them- are always being subjected to cultural, economic, political and environmental dynamics that impact the way these ecosystems are managed, and as a consequence, the type of resources available and further on, the social organization around management of these resources (be it sustainable or not).

There is yet another take on the discussion regarding the relationship of humans to nature: a perspective that takes culture as an essential part of the discussion regarding access to natural resources (Escobar 2005). From a Political Ecology stance, it is politics that determines people´s access to resources, therefore, our study of the relationship between humans and nature must start from an exploration of the cultural meanings of nature to humans, and from asking how politics –that is, power- determine natural resource distribution as well as the relationship between humans and nature. For Escobar (2005) the concept of *distribution* is fundamental in the study of human-nature relationship: the concept of distribution allows to unite diversity, conflict and equality under a single framework. Escobar develops this framework by proposing that distribution is at the botton of the problems related to the sustainability of natural resource management, and he proposes looking at conflict related to natura resource management as a matter not only of economic distribution, but also of ecological and cultural distribution. This framework will be explained in more detail in the section on the analytical framework below. What is important to note here is that for authors like Escobar, Agrawal, Ostrom, and others, the politics of distribution of natural resources are elemental to understanding how natural resources, ecosystems and landscapes are managed.

This thesis combined the analytical framings mentioned above (and which are discussed in more depth in a section below), to create an analytical framework that integrates elements of the nature-culture/human-nature continuum, a view of multiple forest management, and an analysis of the socio-environmental "enabling" conditions that allow for the sustainable management of NTFPs.

Structure of the work

The methodological structure used started with a critical review of the NTFP literature (academic and non-academic) in order to identify and assess the salient reference points of objectives, criteria and indicators for the sustainable management of these resources. Once these objectives and criteria (issues) were identified, they served as a basis for framing the analysis of the case studies integrated throughout the research.

Chapter 1 offers a synthesis of the most important issues that appear in the NTFP literature. This synthesis feeds the analytical framework presented in the second part of the chapter. Both the synthesis and framework borrow from a review of the evolution of plant management, humans and nature and culture and nature. They also use the literature on common pool resource management, social organization and governance related to NTFP

management. The framework also integrates a Political Ecology perspective on the relationship between human-nature-culture and the importance of looking at aspects of distribution –economic, ecological and cultural- as determinant for natural resource management.

Chapter 2 presents a description of the research paradigm and methods used throughout the thesis.

Chapter 3 is a review of the history of environmental policies in Mexico, the second part being an analysis of how Mexican forest policies have integrated the topic of NTFPs, and how successful these policies are at addressing the issues highlighted in the NTFP literature, particularly issues related to rural livelihoods, forest conservation, income generation, culture and traditional knowledge.

Chapter 4 is concerned with NTFP commercialization and marketing. It is a synthesis of a discussion of the potential for NTFPs to become important income-generation options in rural settings. The chapter also offers a brief discussion of NTFP marketing in the city of Morelia and its surroundings, based on a limited number of questionnaires performed in two of the most important traditional markets in the city. These results reflect on the issues highlighted in the literature review, and show the specific conditions that enhance or hinder marketing in each of these communities.

Chapters 5 and 6 are the result of our field work in the two case studies selected: Crescencio Morales *Comunidad Indígena* and *Ejido*, and Nieves *Ejido*, respectively. Each chapter offers the results of our research regarding NTFP management, social organization for NTFP and forest resource management, and the dynamics that have impacted NTFP management in the past decades. The case studies aim to discuss the importance of NTFPs for rural communities, and the obstacles or opportunities that NTFP management faces in each setting. At the end of each chapter (5 and 6) we offer a discussion of how the proposed analytical framework helps us to understand the changes in NTFP management in both communities.

Chapter 7 offers a general discussion of the thesis, integrating the issues discussed throughout the thesis (derived from Chapter 1), with emphasis on the importance of NTFPs for rural livelihoods, the implications of integrating NTFPs in markets and forest policies, and the opportunities to improve forest conservation through promoting NTFPs as alternatives to generating income and improving rural economies.

CHAPTER 1. The context of NTFPs in Mexico and the World

Forests and Forest Products: Present Situation

About 30% of the world´s lands are covered by forests. Forests provide essential products and services to human populations. Yet in the years between 1990 and 2005, forests lost 3% of their area, a decrease of about 0,2 percent per year. Increasing attention is being given to issues such as ecosystem services provided by forests; forests, however, many countries, particularly those of Africa, Latin America and the Caribbean, are losing their primary forests at an alarming rate (FAO 2007).

Wood is currently the most economically important forest product. Between 1996 and 2000 about 3.3 billion cubic meters of wood were harvested annually (FAO 2002), with about one quarter of timber production entering international markets, accounting in 1991 for $100 billion dollars (IIED 1996), which is 3% of total world trade (FAO 2012). Firewood[1], on the other hand, represents half of the wood extracted. The global forestry sector provides subsistence and wage employment for approximately 11 million people. These data however are estimations based on the information from the most important productive sector, which is the wood and timber industry. A whole other sector of the population, those who collect firewood and NTFPs, and also those who use forests for subsistence purposes, have been left out of these statistics (FAO 2010).

Humans have depended on Non-Timber Forest Products (NTFPs) extraction for thousands of years. NTFPs represent an important set of resources for subsistence and income generation for a large number of inhabitants who dwell in or about the world´s forests (Ticktin 2004) and particularly, for the poorest sectors of the rural population (Batagoda et al. 2006; López-Feldman 2014; Vedeld et al. 2004). Vira et al. (2015:15) suggest that forests will continue to be an important element of household strategies to "eliminate hunger and achieve nutritionally balanced diets". For a sector of the population, forests and particularly NTFPs represent a primary source of income, particularly when these products enter international markets. According to Shackleton et al. (2007), the most important value of NTFPs lies in their subsistence uses and trade in local markets. In 1985, Farnsworth et al. (1985) estimated that about 80% of 4,000 million inhabitants of the world population relied on traditional, plant-based medical systems. In terms of their importance as income generation alternatives, Molnar et al. (2004) estimated that as much as 25 percent of the income of close to 1 billion people around the world came from NTFPs. It is estimated that about 1.2 to 1.5 billion people (around 20 percent of the global population) are forest dependent. These estimates include almost 60 million indigenous people who are almost entirely dependent on forests (Vira et al. 2015:14). Forests are a source of food, medicine and shelter for sectors of the population that are poorly served by the market economy, even in countries such as the USA (Robbins et al. 2008).

At the same time, NTFPs are an important source of raw materials for diverse industry sectors, from medicine and cosmetics to industrial products such as glues and solvents (Shanley 2008). In 2004 the global trade in NTFPs was estimated to be worth US $11

[1] Firefuelwood is any awooden materialsmaterial that areis used for fuel.

billion, while in 2010, its estimated value had increased to US $18 billion (FAO 2010). Regardless of their importance, NTFPs´ contribution to national and global economies remains underestimated. Country data regarding products of utmost importance in many national economies is still lacking, while the subsistence value of these products is barely documented (FAO 2010). Due to this situation, development policies focusing on forests should consider forests as a source of income for a broad sector of the population, among which NTFP users should be included. Conversion of forest to timber production, protected areas and conservation areas for environmental services provision may reduce access to and availability of NTFPs, often at the expense of indigenous peoples and the poorest sectors of the population, who lack land tenure and rely on forests for energy, food, medicine, fodder and many other products (MEA 2005).

Many authors have proposed that use of NTFPs can generate greater income than other land use options, such as timber or cattle herding (Mahapatra & Shackleton 2011; Peters, Gentry & R. Mendelsohn 1989), and estimate that around 25% of the income of about 1000 million people comes from NTFPs around the world (Marshall et al. 2006). In 1993 Iqbal (1993) estimated that between 4000 and 6000 NTFPs had commercial importance around the world. Some products have a significant measured share of the market — 116 traded products generate US$7.5 to 9 billion in global trade, while medicinal and cosmetic ingredients generate another U$108 billion (Shanley et al. 2008). To these marketable products we must add other NTFPs that do not have a proper market, but that represent important inputs to subsistence strategies or as elements of production processes (Nepstad & Schwartzman 1992).

Several studies have refuted Peters´ proposal, arguing that NTFPs by themselves do not represent a sufficient source of income for rural families (Southgate et al. 1996), and that they must be contemplated as part of a wider spectrum of strategies to generate economic benefits in these populations (Arnold & Ruiz-Pérez 2001; Batagoda et al. 2006; Vedeld et al. 2007). The argument is that NTFPs, produced and commercialized as a single, most-important, product, will not generate enough income for a family or a community to be able to survive on that one product alone. The critics argue that NTFPs do not have a sufficiently high value in the markets to compensate for producing other products, such as food or timber, and that there are many factors that contribute to this situation (later on in this chapter these factors are reviewed).

The context of NTFPs in Mexico

Present knowledge of NTFPs has come from studies in ethnobotany and ecology, amongst other disciplines. In Mexico, studies have concentrated on the use of medicinal plants, including their active compounds and applications among various ethnic groups. Other studies have focused on edible vegetable resources (resource inventories, and studies of nutritional value and temporal and spatial availability, among others), as well as the study of uses in agriculture. Yet another type of study explores indigenous nomenclature and classification. More recent ecological ethnobotanical studies focus on indigenous groups´ management strategies for their different habitats, and the way this management affects populations, communities and ecosystems (Farfán 2001). Globally, journals such as *Ethnobotany*, *Economic Botany, Ecological Applications, Conservation Biology, Ecology and Society, Forest Ecology and Management, Human Ecology, International Forestry*

Review, *Small Scale Forestry*, and *Acta Botánica Mexicana* (in Mexico) among others, have regular publications focusing on NTFPs and their ecology, economic importance and use around the world. Institutions such as the FAO and the World Bank also host their own NTFP departments, and centers such as the Center for International Forestry Research (CIFOR) have given rise to a broad range of research on NTFPs.

Research on NTFPs fulfills many purposes, and is relevant for the many reasons mentioned above. In Mexico for example, Caballero et al. (2000) estimate that 90% of the plants that are utilized come from the wild, while timber resources account for only 10 to 15 percent of the plants that exist in Mexico. There is a high interest in enhancing knowledge about the potential uses and applications for NTFPs, potentializing their market importance, and also improving management practices so as to assure the resources will be sustained, for subsistence and market purposes, as well as for the provision of associated ecosystem services and landscape management.

In México, there exists an estimate of between 25,000 and 30,000 vascular plant species (Rzedowski 1978), distributed within 45 different vegetation types (Toledo 1988). These different forest categories cover around 70% of the territory, or around 138 million hectares. Of these ecosystems, temperate[2] and tropical[3] forests cover approximately 35% of the territory; these ecosystems hold between 60% and 70% of the world´s biodiversity. It is estimated that about 22 million hectares provide the necessary conditions for commercial exploitation. The principal woody species are pine and oak, of importance both for their economic contribution as well as the large area that they cover. Secondary forests cover about 30% of the forest area, and their primary use is for the collection of non-timber products and firewood (Torres Rojo, 2009).

Casas et al. (1994) have estimated that between 10,000 and 12,000 plant species are used in Mexico (Casas et al. 2017). Other inventories of useful plants in Central Mexico (reported by Solis 2006:249) performed in the Tehuacán-Cuicatlán Valley have found that more than half of the reported plants species have some use. Only in this region, Casas et al. (2016) have found that among the 3,000 plant species inventoried, more than 2,000 (approximately 66.% of the total) have some use. Solís (2006) associates the diversity of uses in this zone with the cultural knowledge in this area that has been transmitted from generation to generation for 700 years. Although there have been many efforts to inventory forest resources in Mexico, few have attempted to learn about traditional knowledge of resource

[2] Defined in FRA for Mexico as: Vegetation cover (watch the font) of northern origin (Holarctic) mainly from temperate and semi-cold regionscoldregions, with different degrees of humidity, typical of mountainous regions of the country, along the Sierra Madre Occidental, Oriental and NeovolcanicandNeovolcanic Belt.
[3]These ecosystems are formed of woody vegetation communities of southern origin, generally from hot and humid or sub-humid and semi-dry climates. They aredryclimates. It composed of a combination of a large number of tree species, many of which have abutments or buttresses. They also containIt vines, lianas and epiphytes, often with thorn trees between the dominant vegetation. These forests?They are classified according to their height and the persistencetopersistence or expiration of the blade during the driest time of year.

use. The works by Caballero et al. (2000); Caballero & Cortés (2001); Casas et al. (2001); Casas et al. (1997); Casas et al. (1999) and more recently, their pupils (Farfán 2001; Pérez Negrón Souza 2007; Rangel Landa & Lemus Fernández 2002; Solis 2006; Torres et al. 2015; Delgado-Lemus al. 2014; Blancas et al. 2013), have made an important contribution to this body of knowledge.

The most important uses reported in studies within Mexico are: medicinal, ornamental, spices, edible, wood for construction and firewood, forage (see Hernández 2005 for a summary of studies and findings). Some of the NTFPs of highest economic importance are: camedor palm (*Chamaedorea elegans*), wild mushrooms (*Tricholoma magnivelare*), pine resin (*Pinus leiophyla, P. oocarpa, P. pseudostrobus*) and zapote mamey (*Pouteria sapota*) (Sosa-montes et al. 2013). In communities in Michoacán, species such as *Ternstroemia spp.* (linden flowers) and *Rubus spp.* (blackberries) are two of the most important resources collected and sold, after pine resin.

It is also important to mention other important uses, such as for craft-making. Bravo Marentes (1999) identifies 666 species used for craft-making (both flora and fauna), of which 541 are plants and 125 animal. He also interestingly identifies the tropical hot-sub-humid zone (zona tropical cálido-subhúmeda) as the one where the highest number of these resources can be found, while in the temperate zone a very small amount of resources for craft purposes can be found. It is also important to note that NTFPs in Mexico grow not only in forests, but in many other diverse environments, such as agroforestry systems, agricultural areas, roads, riversides and wetlands. This implies that the management system, the impact of extraction and the marketing potential, among other issues, will depend on the ecosystems where the NTFPs grow. Findings such as these are important for the development of policies that are suitable for the many contexts in which NTFPs are used.

Research on NTFPs in Michoacán

Prado (1988) offers a thorough revision of works done in Michoacán. Most of the works cited have as an object of study the use of medicinal plants by the Purépecha of Michoacán. Far less has been done in other areas of the state, and even less about social groups that are not considered indigenous, such as the case of the communities that inhabit the Umécuaro microbasin (Delgado 2009). Prado (1988) cites works dating from the XVI century such as the Michoacán Relation (Relación de Michoacán, 1541) and the work by Hernández in 1571 (UNAM, 1959) which is the first to cite some Purépecha plants and their uses. The end of the XIX century and beginning of the XXth saw a rise in interest regarding uses and applications of medicinal plants. Yet, it wasn't until the 1970s that researchers began to carry out ethnobotanic studies, that is, the study of meanings and uses of plants by indigenous populations. The works by Burgos (1964), Young (1978) and Argueta (1981) point in that new direction, but concentrate specifically on medicinal uses. Hernández (2005) does a very complete revision of studies in Michoacán, and she finds that the most important uses are medicinal, ornamental, forage, edible, firewood, wood for construction, fencing, to make tools, and for ceremonies. The most important uses vary per community and have to do with many factors, from availability of a resource to traditional knowledge. In her study of Hernández (2005) she reports medicinal uses to be the most predominant, while Pérez Negrón (2007), Torres (2004) and Farfán (2001) observe that forage is the

most predominant use. Domestic and edible uses are also very important in the areas studied ((Farfán 2001; Martínez et al. 2007; Pérez Negrón Souza 2007; Torres 2004).

The complexity of NTFP definitions

NTFPs can be classified in diverse categories according to their use and the plant part that is used, either as edible products, fodder for domestic animals, colorants, ornamentals, perfumes and cosmetics, utensils and tools, handicrafs, construction materials, as well as exudates such as gums, resins and latex (MEA 2005). The definition of what a ´Non-Timber Forest Product´ is has been under discussion for some time, and the different definitions, concepts and uses that have been given to this term have been diverse, both in the literature, and within the business and government policy sectors. Up until the 1980s, forest policy focused on the use of forests where the main product would be timber, downplaying the importance of other products such as mushrooms, perceiving those as "Other" or "Minor" products. Since the 1980s there has been an increasing realization that those "Other" or "Minor" products and services generated by forests are essential for the well-being of local communities and also of high importance for sectors of society at large.

The recent interest in NTFPs emerged parallel to a new development paradigm that recognizes the need to sustain a natural resource base as well as ensure social wellbeing (Alexiades & Shanley 2004). The "Sustainable Development" paradigm began to see forests as holistic entities, not only as sources of economic income, but also as providers of ecological services such as water catchment, soil retention, carbon sequestration, and also as providers of cultural and social services. This new focus highlighted the need to find new ways to manage forests, particularly in the face of increased deforestation rates perceived in the early second half of the 20th century, when deforestation indices worsened, and marginalization of rural communities increased. In this context, forests began to be acknowledged as providing alternatives for poverty reduction and food security (Arnold, in Alexiades & Shanley 2004) by the international community.

When thinking about the definition or terminology used to designate a resource, it is useful to consider, as Mantau et al. (2007: 393) write, that "terms arise not only from a strictly scientific perspective but are shaped by their context and more often than not evolve as a pragmatic response to policy or advocacy needs". This is exemplified by the history of the term within FAO. Attention to "Other" or "Minor" Timber Forest Products increased in the late 1980s and particularly early 1990s, after the 1992 United Nations Conference on Environment and Development's (UNCED's) Earth Summit, in which NTFPs were identified as important resources that required specific actions, so as to assure their potential to contribute to economic development in a sustainable way (Forest Principles, chapter 11, Agenda 21, UNCED 1992). As a consequence, numerous potential and existing products were identified, all of which had a common attribute: that harvesting them did not imply felling trees. The recognition of the significance and importance of these products to local peoples was aided within FAO by the work of Falconer (1990), who juxtaposed the term "major significance" against the commonly used term "minor forest products" to emphasize that these products had not been given sufficient attention. Once FAO recognized the importance of these resources, it placed them in a specific department within the Forest Products Division (FOP). The term "Non-Wood Forest Products" was coined to differentiate between wood (a classification which had been recently added to the division

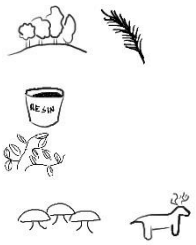
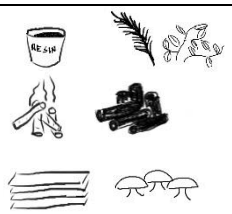
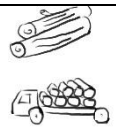
to include wood products in addition to timber such as firewood, what else?) and all "other" products. The term was officially adopted by the FAO in 1995 (Chandrasekharan 1995). In 1999, FAO revised the definition and proposed that "Non-Wood Forest Products consist of goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests" (see Table 1 Classification of resources depending on the definition used

for a comparison of some of the terms included or excluded in the definitions). This definition particularly excludes wood (and all other woody raw materials such as timber chips, charcoal and fuelwood) as well as small wood used for tools, household equipment, etc., it also excludes services, and includes products derived from both natural forests and plantations.

De Beer & McDermott (1989) defined NTFPs as those products that "encompass all biological materials other than timber, which are extracted from forests for human use" (Cited in Belcher, 2003:161). The main difference identified by these authors between "timber" and "non-timber" concepts was that timber is managed on an industrial scale for interests located outside the forest, while NTFPs are "extracted using simple technologies by people living in or near forests". They offered their own definition of forest: by ´forest´ we refer to a natural ecosystem in which trees are a significant component. However, forest products are derived not only from trees, but from all plants, fungi and animals (including fish) for which the forest ecosystem provides habitat. In his review of NTFP literature, Belcher (2003) finds that many authors offer their own definitions of the terms ´NTFP´, ´forest´ and other related concepts. Belcher, however, argues that the various terms are inconsistent, for they can include resources such as gravel and rocks or services such as water provision, while other definitions may consider both ´natural and managed forests´ (Peters 1996).

Classifying forest products based on whether they are or not timber (NTFP) or wood (NWFP) has proved to be an inexact way to distinguish these resources, products and services. Critics of these classification systems (Belcher, 2003; Mantau *et al.* 2007) argue that the prefix "non" not only minimizes the importance of these goods and services, but it also hinders management of these resources in a holistic way. Mantau et al. (2007) propose a typology that is based on the knowledge of the origin of the resources (its source), the product (its production system) and the final user or consumer (markets). This typology, they argue, provides a tool that can be used to address problems at multiple levels with various degrees of complexity, placing a product or service in relation to other resources, products and users of the forests.

Table 1 Classification of resources depending on the definition used

Definition	Sources included	Resources included	Resources excluded	Characteristics common to all definitions *
Goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests. (Chandrasekharan, 1995)				Include 
All biological materials other than timber, which are extracted from forests for human use (De Beer & McDermott,1989)				Exclude 

Source

Forests	Other wooded land	Trees outside forests	Plantations
			

Resources

Wild fauna	Plant part	Mushrooms	Medicinal plants	Gums, exudates resins	Charcoal	Firewood	Wood	Chips	Timber	Services
										

Management

Industrial scale	Small scale
	

Topics that have been integrated to complement a discussion of the importance of NTFPs for livelihoods, subsistence, conservation, culture and markets

As Belcher (2003) argues, the terminology related to NTFPs is diverse and often contradictory and confusing, because there are so many different interests and priorities involved in NTFP management, production and commercialization. Development organizations, for example, see NTFPs as a means for generating subsistence and cash income to benefit the poor, while conservation-oriented organizations may be interested in conserving individual species that are overexploited for market purposes. From the perspective of a forest user or community, they will be managing for the resources that are most valuable for them, and in most cases, where these communities have access to forests, timber and wood will be some of the most important products (Belcher, 2003). However, the value of forest products will also depend on other factors, some social and cultural, which give more value to cultural and domestic uses, and these socio-cultural values will in turn, impact the definitions of what is or is not a non-timber forest product.

Defining what an NTFP is or is not has been a difficult task, where the choices for inclusion or exclusion of resources in the definition are based, mainly, on whether the plant has woody material, on whether to include animal products and on whether to include services (watershed, carbon sequestration, etc.) or management intensity or production scale. Taking these issues into account, Belcher (2003) proposes using additional aspects in the analysis of NTFP management and use that could help us clarify what the most important underlying issues are when studying NTFPs (see Table 2 for a summary of issues highlighted in the NTFP literature). These additional aspects are discussed below.

Table 2 List of prominent issues in the NTFP literature

Issues identified and discussed in the literature reviewed	
• *Source of product* • *Nature of product*[4] • *Scale of production of product* • *Ecological impacts of extraction* • *Impact of conservation activities* • *Land tenure* • *Ownership and distribution of benefits and impacts* • *Access to resources* • *Marketing and certification* • *Income generation* • *Rescue of traditional/local knowledge* • *Gender and ethnicity* • *Indigenous rights* • *Importance for rural livelihoods*	Authors: Alexiades & Shanley 2004; Alexiades et al. 2013, Batagoda et al. 2006; Belcher 2003; Casas et al. 1996; Guariguata et al. 2012; Peters et al. 1989; Stockdale 2005; Tapia-Tapia & Reyes-Chilpa 2008; Ticktin & Ticktin 2004; Wiersum & Shackleton 2001; others.

[4] For most definitions "nature" refers to the physical characteristics of the product, that is, is it woody or non-woody, is it an animal product, is it a service or is it a product such as gravel or soil. The "source of the product" refers to the spatial characteristics of where the product is produced or grown, that is, is it from a plantation, from mixed arboriculture, etc. when referring to a resource, it is implied that it is a natural resource that has not been processed, while a "product" refers to a natural resource that has undergone some type of processing and turned into a different item than its "natural" form.

The source of the product

The question of whether the product or service is produced in a forest, as well as what is a forest, will be a key element in a definition of what an NTFP is. The FAO (1999) definition of ´forest´ includes plantations; this inclusion has caused disagreement, particularly among those with a conservation focus. Their argument is that NTFP production is desirable precisely because it has been considered to be compatible with natural forest conservation. They argue that efforts to promote production in plantation systems would undermine the conservation objective. Others prefer a term that allows them to include other ecosystems, such as grasslands or marine habitats. Thus, differing objectives and interests will determine whether to include plantation forests, grasslands and marine or other habitats. Another issue related to the spatial and temporal distribution of resources regards the areas where certain resources are most often collected. In some cases, the primary or mature stages of forests are perceived to be less valuable than the lands under fallow or other successional stages, because most of the NTFPs are collected in these secondary stages (Arnold & Ruiz-Pérez 1998). Forest conservation therefore becomes of lesser importance than conservation of a mosaic of successional stages, which makes integrating the spatial/temporal as well as the ecological aspects of NTFP use into policy a very complex matter.

Nature of production of the product

The main question here has to do with whether the product has been produced (grown) within a forest or outside of it. The main concerns with intensive cultivation systems is that they may pose a real threat to forest conservation as they tend to homogenize the genetic pool, reduce the economic value of wild systems, and lead to a transfer of benefits from one group of stakeholders (small scale growers) to another (industrialized or larger scale growers). On the other hand, cultivation can reduce environmental degradation by decreasing pressure on wild products, while it also gives higher yields, improves the quality of products, allows more control over timing of harvests and results in overall commercial benefits (Angel 2002). The benefits of cultivation serve as a strong justification for the promotion of the domestication of wild species of interest for markets.

The scale of production

The issue of scale is related to domestication/cultivation, however, it refers more specifically to the degree of industrialization and the scale of the forestry operation. Padoch & Pinedo-Vasquez (1997) suggested that distinguishing between timber and non-timber products does not reflect the way in which most forests are managed in the tropics, and proposes that a distinction considering the scale and intensity of the production system is a more realistic and useful distinguishing parameter. Toledo (2002) suggest, for example, that the distinction between “campesinidad” (degree of peasantization of the management) and “industrialidad” (degree of industrialization of the production systems) could be a basic parameter to analyze the sustainability of natural resource management by rural populations. An industrial plantation of rattan (that may be even surrounded by forests) may be just as damaging for the environment and forest dwelling people as an industrial timber plantation.

The ownership and distribution of benefits and impacts (tenure and access to resources)

The idea that NTFPs are useful for conservation and development because ownership and benefits are more likely to accrue to local stakeholders (and also because most forest poor depend on these resources), supports the contested argument that developing NTFPs will benefit poor, forest-based peoples. The reality is that poor forest dwellers often do not have access to the more valuable NTFPs, and most of the products they do use do not have good potential for market development. Also, it is the poor who do not have access to the resources necessary to develop and take advantage of any potential markets that do exist. In these scenarios, the poor will most probably be displaced by those with better assets. From this perspective, NTFPs do not hold any particular advantage over timber or other products and their production systems (mineral, agriculture, etc.).

The real issue from the perspective of livelihoods is the tenure, ownership and control of the resource (Belcher 2003). Land and resource tenure is an important issue when it comes to production and trade of NTFPs. As trade of a particular product increases, there is a tendency to domesticate the product, yet, many conditions must be met in order for this process to be achieved. Land availability may be an essential condition for the domestication of new products and thus, for a successful participation in the marketing chain. Land tenure and recognized and legal access to NTFPs became an important issue in conservation debates following Nepstad & Schwartzman´s 1992 report of the rubber tapper grassroots movement to protect forest lands from encroaching cattle ranchers. Many other studies have reported changes in NTFP management and access after policy changes associated with land tenure, such as the introduction of the PROCEDE[5] program in Mexico. Vázquez (2002) found that women who have limited access to land or lack land tenure, report collecting practically any type of wood for cooking. The choice of wood used is directly related to the number of hectares of fallow land and the quality of the land that a family units possess, or the quality of the land that a family has access to, given that once land has been registered in PROCEDE, it is no longer possible to take wood from *any* parcel; that is, when land is registered under PROCEDE, the choice of wood that is collected becomes limited, since women only collect from those parcels to which they have access (this observation refers to Vazquez´s study, although there may be other similar examples in Mexico.

Marketing and commercialization/ Income generation

After the 1960´s wave of deforestation, many international organizations and academics proposed that NTFPs could be an alternative to timber extraction, and that NTFP marketing could help halt deforestation at the same time that it created income-generation opportunities for the rural poor. It was thought that the rural poor were mostly responsible for deforestation, therefore providing alternatives to timber extraction was thought an essential development need. Marketing NTFPs has proved to be a more complex solution than thought. Many aspects complicate commercialization, including the availability of resources, which appear most often in very low densities and irregular distribution and yields in the wild (Panayotou & Ashton 1992). Also, since the collection and processing of NTFPs are labor-intensive activities, NTFPs are susceptible to substitution by synthetic

[5] Programa de Certificación de Derechos Ejidales y Titulación de Solares –Program for the Certification of *Ejidal* Rights and Titling of Rural Gardens.

derivatives (García-Fernández et al. 2008). In ecological terms, commercialization may itself be a driving force for changes in land use such as monospecific plantations, or changes in management strategies (Boot & Gullison 1995). As for the socioeconomic aspects, NTFP marketing may imply high opportunity costs and an uneven distribution of benefits among the population (Godoy et al. 2000; Peluso 1992; Ruiz-Pérez et al. 2004).

Ecological impact of NTFP extraction

The discussion of the ecological impact of NTFP extraction has been a key element of the discussion on NTFPs. There are contrasting positions, one of which is the view that NTFP extraction generates less harmful effects on ecosystems than timber extraction (Marshall et al. 2006) in order to meet market demand. Yet, there are ecological conditions that may hinder this possibility, such as the low availability of individuals of the target species, as has been observed by Tapia-Tapia & Reyes-Chilpa (2008), who document that the areas considered to have the greatest biodiversity in the world are also areas with very few individuals of the species used, making commercialization a difficult and unsustainable activity, for it hampers collection and produces very low yields. On the other hand, NTFP extraction may be a principal source of ecosystem degradation (Kilchling et al. 2009), particularly when extraction is linked to market dynamics that intensify it, causing degradation of the resource and the ecosystem in which it grows. Illsley-Granich et al. (2001) also observe that the changes in demand for particular non-timber products have generated a preference for management activities associated with degrading environmental conditions, such as cultivation on pronounced slopes, low-fertility soils, and others (the case of *Brahea dulcis*) in the effort to obtain greater profits from the land.

For those non-timber forest products able to grow under secondary forest conditions, extraction can act as a powerful tool for reducing pressure on primary forests and for increasing the economic returns of harvesters. In the Los Tuxtlas buffer zone, this strategy has served as an incentive to conserve secondary forests that are under threat of conversion to cattle pastures. In the case of *A. magdalenae* in particular, management options such as trimming of the overstory in primary forests or thinning of adult plants to increase incipient light, can help prevent overharvesting in primary forest populations. Alternatively, ramets thinned from primary forest populations could be transplanted to secondary forests to initiate populations. These practices have now been implemented in buffer-zone communities in Natural Protected Areas such as Los Tuxtlas (Ticktin et al. 2002).

Regardless of the great quantity of studies on ecological impact of NTFP extraction, studies focus primarily on extraction itself, while there can be other factors, such as that of livestock browsing, which may confound results of demographic studies of NTFPs. As has been observed by Endress et al. (2004), livestock browsing of the leaves of some NTFP populations may have a greater impact than does harvest of the leaves.

Impact of forest management and conservation activities on NTFP ecology

Is a topic that has received little attention as of yet, Juutilainen et al. (2014) studied the impact of activities that are often included in forest conservation activities in Mexico´s forest conservation programs (e.g. extraction of coarse woody debris (CWD) and fine woody debris (FWD)) on fungi populations. Their revision on studies on the subject associates forest management to impacts on species richness and abundance, and less occurrence of Red-listed and rare indicator species (Junninen & Komonen 2011), and a

more homogeneous community structure (Penttilä et al. 2004; Sippola et al. 2001) than under natural disturbance regimes. Juutilainen et al. (2014) conclude that harvesting of branches and twigs will represent a threat to fungi associated to dead wood. This study exposes the importance of unmanaged stands for fungal diversity, and the need for careful planning in forest fuel harvesting and forest management in general so as to allow enough dead wood quantities within a continuum of unmanaged stands. On the other hand, the author Anna Lowenhaupt Tsing (2016) proposes a controversial argument regarding disturbance and the growth of mushroom species such as Matsutake. She argues that ruin and degradation are an important part of the life cycle of this mushroom, and also of forests. She sees degradation and destruction as part of the lifecycle of forests and of Matsutake, and also of human populations in the current context. More studies on this direction are needed, especially in the present circumstances where conservation activities guided by Payment for Environmental Services policies and other forest conservation activities, such as fire management, may be affecting conditions for the reproduction of some NTFP species.

Rural livelihoods and safety nets

The new focus on livelihoods has been possible thanks in part to studies such as those by Alexiades and Shanley (2004); Arnold and Ruiz-Pérez, (1998); Godoy and Bawa, (1993); Laird et al., (2009); Shackleton and Shackleton, (2004), and many others before them, that demonstrate the importance that NTFPs have for rural livelihoods. NTFPs are seen as part of a wide range of subsistence strategies on which rural communities rely, for the purposes of nutrition, medicine, cattle feed, exchange and income and also as part of their culture.

Consideration of livelihoods has become central to forest policy and rural development programs (UNFF 2006a). Chambers and Conway, (1992:6) define "sustainable livelihoods" as:

> "The capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base."

Incorporating a livelihoods approach to sustainable NTFP management requires the integration of elements such as employment, poverty reduction, well-being, capabilities, vulnerability, resilience and sustainability of the natural resource base (Scoones 1998), and also cultural elements. This adds more complexity to the idea of sustainable NTFP management because it must integrate diverse elements, sometimes apparently contradictory amongst themselves.

Part of the literature generated at the turn of the century emphasized the notion that forests and wildlands could assist rural dwellers to avoid falling into poverty or act as safety nets during economic, social or environmental shocks (Wunder, Angelsen, et al. 2014). Wunder, Börner, et al. (2014) observe that extraction of forest resources can be a response of the poorest groups of the population, especially in villages specialized in extractive activities. However, this response is minimal, about 7% of households or up to 16% of an increase in extraction (López-Feldman 2014).

As fillers of seasonal gaps, extractive resources did not play a significant role, while wage income did (that is, off-farm income such as working in the construction sector, etc.). Other responses to shock seem more important, such as relying on social networks, wage labor, sale of assets, remittances, or other contributions to their safety-nets.

Community organization around NTFP use

Community organization is an essential element to consider even in marketing matters. There is a prevailing emphasis on the short-term gains of production systems, regardless of the harm they may cause to ecosystems. Tapia-Tapia & Reyes-Chilpa (2008) emphasize that forest communities must shift from this short-term, market-driven focus, in order to prevent the loss of their means of subsistence. The authors note that in most cases, the economic gain obtained from traded products is less than what is obtained from produced items. Therefore, in order to make enough profits, traders must sell large quantities of products, a situation that also requires that producers make sure they have sufficient product to meet traders´ demand. Thus, activities such as conversion to agriculture, land use change, harvest of small plants to create plantations, among others, must be socially regulated in order for producers to be able to produce the demanded quantity of product, at the same time as they protect the resource base so that they can guarantee the existence of resources needed for subsistence purposes.

Following this argument, recent studies have emphasized the idea that as a product becomes more important for a community due to an increase in market demand, more adaptation strategies are developed for improving management and securing availability of the resource, such as reforestation and seed production efforts, as well as prohibiting collection in certain areas or times of the year (Blancas et al. 2013; Delgado-Lemus et al. 2014; Delgado-Lemus et al. 2014; Torres et al. 2015). These authors however also observe that risk management for important resources is motivated by a context of scarcity of the product of interest. Therefore, sustainable management of highly demanded species may need to go through an almost-extinction of the resource before more sustainable management practices are developed, and following this thesis, the resources in highest risk of local extinction are those for which no risk management has been developed (Torres et al. 2015). As has been observed by the above authors, the emergence of risk management strategies for NTFPs is influenced by various factors, one of them being community organization around NTFP management.

Impact of policy, regulations and sanctions

One of the perceived impacts of conservation policies, such as community forestry projects, programs of payments for environmental services (PSA), natural protected areas, and others, is the tendency to exclude the participation of local inhabitants in the decision-making processes affecting their environments (Klooster 2002; MEA 2005; Merino 2004; Rist et al. 2012), although this seems to be changing particularly with the implementation of REDD+ schemes. This has led to the creation and implementation of conservation strategies that often do not take into account the diverse values of forests for inhabitants, restricting the use of alternatives and the option values that forests represent to rural

dwellers. These restrictions also impact adaptation alternatives, for as inhabitants lose their link to the forests, they also lose knowledge of management strategies that may constitute a safety-net when it comes to environmental, economic or social crises (Rist et al. 2012).

Often, meeting the legal requirements results in an investment that cannot be met by rural communities, unless they are assisted either by technicians or NGOs knowledgeable on the subject (Illsley-Granich & Ibáñez-Couoh 2012). These restrictions, guided by the prevailing conservation policy discourse, generate a complex legal context that may drive inhabitants to harvest NTFPs illegally, or to abandon NTFP production completely.

A great necessity of national policies that promote NTFP conservation and marketing is for them to devise ways to protect these resources, through trade barriers and other strategies, so that local products under competition from imported substitutes[6] tend towards niche specialization in order to diminish the risk of product substitution.

Gender, ethnicity, age differences and their impact on NTFP management

Social aspects such as gender and ethnicity of users**,** for example, are issues that determine differentiated access to NTFPs in rural populations. Vázquez García (2002) reports that households with a female head have limited access to resources such as construction wood and firewood. Another example of differentiated access relates also to cultural norms and beliefs. Vázquez notes differences in access to resources between *Nahuas* and *Popoluca* women in Veracruz, citing that in Popolucan communities, women bear a restriction to go to the forest to collect resources such as *chocho* and *tepejilote*, two palms whose fruits are collected as food. Nahua women are have more freedom to collect resources in the woods, while Popolucan women´s mobility is restricted to *acahuales* and *milpas*. This coincides with studies done in Latin America, such as by Restrepo Ramírez (1995), who reports that while men are free to move wherever they choose, women have limited mobility because they are thought to need male protection from risks outside their households.

Public policies have only considered women as wives and mothers, and not as producers, thereby reproducing gender inequality in rural societies (Vázquez, 2002). Leach et al. (1995) have identified three main stages in the literature about gender and the environment. In the first stage women are seen as responsible for environmental degradation, given their constant need for resources such as water and firewood. In the second stage, women are rather victims of environmental degradation, for resource scarcity increases work and collection hours because the resources are found increasingly farther from homes. In the third stage, women are seen as having special skills and knowledge that makes them important actors in environmental conservation and sustainable development. Leach *et al.* (1995) also criticize the ecofeminist stance, which proposes that given women´s activities and responsibilities in rural societies, it is they who naturally have a closer relationship with nature. Leach *et al.* (1995) argue that grouping all women in one category is not appropriate, for there are other important factors, such as ethnicity, religion, etc. which also influence women´s relationship with nature.

[6]As in the case of pine resin in Mexico, which is currently competing with Chinese resin, sold at cheaper prices in the national market (Delgado, 2009).

Importance of traditional/local knowledge

As is evident in the discussions about studying diverse management systems, human cultures have evolved hand in hand with management systems adapted to specific environments. Knowledge of NTFP management and uses, as well as the ecological conditions needed for their existence, is a valuable cultural resource that only local communities have. For centuries, indigenous peoples have developed and passed on their knowledge about natural resources, including many NTFPs. More recently, indigenous knowledge has been seen as a tool for achieving the political goals of indigenous peoples whose livelihoods are threatened by development projects such as mines or dams. International conventions such as the Nagoya Protocol (UN 1992) are an attempt to protect indigenous knowledge of natural resource use from international corporations seeking to own this knowledge through the creation of patents.

There is also a recognition that NTFPs are important for local cultures, be it as part of their subsistence activities, as part of their traditional diets, as part of cultural festivities and rites, and also as medicinal products (Casas et al. 1996; Cocks 2006; Kim et al. 2012; Robbins et al. 2008; Shackleton & Pandey 2014; Vazquez-Garcia 2008). The value of these resources does not always lie in their income generation potential, but in other values which make them even more important for local inhabitants. Incorporating these values into forest and development policies that support the use of NTFPs is important, yet not easy to achieve, because most of these policies concentrate on the NTFPs that generate high economic returns.

As can be seen, the sustainable management of NTFPs incorporates matters that go beyond the definitions of what NTFPs are, into concerns about access to natural resources, equity in the distribution of benefits, integration of diverse groups of users into management and marketing, the existence of diverse management and knowledge systems and users, and more. How can we attempt to promote more sustainable management of these resources when so many issues must be considered?

So in consideration of the complexity of ecological situations and conditions in which NTFPs are harvested, grown and produced, how can sustainable management be attempted?

The following sections offer a brief discussion about the difficulty of integrating a coherent and inclusive research framework for the study of NTFP management. Drawing from various authors and perspectives, from an evolutionary, ecological and cultural view to a focus on the social aspects of management of NTFPs, we propose a simplified analytical framework for the study of NTFPs as important elements of rural livelihoods.

Analytical framework

Studying diverse natural resource management systems

Studying the diversity of ways of using and managing plant resources is of great theoretical importance and also practical value, since documenting and analyzing the technological experience accumulated by humans through their interaction with plants may help develop sustainable management strategies (Blancas et al. 2010). Cultural diversity in Mexico is closely related to biodiversity and the many ways it is used (Toledo 2002).

The study of NTFPs and management of these resources by human populations requires knowledge of the degree of domestication and management techniques that have given rise to specific plant phenotypes and ecological requirements. Thus, it becomes necessary to recognize the degree of domestication of plants (in other words, the nature and intensity of the relationship between humans and plants). A helpful approach is to differentiate plants based on their ecological responses to different environments (and therefore, different management strategies), as suggested by De Wet & Harlan (1975). In this approach, plants are classified as:

1) Wild plants: those that grow naturally outside habitats disturbed by humans, and which cannot invade permanently human-disturbed habitats.
2) Weeds: plants that grow in permanently human-disturbed habitats, but which do not depend on human intervention for reproduction and survival (contrary to corn, for example, which depends on human dispersal of seeds in order to reproduce). Among this classification we can include weeds growing in agricultural fields and gardens, and plants growing alongside roads (ruderal plants).
3) Domesticated: plants that grow in human-made habitats and which have a strong dependence on human intervention for reproduction and survival. These plants usually present characteristics desired by humans, such as gigantism of fruits, and a wide range of morphological variation, suppression of natural defense and dispersion mechanisms, and other features related to domestication (De Wet & Harlan 1975).

Human interactions with plants may influence not only plant populations, but also plant communities. Studying the degree of influence and interaction between humans and their plant environments allows us to determine what could be the appropriate forms and levels of management, in order to perform a sustainable management of plant populations and communities, so as to maintain their defense and reproductive capabilities, their genetic and phenotypic diversity, and their importance to humans as provisioning services of ecosystems.

Conventionally, different strategies of human-plant interactions had been recognized. Most are based on dychotomies of interaction based on the intensity of management. Gathering and agriculture are the two most recognized types of interaction. Other types have been described by (Higgs & Jarman 1972), for example, who distinguish between “minor” and “major” forms of plant manipulation. Whereas, (Rindos 1980) distinguishes between “incidental” and “specialized” practices, the latter being more intense. This dichotomy of practices may not be representative of all the degrees of human-plant interaction recognized

in several studies, including those of (Alcorn 1983; Blancas et al. 2010; Bye 1993; Casas et al. 1996; Casas et al. 1997; Ford 1985; Harris 1996; Harris & Hillman 1989). Casas *et al.* (1996), for example, propose two main forms of human-plant interaction in which to base the study of plant management: *in situ* and *ex situ* management. Within those two categories, several others may be recognized.

In situ management involves activities that take place in the space occupied by populations of weeds or wild plants. These interactions may involve slight impacts on plant populations, as in some forms of gathering, or on the other hand, represent the alteration of phenotypic and genotypic structure in order to increase (or decrease) the numbers of particular plant phenotypes. Included as the main *in situ* management strategies are gathering, tolerance or sparing, enhancement and protection or selective felling (Casas *et al.* 1996). It is still a matter of debate at which point a plant becomes subject to real management. Blancas *et al.* (2010) operatively consider management as those practices "directed to adapt or transform an object (a system, its elements, and/or its processes) according to a human plan". Therefore gathering could be considered the simplest form of plant management. *Ex-situ* management, on the other hand, comprises sowing, planting of vegetative propagules, or transplanting of entire plants from their natural habitats into managed areas such as agricultural areas, homegardens (Casas et al. 1996), plantations or orchards.

Human management is an activity that may not be isolated from people´s culture. What we observe today in many, if not most, ecosystems that have been influenced by human activity for thousands of years, is the result of complex interactions between humans and plants. Hernández-X. and Ramos (1977) wrote: "Ethnic groups have maintained much plant species in different domestication levels according to the uses and achievements of the desired features." Thus, the differences in plant colors, flavors, odors, shapes, textures, as well as ease of management, are all modulated by culture, which determines the morphologic preferences at the point of management. Thus, it becomes important to consider what are or have been the changes affecting cultures, for these changes may also influence domestication trends through time (Casas et al. 1996).

In this same line, Wiersum (1997) argues that in the study of rural landscapes it may not be appropriate to consider it a dichotomy between natural forest areas and the domesticated landscape as characterized by agricultural cultivation. He emphasizes that local peoples have manipulated their original forests throughout time, as long ago as the Pleistocene, which is some 30,000 to 40,000 years ago, in order to promote the growth of resources useful to local societies. Such forests are a manifestation of the evolution (in the sense of change through time) of a nature-culture continuum. The manipulation of forests in order to meet human demands has not necessarily meant the complete transformation into agricultural landscapes. The result may rather be a domesticated landscape characterized by a mosaic of managed forests and other transformed landscapes. Table 3 offers a comparison of some examples of management classifications proposed by Casas et al (1996) and Wiersum (1997), according to the practices performed, the degree of manipulation and impact on populations/ communities.

Examples of degrees of managed forests have been found all over the world and throughout history. Wiersum (1997) summarizes the various types of forests resulting from human management as:

- *Protected native forests*: these are forests that were or have been protected because of their religious/ cultural significance, their role in protecting water sources or in providing useful materials. Forests may be wholly or partially protected depending on the objective.
- *Resource-enriched native forests*: these are forests that have been altered through selective protection and or incidental or purposeful dispersion of food or commercial species.
- *Reconstructed native forests*: forests that have been entirely or partially cultivated with several useful species, with tolerated or encouraged wild species of lesser value and other non-tree plants such as herbs and lianas.
- *Mixed arboriculture*: these forests are composed of exclusively planted and often domesticated tree species cultivated in mixed stands
- *Plantations*: in addition to the types of forests mentioned above, there exist also forest plantations, which are composed of plants species exclusively planted in monocultures for commercialization purposes.

Based on these and other observations, Wiersum (1997) proposes a gradient of evolutionary phases of human-plant interactions, of which the different indigenous forms of management existent around the world are an example. Wiersum´s proposal is based on the idea that as human-plant interactions became more complex, the energy requirement also increased in terms of input of human energy per unit of exploited forest. The gradient proposed expresses a continuum of forest-people interactions which at the same time illustrate a nature-culture continuum. In the present era, one extreme of this continuum could be represented by tree plantations which have high demands of energy and inputs, while at the same time eliminating other species that appear in the other forests mentioned by Wiersum (1997).

Table 3 Examples of management classifications according to the practices performed, the degree of manipulation and impact on plant populations/communities recognized by Casas et al (1997) and Wiersum (1997).

Type of management	Main activity	Degree of manipulation/ other associated activities	Ecological effects	References
Uncontrolled procurement of wild tree products	Casual gathering/ collecting	Gathering as part of other forest resource collection activities.	Incidental dispersal of propagules, no transformation of natural vegetation composition and structure	Wiersum, 1997.
Gathering	Taking useful plants or plant parts directly from natural wild plant populations or weedy plant populations	Digging Clearing of vegetation Cutting of branches	Alteration of plant population structure	Casas et al. 1997.
Tolerance or sparing Sparing from cutting useful species present in human-made environments	Sparing of plant species within human-made environments, useful plants that existed before the environments were transformed.	Collecting plants surrounding the plant of interest.	This practice may favor an increase in number of individuals of a particular plant species or particular phenotypes. Eg. trees producing larger seeds and pods in tolerated populations than in wild populations.	Casas et al. 1997.
Protection Principally of wild or weedy plants	Elimination of competitors and predators	Fertilization Pruning Protection against frosts, etc.	Reduction of competition, limited transformation of forest structure/ composition	Casas et al. 1997.
Controlled utilization	Controlled procurement of wild products	More or less systematic gathering/ collecting Systematic collection with	Reduction of competition, limited transformation of forest structure/ composition	Wiersum, 1997.

		protective tending of valuable tree species		
Enhancement With the objective of increasing the density of population of useful plants	Intentional propagation of vegetative structures in the same places occupied by populations of wild or weedy plants	Sowing of seeds		Casas et al. 1997.
Purposeful regeneration	Cultivation of wild trees	Selective cultivation by transplanting of wildlings and/or dispersal of seeds/ vegetative propagules in forest environment. Tree crop cultivation (possibly in combination with annual crops)	Purposeful dispersal of propagules to new habitats, partial transformation of forest structure/ composition. Land clearance, total or almost total transformation of forest structure/ composition	Wiersum, 1997.
Domestication	Production of domesticated trees	Cultivation of domesticated trees in tree crop plantations	Propagation of genotype variants, land clearance and soil modification inputs of fertilizer and pesticides	Wiersum, 1997.

The management practices cited in the table above, and their evolution, are also directly related to the evolution of a diversity of landscapes, each of which contains a diversity of species, populations and biological communities.

Multiple Forest Management, or Multiple Use of Forests, has been a line of study for many years now. Rural and indigenous communities all around the world have used forests in multiple ways, and have adapted these uses to emerging economic, cultural and political changes (Alcorn 1981; Toledo et al. 2003). What is most interesting, is that the occurrence of management practices has developed hand in hand with the configuration of landscapes,

and also, institutions. Examples of multiple forest management can be found all over the world. What is important to note is the notion that local communities create different landscape niches which are used for various purposes, and that this gradient along the nature-culture axis offers a more varied scope for biodiversity conservation through both *in situ* and *in-domo*[7] conservation than the conventional notion of production and conservation areas destined for *in situ* conservation (Wiersum & Shackleton 2005:83), presently being promoted by institutions such as IUCN or WWF and governments in different countries. Following this line of research, it becomes important to question the actual conservation policies which promote the segregation of landscapes into those that can be used and those that cannot. As has been discussed in the former paragraphs, many studies have identified effective biodiversity conservation systems that do not necessarily segregate landscapes into use and non-use, as in the present conservation policies. Thus, studying and comparing different management systems, from conventional conservation to multiple use of forests, becomes a task necessary in the formulation of effective environmental and socioeconomic policies.

Studying social organization for common pool resource management

Hand in hand with the rise of diverse landscapes and management systems comes the social organization around management, accompanied by rules, institutions, values, knowledge and cultural aspects that evolve in relation to the resources and the natural systems being managed. Just as there exist a diversity of landscapes and management practices associated with them, there is also great diversity of social arrangements around management of NTFPs and natural resources. Which arrangements are more successful, promote better (more sustainable) management practices, more equality in the distribution of benefits and impacts, that is a question that has been studied for many decades by authors such as Elinor Ostrom and her pupils. Interestingly, one of the conclusions at which these researchers have arrived is that there are no panaceas for conservation of natural resources (Hayes & Ostrom 2003); rather, they depend on factors that include local recognition of rules and regulations, biophysical features, financial and human resource support, and mechanisms for conflict resolution, among others (Ibid: 617).

Most of the NTFPs in the case studies presented in this thesis appear to have the attributes of common pool resources (CPRs), studied by authors such as Agrawal (2001), Baland & Platteau (1996), Ostrom (1990), Stockdale (2005) and Wade (1988). These researchers focus on the conditions that allow sustainable natural resource management under communal arrangements, such as those that may be present in *ejidos* or *comunidades indigenas* in Mexico. Others concentrate on the rules that govern CPR management, rather than the context (or conditions) in which sustainable CPR management occurs.

The proposals of these authors contain important observations about the relationships between the resources used, the management system, and the users of these resources and their impact on the conservation of natural resources. Table 4 below offers a synthesis of

[7] The *domus* concept refers to a specific área where selective environmental knowledge and resource strategies are applied at a specific time. A *domiculture* encompasses the parcels of knowledge, strategies and actions applied to each *domus*(Hynes and Chase, 1982).

the work by Agrawal (2001) and Stockdale (2005), who synthesize a group of "critical enabling conditions for sustainability on the commons" or "predictors" of sustainable management of common pool resources, among which NTFPs can be included. These predictors focus principally on the social aspects associated with CPR management. It is important to observe that there is also a great diversity of predictors or conditions, pointing to the idea that the rise of a diversity of landscapes and natural resources goes hand in hand with the rise of a diversity of social institutions and social organization around their management. The following table (4) offers a synthesis of each of the aspects highlighted by these authors, and how they relate to NTFP management and conservation, as well as the implications for livelihoods. To this discussion we add some aspects that are not explored by CPR theorists in length: cultural aspects, local knowledge, implications for livelihoods, NTFP governance and conservation/development policies.

Table 4 Enabling conditions (Agrawal 2001) or predictors (Stockdale 2005) for the sustainable management of common pool resources.

The two columns indicate the predictors proposed by Agrawal and Stockdale, while the rows in bold indicate the type of predictors presented in the rows below the bold titles. Agrawal, for example, proposes that "Small size" is a characteristic of the resource system that allows for the sustainable management of common pool resources.

Agrawal (2001) based on Ostrom (1990), Wade (1988) and Baland and Plateau (1996)	**Stockdale (2005)**
Resource system characteristics and resource characteristics	
Small size Well-defined boundaries Low levels of mobility Possibilities of storage of products extracted from the resource Predictability	Yield of NTFP resource Distribution regionally Habitat specificity Resprouting capability in plants Growth rate Age to reproductive maturity Reproductive rate Pattern of reproduction Pollination in plants Impact of NTFP management on the rest of the ecosystem Plant part harvested
Relationship between resource system characteristics and user group characteristics	
Overlap between user group residential location and resource allocation Fairness in allocation of benefits from common resources Low levels of user demand Gradual change in levels of demand Predictability of benefit flows Heterogeneity Exclusion of non-group members	Community capacity Community cohesion Social equity Community decision-making Conflict resolution mechanism User group size User group identity Location of NTFP resource users Tenure to land/resources

	Rules for NTFP resource use Punishments against rule breaking Free rider recognition Population density of people relative to that of the NTFP resource Local knowledge User group size
Institutional arrangements	
Rules are simple and easy to understand Locally devised access and management rules Ease in enforcement of rules Graduated sanctions Availability of low cost adjudication Accountability of monitors and other officials to users	Rules for NTFP resource use Punishment against rule breaking Free rider recognition Uses for lands and resources Tenure to land/ resources Boundaries around land resources
Relationship between resource system and institutional arrangements	
Match restrictions on harvest to regeneration of resources	Boundaries around land/resources Uses for lands and resources Local knowledge, values, practices and laws Uses for lands and resources
Relationship between resource system and external environment /Political Predictors	
Low cost exclusion technology Time for adaptation to new technologies related to the commons Low levels of articulation with external markets State: Central governments should not undermine local authority Supportive external sanctioning institutions Appropriate levels of external aid to compensate local users for conservation activities Nested levels of appropriation, provision, enforcement, governance	Policies related to NTFP management Policies related to protection of the environment Policies related to tenure Policies related to community leadership and autonomy Partnership with other outside parties (Government, NGOs, industry, donors) Level of participation of community members in partnership decision-making

Resource system characteristics and resource characteristics

The predictors for sustainable NTFP management presented by Stockdale (2005) consider a wide range of conditions, presented in the table above. All of these predictors are important to consider when thinking about improving management of NTFPs. However, these conditions by themselves are not necessarily determinant of more or less sustainable management practices. Agrawal (2001), based on his review of CPR studies, suggests that stationality (that is, the characteristic of being harvested only during specific seasons) and storage of the resource are two features that affect institutional solutions to CPR management; this, because of their impact on the reliability and costs needed for such

solutions. As Stockdale (2005) implies in her manual, local knowledge of characteristics of the resource, such as its stationality or yield, can be combined with scientific studies about the resource, so that groups of users can rely on specific information to make better informed decisions. This however may be costly and in many instances, the characteristics of a group of users may be determinant of the potential for improving management based on knowledge of a resource, as discussed below.

Relationship between resource system characteristics and user group characteristics

Regarding CPR management, Ostrom (1999) cites predictability of benefit flows from the resource, dependence of users on the resource, and successful experience in self-organization as conditions for sustainable resource management. When users can predict the "benefit flow" or availability of the resource they can generate more realistic scenarios on organization around management. However, in many contexts there is a limited possibility of exclusion of non-group members from harvesting, therefore, it may not be possible to predict how much of a resource may be available in a specific time period, a problem that may also affect marketing. Agrawal (2001:1652) suggests that where availability of resource is regular and high, and users significantly depend on resources, defining a lower limit for harvesting resources will likely lead to unnecessary rule infractions.

The degree of dependence of users on a resource may in fact be an important point that users consider when generating arrangements to improve management. However, this characteristic by itself will not guarantee that users will become better organized to assure availability, because other factors, such as the possibility to store harvested resources or conditions such as the degree of poverty of users (which in many instances increases dependence of users on a resource) may also be interacting.

User group characteristics

The user group characteristics are an important element to consider in sustainable NTFP management. Baland & Platteau (1996) for example, considered small size and homogeneity of a user group as a characteristic that may lead to cooperation among group members. The impact of group size can also be mediated by many other variables such as production technology of a collective good, its degree of excludability or jointness of supply.

Ostrom (1997) considered the level of heterogeneity in a group as a factor that also affects management in different ways. Groups can be divided along multiple axes such as ethnicity, gender (Agrawal 2001) or land tenure, for example. Baland & Platteau (1996) hypothesize that heterogeneity of endowments have a positive effect on resource management, while heterogeneity of identity and interests may be obstacles for collective action (cited in Agrawal 2001:1658). Agrawal (2001) identifies gender as a characteristic that creates significant differences within groups, because of "the often critical role women play in gathering and harvesting of products from common-pool resources, the simultaneous position of relative marginality to which they are relegated in terms of decision making, ownership of assets, and exercising political power, and the seeming invisibility of such relegation to the margins (Agrawal 2001:1657)."

Economic differences between users also impact resource management and social organization around it. Research on development projects and CPR management suggests that group members experiencing better economic conditions are likely to gain a larger share from a resource (Agrawal 2001; Belcher & Schreckenberg 2007; Godoy et al. 1995; Marshall et al. 2006; Shackleton & Shackleton 2004). It has also been observed that those with better economic conditions can also start domestication processes and later on, chose more intensive production systems for NTFPs (Belcher 2003). Thus, economic differences between user groups must be pondered when promoting NTFPs as a path out of poverty.

Institutional arrangements

Agrawal (2001:1651) criticizes the studies performed by Baland & Platteau (1996); Ostrom (1990) and Wade (1988) which focus primarily on CPR management and the importance of institutions, arguing that these studies aim to show that common pool property arrangements can be an efficient way of promoting efficient use and equitable allocation and sustainable conservation of resources, but leave out aspects of the resource system, some aspects of the user group membership, and the external, social, physical and institutional environment that affect institutional durability and long-term management at the local level. Following this line, Stockdale (2005) suggests a group of ecological predictors for sustainable NTFP management, but also considers other questions associated with the community´s institutional arrangements, such as the rules for NTFP resource use, punishment against rule breaking, free rider recognition and clear boundaries around land or resources, which are defined through institutional arrangements.

Relationship between resource system and institutional arrangements

As new markets arise for NTFPs and new technologies are developed to produce them, new interests from users may also arise regarding the resources harvested, harvest technologies and rates of harvest. This changes can also motivate changes in local power relations as different groups of users attempt to consolidate their gains (Agrawal 2001), or to exclude former users. In some cases, new market actors may seek alliances with state actors in efforts to privatize commons or a specific resource (Agrawal 2001). This can also be done through the creation of institutional arrangements within communities to limit harvesting quantities or access to certain common pool resource areas. This is why Stockdale (2005) suggests that to achieve sustainable NTFP management, there needs to be consideration of arrangements regarding boundaries around land or resources, arrangements regarding uses for lands and resources and the integration of local knowledge, values, practices and laws.

Relationship between resource system and external environment

The conditions recognized by Agrawal (2001) relative to the relationship between the resource system, the group of users and the external environment have to do with: the cost of exclusion technology, the time it takes users to adapt to new technologies related to resource use/extraction/production, and the degree of articulation of users with external markets. An example of an effect that the external environment may have on resource use is that suggested by Agrawal (2001:1656), who hints at the fact that a better connection of local economies with larger markets may increase the possibility that subsistence users increase harvesting levels because they can also exploit resources for cash income. As was mentioned in the section about institutional arrangements, changes in the external

environment related to markets may also force new institutional arrangements and also involve new actors who see a benefit in using a resource that previously had not much market value.

Cultural aspects, local knowledge and livelihoods

These are some aspects that have not been considered by Stockdale (2005) and Agrawal (2001) in their documentation of conditions or predictors for sustainable CPR or NTFP management. Cultural values may contribute to unequal resource distribution processes (Papanek 1990) such as those associated with gender, as mentioned by Agrawal (2001) above, or ethnicity. Focusing on the conditions necessary for recovering and promoting local knowledge to enhance CPR or NTFP management is important, yet no mention of these elements is made either by Agrawal nor Stockdale. Learning about cultural values helps to better understand power relations within user groups in domestic units (Papanek 1990). Cultural values have an impact on resource management, resource access, marketing and other factors necessary to manage a resource successfully. Culture, however, is not a tangible object that can be studied under controlled conditions. Studying culture requires complex methods, long periods of time, profound interaction with what (or who) is being studied, than other studies from ecological or geographical perspectives, for example. It comes as no surprise that because of the difficulty (theoretical, methodological) of studying the cultural aspects of NTFP management and use, these have not been in the focus of attention of most NTFP and forest resource research. However, these aspects are very important, because they determine the way people think of and act upon their natural resources.

Incorporating a perspective that considers NTFPs as part of rural livelihoods -which in themselves integrate a diversity of production systems and resources, varying degrees of knowledge, and different economic and political contexts- into a framework that focuses on common pool resource management, is necessary but difficult. A livelihoods approach to sustainable NTFP management must integrate components of employment, poverty reduction, well-being and capabilities, livelihood adaptation, vulnerability, resilience and sustainability of the natural resource base (Scoones 1998), whilst also incorporating cultural elements.

The common discourse of CPR management concentrates principally on community organization around managing a resource, but it does not effectively integrate the elements highlighted as part of a livelihoods approach. The livelihoods approach, on the other hand, does not sufficiently consider issues of how community organization or the characteristics of the resource managed allow for the domestication of a resource, or for improved management through CPR community arrangements. Nevertheless, all three perspectives - CPR, the perspective of evolution of management systems, and the livelihoods approach - offer important views on NTFP management.

The challenge is to integrate these three views into a single simplified analytical framework that allows to understand the role that NTFPs play in rural livelihoods, and the potential for improving their management and contribution to rural subsistence and as income-generation alternatives. An effort to integrate these elements into a framework is the work by Wiersum et al. (2013) on NTFP governance. In their analysis of NTFP governance, the

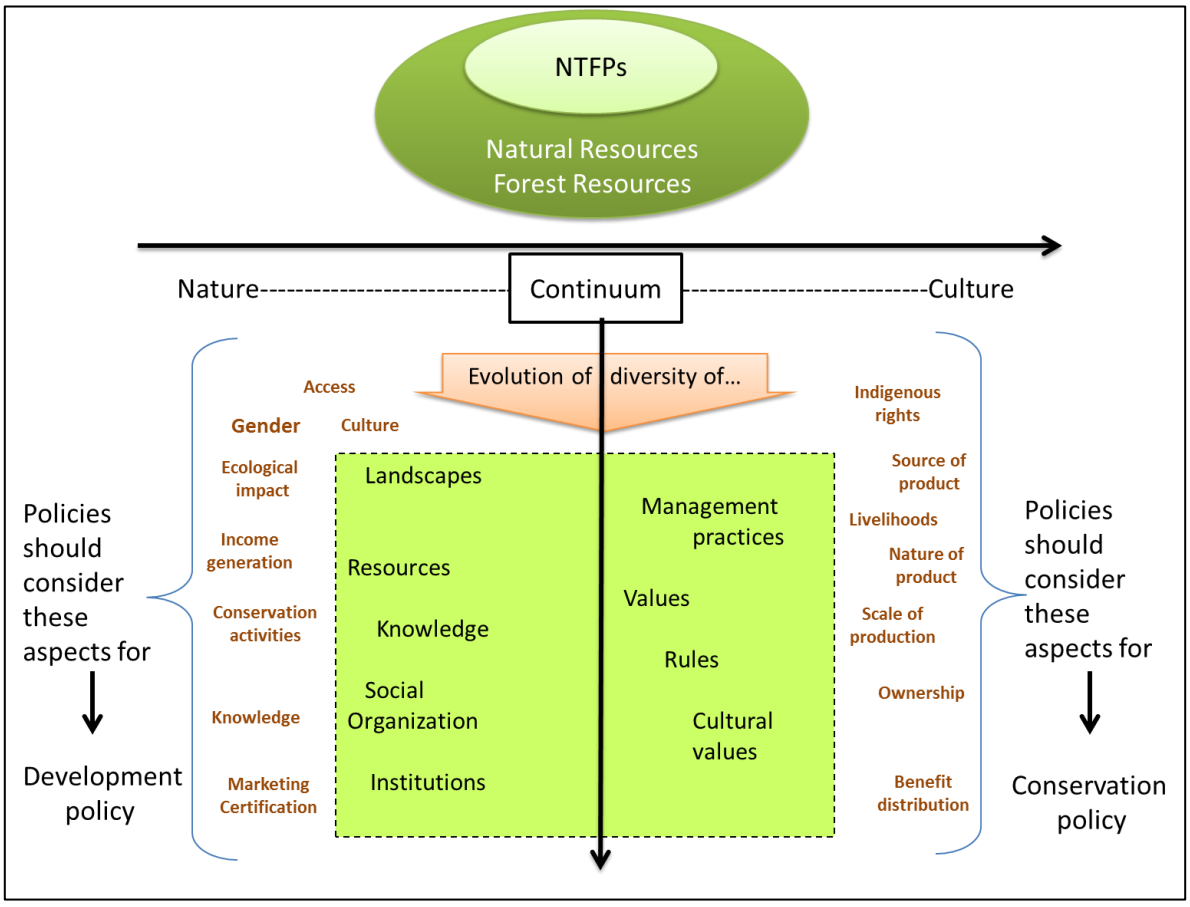
authors include various elements of the discussion of NTFP governance, from a focus on the diversity of management systems and landscapes, to community organization around marketing and the importance of the relationship with the external environment, be it through policies or marketing arrangements, or relationships of another nature.

NTFP Governance and Conservation/Development Policies

Wiersum et al. (2013) refer to NTFP governance as "the multi-stakeholder and multilevel process of interactive decision-making and creation of institutional frameworks for the allocation, use and trade of NTFPs". A strong consensus has emerged surrounding sustainable management of common pool resources, amounting to the coining of terms such as "NTFP governance". In this line of thought, governance of natural resource and CPR management necessarily incorporates a political element and a linkage with the external environment. Stockdale (2005) therefore goes on to consider as predictors of sustainable NTFP management political factors that are also considered by CPR theorists. Partnerships with outside parties - such as NGOs or government officials- and the degree of participation of resource users in such partnerships is fundamental to generating an environment that promotes governance of NTFPs. Policies related to land tenure, resource access or to environmental conservation are also important. Agrawal (2001) also adds the need for central governments to support local authorities in decision-making processes, this, through supportive external sanctioning and enforcing institutions, and through appropriate levels of external aid to compensate local users for conservation activities. Therefore, the participation of governments, local authorities, and institutions such as NGOs are important elements to consider when promoting NTFPs that are managed as common pool resources, and also managed as part of a more ample range of livelihood options that incorporate cultural values as determining factors of sustainable management.

This section concludes with the idea that a framework for the study of sustainable management of NTFPs must be aware of the diversity of landscapes, resources, management systems, social organization and cultural values, and the relationship with the external environment, all of which interact to create particular contexts with particular needs. The diagram below (Figure 1) integrates this idea.

Figure 1 Proposed analytical framework for the study of NTFPs and their importance for forest conservation, livelihoods and culture.



As Figure 1 shows, creating integrated policies to promote sustainable use of NTFPs and which also contribute to improving rural livelihoods is a complex process. This process must incorporate a reflection of how local resources and management systems have evolved through time, of the differences among different resources and management systems, of the differences in values conferred to resources, and the relationship of local users with markets and other external elements which determine the conservation potential and the sustainability of uses. In particular, there is a stronger focus on the importance of markets and of policy for the sustainable management of NTFPs and for rural livelihoods.

Our analytical framework proposes that the study of NTFPs must integrate a holistic view of these resources as they interact with the dynamics related to the physical environment, but also in their interaction with social phenomena, such as cultural values and institutional arrangements. The broader framework within which this work is framed is the perspective that nature is not only an entity outside human societies, rather, it is profoundly grounded on the colective practices of human, who see themselves as integrally connected to nature. In this vision, biodiversity is not just a collection of genes. Biodiversity is seen as "territory plus culture", and which is reproduced through the daily practices of the communities that inhabit these territories. The territory is then considered a fundamental and

multidimensional space for the creation and re-creation of ecologic, economic and cultural practices of the communities inhabiting it (Escobar 2005:136). It is also the space where conflicts of distribution happen. From a Political Ecology stance, or rather, what he calls a "Political Antrhopology", Escobar sees as fundamental to analyse the conflicts of distribution as determinant for sustainability. According to him, modernity and development have been promoted over an injust distribution and unequal exchange at the economic, ecological and cultural levels. Thus, it becomes necessary to promote equity in how the economic, ecological and cultural spheres are distributed. Of particular interes to the topic of NTFPs is the influence that cultural perceptions of nature have on the way it is used, managed and its benefits distributed. But culture is just as determinant when in comes to views regarding development and the economy; the dominant culture associated with modernity and development promotes, for example, production processes based on biotechnology and plantations. "If the dominant production system denies the underlying ecological processes, it also denies the cultural processes that are at the base of people´s relationship with the natural world" (Translated from Escobar 2005:127). These three distributional conflicts –economic, ecological and cultural- must be included in any analysis of natural resource management with focus on sustainability.

The study of NTFP management then becomes very complex when it integrates these levels of analysis (evolution of management systems, diversity of management systems, distributional conflicts). In this work we attempt to show how this framework can be applied to analyse NTFP management systems (ecological, political, cultural, economic), and and how it can contribute to improving the conditions needed to promote more sutainable management systems.

The case studies selected (Chapter 5 and 6) present a picture of the complexity of this study, and of the importance of recognizing the factors that must be studied in greater depth after an analysis of this complexity has been performed. The result of the work done in the selected communities (case studies) is presented after two very important topics are discussed: policy (Chapter 3) and markets (Chapter 4). The case studies attempt to apply, through a concrete methodology, the analytical framework proposed in this introductory chapter.

CHAPTER 2. Methods

Research paradigm

Finding a research model that is accepted by everyone and which adjusts to every type of research is a "strange hallucination", as Gramsci writes (1973, quoted by Rojas 2013). Nevertheless, it is possible to find *general criteria* that constitute the collective consciousness of researchers, whatever their specialty, and which should be spontaneously present in their research. Rojas (2013) proposes that the scientific method is flexible enough that, even though research is performed according to general rules and criteria, the requirements of the research objectives make it necessary for the researcher to adjust these rules and criteria to suit her own research. This means that the researcher performs two or more stages of the research moving forward, then goes back one step to revise the consistency of her proposal in light of new information and experience about the reality in which she studies. This method can be classified as "grounded theory", where, according to Corbin & Strauss (1990), "the analysis begins as soon as the first bit of data is collected". In this way, the next steps in the research can inquire into issues may have been left out of the first stages.

New approaches to the study of complex systems (Holling, 2001) emphasize the importance of adjusting the process of study to the reality (Clayton & Radcliffe 1996; Holling 2001; Gallopín 2003)[i] and the levels of reality being studied. Natural resource management systems (NRMS) are systems that have hierarchical structures, which are divided into subsystems while being part of other systems (Clayton & Radcliffe 1996; Gallopín 2003; Holling 2001). The scale of study of a NRMS is of great importance, since it allows us to define its extent either in spatial or temporal terms. Also, the management objectives of a NRMS can vary according to the actors involved and their conception of a NRMS. While some actors in a scale may be concerned about maintaining hydrological ecosystem services provision, other actors at a smaller scale, say, the rural production unit (RPU), may be more concerned with the increase in maize yield in the short term. Research of socio-ecological or socio-environmental issues ought to be able to capture the complexity associated with the objectives of different actors at different scales.

A relevant issue in the study of complex systems is the issue of interdisciplinarity. This concept not only has to do with the interaction of disciplines, but is also a redefinition of the object of study. As Roland Barthes writes "Interdisciplinary work, so much discussed these days, is not about confronting already constituted disciplines (none of which, in fact, is willing to let itself go). To do something interdisciplinary is not enough to choose a "subject" (a theme) and gather around in two or three sciences. Interdisciplinarity consists in creating a new object that belongs to no one" (cited in Clifford & Marcus 1986, pp. 5).

To go even further and deeper into the complexity of research of socio-environmental subjects, we confront the impossibility of being able to present "the truth", an ideal at which we are supposed to have arrived at after conducting our rigorous scientific studies. In studying social subjects, that is, people –who have thoughts, feelings and social constraints of their own- we find ourselves constantly doing a power dance where knowledge and truth are the objects being contested. Moreover, studying issues that in themselves may imply a

degree of "illegality", of being outside what is socially or institutionally accepted, can represent an obstacle when trying to obtain valuable data (that is, that which can be presented in conventional scientific reports such as indexed journal articles). As a Saramaka folktale told by Richard Price (1983:14, cited in Clifford and Marcus, 1986) tells: "knowledge is power, and […] one must never reveal all of what one knows".

This study recognizes the limitations posed by studying human objects, and accepts that what is presented here as results are but one version, and a very limited one, of what rural communities actually do with their resources, and what they actually negotiate with their community members and government representatives. Arriving at significant information is not only a question of time, but also of developing close, trusting relationships with key informants. In my experience, arriving at significant information about the main object of study, the NTFPs, took in one community, a long history of contact with key informants, who after several years finally admitted to knowing people in the community who depended on these resources for income. In other communities, culturally farther separated from the researcher (myself), the lack of a common language and the significance of the object of study to the community have also played important barriers to obtaining meaningful information. When people simply do not think an issue is important (as may be the case of NTFPs), they dedicate little time and attention to it, and go on to talk about more relevant subjects.

Important information may arise through informal discussions with local people, such as those that happen on the way to a workshop or to a sampling site. This fact also questions the way we think about our methods, the type of questions we ask, and the tools we use to arrive at information that is important to us as researchers. The perception of the researcher may be that the study of NTFPs can start by disaggregating resources and studying each resource on its own. However, resources such as NTFPs are managed as part of a larger group of resources and a broader livelihood strategy that also integrates other production systems, such as cattle herding, agriculture, forestry, and construction work. Thus, it is important to integrate not only different methods through which the researcher can arrive at meaningful information, but also perform research in different spaces, with different peoples (not only "key informants") and at different times in the day and in the year. This will allow for research that integrates the experiences and views of a broader group of users, and also will allow the research to relate to elements of the space and the time in which the interaction between the researcher and the object of study is happening (for example, it is easier for an interviewee to think of concrete resources that are used in the community when these resources are actually growing, and when he or she have recently, such as in the past week, collected the resources, etc.).

The legal context of extraction of some NTFPs will also affect the information that people share about that resource, as in the case of resources that grow within NPAs. In this case, most people do not feel comfortable talking about this matter for fear of giving out information that may harm users from the community. Performing social research is a sensitive topic which involves creating trust with the people being studied, being aware of the space and the season or time in which these interactions happen, as well as recognizing the contextual limitations posed on research.

Taking these concerns into account, proposing a methodology that attempts to be representative and sensitive to the difficulties discussed above is a great challenge. The following sections offer a description of the methods chosen, how they relate to the objectives of this study and how they relate to the analytical framework proposed. There is no single way of reaching similar results; however, as a popular saying notes, “all the paths end up in Rome”. This is just one of many different proposals to study the sustainable management of NTFPs in Mexico.

Objectives of this study

The following table presents the specific objectives of the thesis with their associated research questions and methods.

Table 5 Objectives and associated research questions and methods

Objectives	Research Questions	Methods	Chapters where the information may be found
1. Perform a critical literature review of case studies of NTFPs and of the history of NTFP management in the world and in Mexico	What are the most important issues that appear in the NTFP literature (academic and non-academic)?	Literature review of articles, books, thesis, newspapers, etc.	Introduction
2. Define what is the present stance of policies regarding NTFPs and their relation to ecological conservation in México, what changes have these policies been through, and the importance of these policies in explaining changes in NTFP management in the past decades in the selected case studies.	What policies have been implemented in the last years? What has been the focus of environmental/agricultural/market development policies? How have these policies affected land tenure? What changes have been observed in markets related to policy changes? What changes have policies caused to community organization around NTFP use?	Literature review Policy review Discourse analysis	Chapter 4
3. Analyze the role played by markets in management of NTFPs, and what are the real social, economic and environmental possibilities/ implications of promoting NTFPs as income-generation alternatives.	What is the importance of NTFPs for subsistence, for markets? How are these markets influenced by consumer preferences? What other factors influence market demand/flows? How are externalities dealt with in these markets? Are there examples of similar resources/communities/ecosystems? What are the barriers for marketing local products?	Interviews Surveys Visits to markets Participant observation Literature review Discourse analysis	Chapter 3

4. Develop an analytical framework for understanding the role of NTFPs in rural livelihoods, concentrating on the Rural Production Unit (RPU), based on results of the selected case studies in the State of Michoacan.	Who are the principal managers of NTFPs, how do they organize their activities spatially and temporally, what are the internal agreements regarding NTFP extraction, and what is their perception regarding environmental impacts of NTFPs and relationship with ES provision? What is the economic importance of NTFPs, what is their importance for subsistence and for markets?	Interviews Surveys Group interviews Participatory Mapping Transects Literature review	Chapters 5 and 6
5. Identify changes surrounding NTFP extraction, availability, management systems and impact of these changes on the livelihoods and cultures of the selected case studies. Consequently, identify the time periods in which these changes have been more evident, with a focus on the past 30 years.	What are the resources used? What are the quantities extracted? What is the availability of these resources? In what areas are they found and collected? What are the management activities/methods? Who are the main users? What are the profiles of the main users? What is the economic contribution to RPUs? What are the associated changes in ecosystems and society?	Interviews Surveys Participant observation Walks and transects Review of studies in the area Discourse analysis	Chapters 5 and 6
6. Offer a discussion and conclusions regarding the importance of this work, of the methodology used, and of the findings, for improving NTFP management, conservation and the livelihoods of those who depend the most on these resources in Mexico´s rural communities.	What are the most important NTFPs used in the areas studied and in other areas of Mexico? What are the most important threats to the sustainable use of these resources? What are the causes of the principal changes around NTFP management? What are the opportunities for sustainable use of these resources? How can policy contribute to enhancing sustainable NTFP management? How can marketing help reduce rural poverty and contribute to forest conservation?	Triangulation	Chapter 7

Methodology proposed for this study

NTFPs have been studied from many points of view and with many objectives. Studies that use ecological surveys and inventory methods have been more commonly done than studies that focus on management and questions regarding social organization around NTFPs, their use and marketing. The ecological methods most used have to do with the impact of extraction –mainly for commercial purposes- on resource availability, plant inventories, population dynamics, and spatial availability of resources (Ros-Tonen et al., 1998). However, in the 1990´s studies of NTFPs began to focus on other aspects, such as management of the resources by the users, the economic value of NTFPs, their markets, the social institutions around the management of these resources, their cultural significance and associated traditional knowledge (see the works reviewed in The complexity of NTFP definitions section in the introductory chapter). The sphere of NTFP study thus has become even more broad, with many branches and approaches. Thus, the methodology used in this study is a compilation of various methods that have been used in NTFP research. Most of the selected methods come from the social sciences. The methods chosen will be described below.

Literature review on NTFPs and environmental conservation policy research

The first step in the development of a concrete methodology proposal was doing a first read through the existing literature regarding the subject of NTFPs, environmental conservation policies, rural livelihoods and other related topics. The main objective of this revision, regarding methods, was to learn about the different strategies that have been performed to study the subject.

The literature review was based on an intensive search of academic articles and publications, institutional reports and mainstream media publications of the past 60 years. Research of NTFPs is extensive and more work is being published all the time. The aim of the review however was to learn how NTFPs have become an important issue for academic institutions, government and the general public, expressed through mass media, and the effect that this interest has had on actual practice. Our literature review started with a broad search of scientific journals, through databases such as Sciencedirect and other ELSEVIER search engines, EBSCO, JSTOR, and also Google Scholar. A group of journals was selected based on the frequency with which articles on NTFPs had been published in them (see Annex I). A fast scan of each journal allowed us to make a selection of the articles that had most relation with the main issues of interest, focusing on issues such as livelihood importance, environmental policy, poverty alleviation, commercialization, and government programs, all related to NTFPs. We selected a total of 136 documents, all of which were read and coded using the program N-Vivo 10, in which we created categories based on issues (see **¡Error! No se encuentra el origen de la referencia.** for key NTFP issues mentioned in the literature).

A parallel search was done within international institutions which in the past years have developed a particular interest on NTFPs, mainly FAO (Food and Agriculture Organization of the United Nations) and CIFOR (Center for International Forestry Research), although some documents published by the United Nations and the World Bank were also included (reports from their programs). We also consulted national government agencies in Mexico such as CONAFOR (National Forest Commission) and SEMARNAT (Environment and

Natural Resources Secretary), and the state-level agency COFOM (Forest Commission of the State of Michoacan).

A third source of information came from a hemerographic search through local newspapers since 1950 onwards. This search was done for every five years of publication, looking at news published all through the entire year selected (for example, we searched the year 1972 and all months published in that year). The media search focused on the search terms "non timber forest products" ("recursos forestales no maderables"). However, we did not find many publications using this general term, so we proceeded with a second search using more specific terms such as "resin", "mushrooms", "moss", "soil" and other products that have come up in the questionnaires and interviews as being of most importance. From the year 2000 onwards, the search was done through the Google Search engine. The results are presented in CHAPTER 3. The Policy Take on NTFPs and Their Association with Environmental Conservation Policies and Rural Livelihoods.

Lastly, we include information obtained from 105 questionnaires and 22 interviews performed from September 2012 to December 2013 in the selected communities.

Criteria for selecting a community
After several field visits to the areas of study, two communities were selected based on the following criteria:

- Use of NTFPs by local communities
- Communities´ willingness to participate in the research project
- Location within the state of Michoacán
- Participation in forest conservation programs (such as PES, NPA, etc.), or an experience of having participated in such programs in the past, or of having a previous experience with decision making around PES programs.

The original idea of this study was to work with three communities (localidades) in the state of Michoacán, in order to gather information that could be generalizable to the whole state. We therefore intended to include a community from the hotter region of "Tierra Caliente", with La Huacana municipality as a prospect. For security reasons and time limitations, this community could not be wholly integrated.

The two *localidades*[8] selected in the Monarch Butterfly area are located within Crescencio Morales Indigenous Community. We also included information about the *ejido* Crescencio Morales, due to a decision to consider both the *Ejido* and *Comunidad* as a single community. Crescencio Morales Indigenous Community and Crescencio Morales Ejido are located one right next to the other. It took a long time to understand that they are in fact two distinct legal/tenure figures, because people talk about Cresencio as a single community. Although agrarian distinctions are important, they come second place when people talk

[8] Localidad is the name given to small rural communities, usually below 2500 inhabitants. The formal name "comunidad" (translated as "community") is the name given to a type of agrarian nucleus, and refers rather to a territorial organization unit similar to the *ejido*.

about their identity as a community (many of whose members are related in some way and are also owners of land in both *ejido* and *comunidad indígena*).
Nieves *ejido* is a particular case, because the decision to include this community was rather built on previous work done in the community, the connections with a number of families in the area, and the existence of previous data collected in this community.

Our selection of case studies resulted in the following communities being chosen (more detail will be presented in Chapters 5 and 6):

- Localidad El Rincón and San Mateo (which due to their proximity are considered one community for this study) Crescencio Morales *Indigenous Community*, Zitácuaro Municipality.
- Ejido Nieves, located within Villa Madero and Morelia Municipalities.

More informally, we included information about another locality from Crescencio Morales, La Viguita, where we performed group interviews and mapping exercises.

Data collection methods
The methods used for collecting data for any study depend on the objectives and in our case, on the target population. Therefore, an explanation of how the target population was chosen is important for understanding the choice of method.

Target population
Choosing a segment of the population with whom to work was an easy task at the beginning. The idea was to perform surveys of a sample of the population of the selected *localidades*, and from there, use snow-ball techniques to arrive at key informants (those people who are more knowledgeable about NTFP management in the area). Finding the correct people to work with was a difficult task, because in theory, it should be people from the communities who collect and sell NTFPs. Yet, as the work of Marshall et al. (2006) finds, marketing chains are comprised of different types of people, from collectors and processors, to intermediaries and sellers. Our field research allowed us to find key informants from the communities studied, some of whom are sellers. However, finding the connection between collectors and the sellers in the city markets is not always easy, due to the fact that some of the products sold in the big markets are collected "illegally" by outsiders who do not belong to the communities, and therefore, are zealous about not revealing their identity.

Our main group of informants were:

- Key NTFP collectors and users
- Sellers in the city markets (Morelia and Zitácuaro)
- A random sample of heads of households in the communities studied (who provided general information through questionnaires).
- Representatives of NGOs and Government agencies.

The importance of focusing on the household unit when studying livelihoods
Chambers & Conway (1992:6) suggest that the definition of a livelihood can be at many different levels, of which the household level is the most commonly used. They define a household as "the human group which shares the same hearth for cooking", although other definitions can apply (for example, the nuclear family that shares a house, a room or a defined space). These authors emphasize the importance of recognizing "an individual and intrahousehold level, in which the wellbeing and access of some household members, and specially women and children, may be inferior to that of others, especially men; and also the broader levels of the extended family, the social group, and the community."

Focusing on the household level allows us to learn about the subtleties of forest resource management and how management is organized within the household. A community's households also differ from one another, and these differences can be important for NTFP and CPR management.

Field observations
After an initial literature review, field visits were the first method used, in hopes that these visits would unearth important facts about the areas, through the problems mentioned in people´s conversations and interviews.

In Crescencio Morales, the initial work was done thanks to the help of "Tacho", an employee of an NGO called Alternare, with several years of experience working in the Monarch Biosphere Reserve and the communities surrounding the reserve. Several field visits to Crescencio Morales were performed before deciding to stay in Crescencio. In this phase several visits were also made to Nieves, and also a quick screening visit to Ichamio, in La Huacana municipality. These visits helped define the criteria for selecting the study sites mentioned.

Interviews
In this study we carried out: individual interviews with key informants, questionnaires for the general population, group interviews that served as a scoping exercise, and participatory mapping sessions. The difference between each kind of tool is described below. In the rest of the text, the information gathered through the different tools is used indiscriminately. Where appropriate, the text indicates whether the information came from interviews with key informants or groups, questionnaires or the mapping exercises.

In-depth interviews with key informants
Payne (2004) defines key informants as "those whose social positions in a research setting give them specialist knowledge about other people, processes or happenings that is more extensive, detailed or privileged than ordinary people, and who are therefore particularly valuable sources of information to a researcher, not least in the early stages of a project". We carried out interviews with key informants in the communities studied, as well as with government and NGO employees. Key informants were either people who are known in the communities as those who are more knowledgeable about the subject, because they are collectors and sellers. Other key informants were employees of government and NGOs that work directly with the communities, and have knowledge about internal community

dynamics, the problems within the communities, as well as the resources that inhabitants depend on the most. Each interview lasted about an hour, and in some cases more than one interview was applied to a single key informant (for example in Nieves, several interviews were applied to the same person, including a mapping interview where the key informant was asked to mark collection routes and areas using a map while being interviewed).

This study integrated 13 in-depth interviews with key informants in Crescencio Morales, while in Nieves 7 interviews with 5 key informants were done. One interview was made with a seller at the Mercado Independencia in Morelia, and two interviews were made with the former and current directors of the MBBR.

Group interview (Scoping)

One of the first formal interviews was with a group of participants of Alternare´s Greenhouses Program. This group came from "La Viguita" community, part of Crescencio Morales *Comunidad Indígena* (for more information about how the Crescencio Morales community is constituted, consult Chapter 5). The group was made up of mostly women (5) and one man. In this group interview, general questions were asked about NTFPs used by inhabitants of La Viguita. The objective of the interview was to learn what are the most important NTFPs used in the Crescencio Morales area. I summarize the information mentioned in Annex II. This initial information was helpful in defining the in-depth interview structure and also the pilot questionnaires. It was also a useful tool to learn about plants and their uses in the Crescencio Morales localities. The La Viguita community however was not integrated in the subsequent field work, which consisted of questionnaires. It was, on the other hand, part of the localities in which we performed participatory mapping.

The group interview in La Viguita consisted on making a list of plants/animals and their uses. Afterwards, there was a short walk through the gullies close to La Viguita (Barrancas), which are the places where most plant collection happens. On the way, the group identified some other plants they had not mentioned in the interview. All the plants mentioned in the interview and the gullies are presented in Annex II.

There are a few interesting points to mention in regards to the data collection process: the first is that when asked about uses, people of the older age strata (30 and over) are aware of many plants and their uses, as was evident in the group interview in which 30 plants and their uses were mentioned. Many more resources were mentioned in the questionnaires, adding up to 65 plants whose uses are known, or which are actually used. However, there were differences in the type of information gathered through each type of instrument. In the questionnaires, the responses focused more on resources actually used, while in the group interviews and walk through collection areas, the information that was gathered related to knowledge about plants and their uses in general, even though many of these plants are not commonly used.

Questionnaires

Pilot questionnaires

Based on the information collected through group and individual interviews, a pilot questionnaire was designed in order to find out what was the community inhabitants'

perceptions of NTFPs, Environmental Services, and their use and knowledge of existing NTFPs and Payment for Environmental Services programs in the area. The questionnaires also asked about the Biosphere Reserve, and the periods of time in which the informant had identified significant changes in the use, availability and condition of the resources. The pilot questionnaire can be consulted in Annex IV. This survey was applied to 30 inhabitants in five communities within Crescencio Morales ejido and indigenous community. The reason for applying this questionnaire in various communities was to find out which communities had a closer relationship with the forest and which collected more NTFPs. The questionnaire was redesigned (Annex V) and applied to a selected number of participants (a different group from the initial 30), using the formula suggested by Rojas Soriano (2013) for defining the sample population for small N with a 5% precision, and 95 confidence level, or 0.5 variability. The resulting sample consisted of 35 households in Nieves. In the case of Crescencio Morales, 70 households participated , which constitute 10% of all households in the two communities visited. The ages of respondents were between 18 and 70 years old, with an average of 58 years. 64% of respondents were female and 36% male. The average educational level is only 3.6 years of schooling (4.7 according to INEGI 2010). Most (86%) of the studied households have a male head of household.

Participatory mapping

- Crescencio Morales *Comunidad Indígena*

In this community two participatory mapping workshops were performed. The first workshop was held with women who were present in the first group interview in La Viguita. Only three women were present this time (the other women were waiting for the "despensas " -food baskets that are given to participants of the Oportunidades program every so often.

The women were interested in doing the mapping exersice; however, they had never been in an activity like this, so it was difficult for them to imagine what was expected of them. The first activity was to draw a mental map of where the resources are located, with an emphasis on the areas where they usually extract or know that NTFPs can be found. Seeing that this exercise didn´t go very far, the researchers decided to work directly with printed aerial photographs.

These photographs were taken from the Google Earth platform. One of the difficulties in printing these photographs was to find a way of knowing and marking the scale of the prints. We took a reference height for all the prints. They were printed in a 90 x 100 cm sheet. We also took acetate with the idea of marking over the acetate and re-using the prints for another exercise. However, we found that the acetate generated a reflexion that made it difficult to distinguish the features in the photographs, and thus to locate houses, collection areas, etc. This problem could be confounded with the "gender" factor, because the women in the first mapping session found it more difficult to locate their houses, the wooded areas, the roads, and so on, while men in the second session found it much easier. In any case, we allowed both groups to draw directly over the prints, hoping to make better prints for future workshops.

The second participatory mapping workshop was held with two men from San Mateo. With the men´s group we started the activity by drawing directly over the prints. The men took a

couple of minutes to locate the areas, but soon found it easy to mark different resource use areas. The results of this workshop are part of the analysis presented in Chapter 5.

- Nieves *ejido*

In Nieves *ejido* three mapping excersices were done. The first was an exercise with a group of students (around 20) from the *Telebachillerato* of the *Colegio de Bachilleres*[9]. A second mapping session was done with a group of 5 inhabitants, one of whom was also interviewed as a key informant. A third mapping was done at the same time that an in-depth interview was applied. This last interview was conducted with only one key informant. The mapping sessions consisted on bringing people together to draw NTFP collection areas, using prints of aereal photographs at a scale of 5000. The mapping exercise was done using an interview template which asked about the areas where resources are collected, and which type of resources can be found in each area. It also asked about changes through time regarding the areas where NTFPs are collected, and other changes in land uses.

Plant inventories

Annex II shows the combined results of the data collection efforts: group interviews, questionnaires and a literature review of NTFPs used in the Crescencio Morales area. The group interview in La Viguita was used as a first source of information, and later on information from questionnaires and key informant interviews were added to this annex. Lastly, information from Farfan´s (2001) work was included. After making a list of resources, we consulted other sources of information, such as the book by Calderón de Rzedowski & Rzedowski (2005) and internet sources such as CONABIO (2012) and UNAM (2009)´s web repositories of Mexican plants (wild, domesticated and "ruderal"), including their common names and uses according to regions or the indigenous groups that use them. These sources were helpful in finding scientific names. In the case where the species name could not be determined, we kept to the common names.

Data analysis and tools

Use of N-Vivo software to organize and analyze data collected:

All interviews were transcribed and entered into an N-Vivo 10 software platform to be identifying important themes. The work was done in stages at the same time that other tasks were being completed (for example, the literature review on policies). Firstly a broad search of terms, concepts and themes was done, to group them into broad "codes" –as they are called in N-Vivo. Each code contains interview information associated with a specific theme. N-Vivo 10 allows for diverse types of analyses; for example, it can draw information on a specific theme, and at the same time distinguish between different types of respondents. Different types of analysis were done; each associated with a specific research question, and the results presented in each section corresponding to the research questions.

[9] In many rural áreas the amount of students may not be enough to build the same education infrastructure as in urban areas. The Telebachillerato is a format where high school subjects are taught through television classes, with the support of a teacher who is present and in charge of tutoring students. Nieves is the centre for the Telebachillerato of its district, and in the area it has students from other, smaller rural communities in the area.

Statistical analysis:
Descriptive statistics were extracted using a simple database program (Excel).

Index of Intensity of Use
With the help of Ernesto Vega from IIES-UNAM, a Intensity of Use Index was created. This is an index that incorporates information about the quantity of resources collected, the time if takes to collect and the time it takes to travel to the collection zone. This index allowed to learn about which resources are more important in terms of people´s preferences, the time they spend collecting them, etc.

A Correspondance Analysis was also done, crossing characteristics of respondents such as gender, land tenure status and other productive activities, with whether they sell NTFPs collected or not. The objective of this analysis was to differentiate between groups of users. The results are presented in the corresponding sections on the profiles of users.

Triangulation, interpretation and integration of data
Triangulation is the process of combining two or more theories, data sources, methods or investigators in an attempt to increase validity or robustness of a study (Yeasmin 2012). Triangulation can be achieved by using different research techniques and can be used to provide cross-checking and completeness with the purpose of increasing the credibility and validity of research. Proponents of this technique such as Denzin (1970), distinguish four types of triangulation. The first is data triangulation, in which data retrieved from different sources is used; the second is investigator triangulation, which uses multiple observers to gather and interpret data; the third is theoretical triangulation, in which several theoretical positions are used to interpret data, and; fourth, methodological triangulation, in which more than one method or research technique is used.

One of the most recognized benefits of triangulation is for confirmatory purposes; triangulation can overcome the challenges related to biases inherent in using a single method, a single observer or a single theory. Another objective of triangulation is to increase completeness, that is, to achieve a more integral and coherent vision of the problem being studied (Yeasmin 2012). In the process of carrying out this work, and also in the analysis phase, triangulation was used to integrate the methods, theories and data collected in order to reach a more complex understanding of the object of study (the sustainable management of NTFPs).

CHAPTER 3. The Policy Take on NTFPs and Their Association with Environmental Conservation Policies and Rural Livelihoods

Summary

This chapter will analyze the perspectives of government and non-governmental institutions, as well as businesss, intermediaries and other sectors of the general population, with regards to NTFPs and their relation to conservation policies, rural livelihoods and cultures. It will also perform a review of the literature on the most important issues that appear in the NTFP literature in relation to these themes. Based on this analysis, we propose a set of dimensions useful for analyzing forest policies and how they incorporate NTFPs as a strategy to achieve conservation, livelihoods and cultural goals.

History of environmental policy in Mexico and the integration of NTFPs in conservation discourse

Diving into the history and evolution of Mexican conservation policy is a task that many authors (Brenner 2009; Carton De Grammont 2012; Merino 1999; Merino 2004; Merino 1995; Merino 2006; Merino-Pérez n.d.; Simonian 1995; Simonian 1999) have carried out successfully, and thus it is beyond the scope of this work to attempt to develop this history futher. Nevertheless, knowledge of this history is necessary if we mean to understand the present situation of NTFPs and how they are regarded in conservation policy.

Since the beginning of Mexican history, there have been attempts to protect specific natural resources or natural areas. In pre-Hispanic times, restrictions on use of natural resources was common policy, such was the case of Netzahualcóyotl´s prohibition on tree felling and hunting within the Bosque de Chapultepec, while Moctezuma Xocoyotzin established the garden of Oaxtepec, in Morelos, which at the arrival of the Spanish conquerors, had been a protected area for over 75 years (de la Maza 1999). From then on, examples of actions to protect specific areas or resources abound in Mexican history (Carton De Grammont 2012), particularly those focusing on resources of importance, such as wood resources (Simonian 1999b). During the colonial period, several restrictions were implemented on urban forests (such as the case of Chapultepec in Mexico City by the Viceroy Don Antonio de Mendoza during the 1530s-1540s). Other attempts to protect forests during that period came from specialists, mostly naturalists who would come together to create gardens where they would carry out botanical study groups and other activities. It wasn't until 1861 that the first rules were documented regarding forest exploitation and conservation (de la Maza 1999). During the second part of the XIX century, conservation efforts focused on species of economic importance, and lacked a broader policy for the protection of a great number of the remaining species (Simonian, 1999:70). Overexploitation continued through General Porfirio Díaz's XIX presidency, and it wasn´t until 1894 that a Forest Law was created. This law authorized the creation of forest reserves and it was through this law that the first modern version of a protected area was created, in the state of Hidalgo in 1898. In 1917 the new and still valid constitution established that the Mexican nation could, at any time, regulate the use of natural resources, which were susceptible for expropriation for, among others, conservation purposes (SEMARNAT 2006:66).

Conservation policy in the beginning of the XX century was characterized by the establishment of federal ecological areas or reserves with diverse protection categories. This was due in part to the work of Miguel Angel de Quevedo and his collaborators, who in 1922 created the Sociedad Forestal Mexicana, the new version of the Junta Central de Bosques y Arboledas. This society put pressure on the Mexican government to create a renewed forest law. In 1926, the new Forest Law was passed. This law was the foundation for all subsequent forest policy (Carton De Grammont 2012; Cortez Noyola 2009).

Forest conservation policy remained, however, subordinated to agricultural interests. The agrarian reform demanded by Emiliano Zapata, which had become embedded in the constitution, had the objective of restoring the land to peasants whose lands had been taken in previous times. During the 1930´s, President Cárdenas gave this agrarian reform an economic rationale: to produce cheap food for the country´s population, and this was the reason why the redistribution of lands was accelerated. With this redistribution came policies focusing on agricultural development, and the creation of important institutions and organizations, such as the Banco Nacional de Crédito Ejidal and the Confederación Nacional Campesina (CNC), which helped rural producers access public resources for rural food production.

One fact that would mark environmental change in the following decades was the redistribution of lands that were suitable for forest development to *ejidatarios*, who, following national economic policy, used their new lands for agricultural and cattle raising purposes. Moreover, the land given to each *ejidatario* was on average 5 hectares; with this quantity of land peasants could not implement the rotation system that they had traditionally used, where land is left to rest "idle" and regenerate with successional phases of secondary vegetation, while production happens on lands only after they have completed this fallow period. In addition, the construction of dams and irrigation systems caused profound environmental degradation. Forest policy, on the other hand, was rather restrictive, prohibiting local inhabitants from using forests, while allowing forests to be exploited by third parties, usually international timber corporations (Carabias et al. 2008).

Advances were made however in terms of forest conservation policy. President Lazaro Cárdenas, during his administration (1934-1940), was the first to take environmental issues seriously, particularly forestry issues. Through the creation of the Forests, Hunting and Fishing Department, Cárdenas and his functionaries promoted research and development of new uses for forest products, such as *chicle* (gum resin), *ixtle* fiber (sisal fiber) and *candelilla* wax, as well as the creation of forestry cooperatives. The intention of these cooperatives was to reverse the negative impact that foreign concessions had had on vast forest areas, particularly in South and Southeast Mexico. Another great achievement of the Department of Forestry of the Forests, Hunting and Fishing Department, was the creation of 40 new protected areas, within which tree harvesting was prohibited until 1960. In contrast with Natural Protected Areas created in the United States, those in Mexico were usually established in areas that did not previously belong to the state, and thus in their creation, intense negotiations with *ejidatarios* were common practice, not always producing the best results n terms of peasant´s relationship with the government (Simonian 1999b).

In regards to the protection of wild fauna, the Treaty for the Protection of Migratory Birds and Cinegetic Mammals, signed by the Mexican and United State governments in 1936, was an important step in the history of multilateral cooperation in favor of wild fauna protection. With regards to their sensitive relationship with peasants and indigenous communities, Cárdenas´ administration conceded special permits and flexibility for poor *campesinos* and indigenous communities to continue hunting wild duck. This would also be the case for other forest products traditionally used by rural communities in Mexico (Simonian, 1999).

As Cárdenas ended his presidential period, a new stage in the history of conservation began: the ´decadence´ phase. During the 1940´s, the Mexican government not only promoted the expansion of agricultural areas, but also the use of heavy machinery, extensive irrigation systems, inorganic fertilizers and pesticides (Carton de Grammont, 2012). Cattle production in all its forms also increased, impacting tropical forests as many Natural Protecte Areas were overridden (Carabias et al. 2008). Given their importance to agriculture, water and soil resources were protected through a new Law for Soil and Water Conservation (Ley de Conservación del Suelo y Agua) passed in 1946. Although in 1948 a new Forest Law was passed, new logging concessions were given out in the 1950´s which were responsible for the devastation of extensive forest areas (Simonian, 1999). Although Mexico became a member of the new Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere, and passed a new law restricting hunting (Ley de Caza) in 1952, this was a period during which wild fauna was poorly protected (Simonian, 1999). Although new forest protection zones were declared with the purpose of conserving water bodies[10], other areas lost their protection status in order to open them for productive purposes[11] (Carabias et al. 2008).

The 1950´s was a period of drastic change: the rural population began to migrate to cities, while the country´s population in general grew at a higher rate than agricultural production, representing a new challenge to Mexico´s economy. The capacity to fulfill the country´s needs decreased, forcing increased imports of food. At the same time, the urban population´s increasing demand for meat justified the implementation of several megaprojects that aimed to increase agricultural production in the humid tropics; for example, they attempted to create a cereal production zone, but with very poor results. According to Carabias et al. (2008), from the mid 1960´s up to the second half of the 1970´s, government development was based on the idea that the country had abundant natural resources, that nature could renew itself indefinitely, and that environmental degradation was a price to pay for economic growth.

The 1970´s represented the second period of decadence in Mexican environmental policy, according to Carton De Grammont, (2012). The Programa Nacional de Desmontes

[10] Such as the Zona Protectora Forestal del Valle de México in 1941 and the irrigation basins for the irrigation districts in 1949, which encompassed 30 million hectares, as well as the Establishment of the Lagunas de Montebello in Chiapas in 1959 and several other national parks.

[11] Such is the case of the reduction of the limits of the Popocatépetl-Iztaccíhuatl national park, Lagunas de Zempoala and Cumbres del Ajusco to allow the paper mill San Rafael y Anexas forest exploitation in those areas.

(National Forest Clearance Program) promoted the expansion of the agricultural frontier (de la Maza 1999; Villalobos 2000) and new logging campaigns were established in the Lacandon Forest (de la Maza 1999; Villalobos 2000). This decade represented a breakthrough and rise in international conservation, although this was shallowly reflected in the Mexican context. The United Nation´s Conference on the Human Environment, held in 1972, promoted a new awareness of environmental problems around the world. In Mexico, environmental policy during this period concentrated on pollution and its impacts on human health (Carton De Grammont 2012).

Towards the end of the 1970s, due to pressure from academia, Mexico took a new approach regarding conservation, by creating two important Biosphere Reserves, becoming also a member of UNESCO´s Man and the Biosphere Programme (Carton De Grammont 2012). In the 1980´s, the foundations were laid for what Carabias et al. (2008) call "Modern Environmental Policy". During this decade, attention to the environmental crisis were heightened by the pollution situation in Mexico City, and also due to the consolidation of environmental research in Mexico. The rise of numerous academic and civil organizations working on environmental topics drove important changes in environmental policy[12]. The most significant changes were the amendments to the constitution in 1982 and 1983, establishing the imperative to consider the environment in development matters, the inclusion of an "Ecology" chapter in the National Development Plan of 1983-1988, and the creation of the Federal Law for the Protection of the Environment (1983) (Carton de Grammont, 2012). The creation of the Secretary on Urban Development and Ecology (Secretaría de Desarrollo Urbano y Ecología) with a Subsecretaría de Ecología[13] broadened the environmental policy horizon.

However, in 1986, the General Agreement on Tariffs and Trade (GATT) came into force, with significant negative impacts for the Mexican forest sector. These impacts had to do with the almost total elimination of tariffs on imported forest products, the low competitiveness of the forest sector (Bourke, 1995, cited in Del Ángel-Mobarak, 2012:124), and a reduction or elimination of subsidies for the forestry sector in Mexico, (Anta et al. 2009).

An important parenthesis: the role of international institutions in promoting changes in conservation policy and the integration of NTFPs and rural livelihoods

Attention to other minor or non-timber forest products increased in the late 1980´s and particularly early 1990´s. The second half of the 1980's marked a breaking point in world forestry (Chipeta & Michaelsen 1995). Events such as the launching in 1985 of the Tropical Forest Action Plan (TFAP) and the United Nations Conference on Environment and Development (UNCED) in 1992, paved the way for more concrete efforts to include NTFPs in international and national development, now called "sustainable development", policies. In the following section we discuss briefly the impact of these events on forest policy related to NTFPs and rural livelihoods.

[12] Among these organizations were Pronatura , Biocenosis, Grupo de los Cien and international organizations such as The Nature Conservancy (TNC), Conservation International (CI) and World Wildlife Fund (WWF).
[13] Secretary of Urban Development and Ecology with a Subsecretary on Ecology.

Tropical Forest Action Plan

The TFAP was a first attempt at generating a global framework for forest conservation and development (Liss 1999). The objective of the programme was to promote the creation of National Forest Programs within a unique global forest program (the TFAP), through which national governments could "create awareness for forestry issues and […] initiate the momentum for a joint effort towards conservation and development of forests". Although the TFAP was not successful as a global forest program (it was extinguished in 1995), it did help countries incorporate into national forest policy a consideration of sustainable development. The use of the term "forest" instead of "forestry" used in newer formulations of National Forest Programmes reflected a wider approach that included any activity related to forests and not only to the forestry (a.k.a. timber) sector (Liss, 1999).

Forest Principles of Agenda 21

A major achievement for the global forestry community was Chapter 11 of Agenda 21, the result of extensive preparatory meetings, which were completed in 1992. Throughout this chapter, non-timber forest products were placed in same terms of importance as timber products. Section 11.20 states:

> "The vast potential of forests and forest lands as a major resource for development is not yet fully realized. The improved management of forests can increase the production of goods and services and, in particular, the yield of wood and non-wood forest products, thus helping to generate additional employment and income, additional value through processing and trade of forest products, increased contribution to foreign exchange earnings, and increased return on investment. Forest resources, being renewable, can be sustainably managed in a manner that is compatible with environmental conservation. The implications of the harvesting of forest resources for the other values of the forest should be taken fully into consideration in the development of forest policies […] Concerted action is needed in order to increase people's perception of the value of forests and of the benefits they provide."

Later on, section 11.22.c. affirms that the actions taken to achieve this endeavor should have as a goal to improve:

> "environmentally sound methods and practices of forest harvesting, which are ecologically sound and economically viable, including planning and management, improved use of equipment, storage and transportation to reduce and, if possible, maximize the use of waste and improve value of both wood and non-wood forest products".

This same section also points to the importance of developing processing industries for non-wood products, as well as promoting underutilized species in natural forests through research, demonstration and commercialization.

In section 11.25, there is special emphasis on doing research on properties of non-wood products and their uses to improve utilization.

Section 11.31.d. also highlights the need for national systems of accounts and planning systems that account for "the full range of wood and non-wood forest products and services".

UNCED

From 1995 to 1997 four meetings were held by the Intergovernmental Panel on Forests (IFP), with a final meeting in which Amazonian countries, such as Brazil, opposed a (international) forest convention, partly due to claims by environmental and indigenous groups, that the convention would favor the interests of the timber industry. Instead of a convention, countries opposing a convention proposed the creation of a United Nations Forum on Forests (UNFF) (Humphreys 2007). One of the objectives proposed in the Forum's sixth session in 2006, was to "enhance forest-based economic, social and environmental benefits […] by improving the livelihoods of forest-dependent people", an objective that incorporates a more integral view of the benefits that societies obtain from forests, and the importance that forest have for poor sectors of the rural population whose livelihoods depend on forests (UNFF 2006b). By the tenth session of the United Nations´ Forum on Forests, held in 2013, it was clear that NTFPs had gained in importance. The Report on the Tenth Session highlights the importance of NTFPs as resources that have not been sufficiently studied and which deserve recognition and valuation (UNFF 2013)[ii]; and as providing important non-market values that should be assessed and incorporated into national accounting systems. A strong case is also made for NTFPs as a source of income for forest dependent populations and rural communities (UNFF, 2013:41). These documents make clear that these resources have become recognized as important, and that mechanisms have been developed to promote them, however, these are non-binding agreements and it is up to individual nations to work these recommendations into their internal environmental and economic policies.

The Millenium Development Goals and the Millenium Ecosystem Assessment

Although the Millenium Declaration of 2000 makes no mention of specific forest resources, it nevertheless emphasizes the importance of applying the Convention on Biodiversity (CBD) and the United Nations Convention to Combat Desertification (CCD) to ensure the protection of the environment (UN 2000). The CCD makes no reference to NTFPs; on the other hand, it emphasizes the need to promote and improve "alternative livelihoods" (UNCCD 2007:39, 46, 57).

Food and Agriculture Organization (FAO)

Although FAO had been involved in research and work related to NTFPs during the 70s and 80s, it wasn´t until the 1990s that an actual program concentrating on NTFPs was created within FAO´s Forestry Department. Coming up with a working definition that suits the interests of very diverse approaches and departments within FAO has been just as difficult as creating a department concentrating on these resources. Moreover, the development and promotion of these resources has been hampered by several factors, some of which are identified by the report called "Non-wood Forest Products: The Way Ahead" (FAO 1992) as:

- The prejudice of developing countries´ government functionaries and populations at large in favor of western-style products over indigenous ones
- Lack of interest on the part of government personnel to strengthen products and areas of lesser priority to the economy, given their relatively minor contribution.
- A lack of interest on the part of the scientific community in studying minor products that require "unsophisticated analysis" and which are of little interest to the scientific community and public at large (in contrast to the interest in studies of climate change, environmental services, REDD+, etc.).
- A lack of detailed basic information on resource availability, yield, utilization and market potential and value to national economies. Information on NTFPs appears in very specialized journals that are available only in major, and often not very accessible, libraries. Currently, this obstacle is being solved by making information available through the internet; still, most of the journals specializing in NTFP research are only available to the academic community who have access through their university´s library.
-

Many other obstacles are identified in FAO´s 1991 report.

On the other hand, FAO´s report identifies factors that may encourage development of NTFPs, such as:

- deteriorating national economies and an increasing demand for local resources such as pesticides derived from plants;
- some governmental administrations are realizing the importance of these products for local subsistence;
- new market opportunities and the rising and acceptance of "ethnic markets" have also opened-up spaces for NTFPs;
- greater awareness of the potential of NTFPs as sources of new biochemicals and pharmaceuticals;
- the realization that NTFPs can be an option for fighting famine around the world.

As a response to these needs and opportunities, the FAO's Non-Wood Forest Products Program was created in 1991. Since then, this program has contributed research publications, information guides and conference summaries on NTFPs, while also aiding governments to identify NTFPs with the greatest potential and to implement policies to encourage the sustainable management of these resources.

CIFOR

The Center for International Forestry Research (CIFOR) was created after a decision by the Consultative Group on International Agricultural Research (CGIAR) to establish a global forestry research entity (CIFOR 1993). CGIAR is an "international organization that […] advances international agricultural research for a food secure future" (http://www.cgiar.org/cgiar-consortium/). It was founded in 1971, initially focusing on research to improve varieties of commodity crops, however, in the 1980s it was observed that these developments were not reaching a majority of farmers in the world because the technologies were too expensive or too risky. A 1987 CGIAR report noted that in order to

solve farmers' problems it was also necessary to concentrate on solving the problems of the environments in which farmers are embedded.

The TFAP encountered barriers to implementation, partly due to the poor information in which it based its actions. A group of CGIAR which met in 1987 to define research priorities decided to establish a new international center for forestry. After UNCED highlighted in 1992 the importance of forest products, both timber and non-timber, as well as forest services for the wellbeing of poor people in the tropics, CIFOR was finally created in 1993, the last center to join the CGIAR system (CIFOR, 1993).

From the start, CIFOR´s research agenda has focused on issues related to:

- The value of forests and importance for sustainable livelihoods of forest dwellers and people on the margins of the forest
- Equity in distribution of benefits derived from the forest
- Income generation through better land use, better management and more efficient utilization of wood and non-wood products
- Adaptive and applied research for the benefit of forest users and managers

These subjects are studied and pursued through several programs, all of which have in common the aims of: improving of rural livelihoods, reducing poverty in forest communities, promoting a more diverse use of the multiple goods and services that forests offer, and conserving the resource base.

CIFOR represents a shift from the conventional forest conservation focus of the 70s and 80s, characterized by the promotion of natural reserves and protected areas, to a focus in which people gained importance as actors responsible for the ecological wellbeing of forests. Its Policy Development program has integrated a social science analysis of the factors that influence peoples' decisions to clear or conserve forests, while its Products and Markets program examines the value of forest goods and services and the pre- and post-harvest aspects of forest production. The Products and Markets program has been particularly interested in the management of non-wood forest products by local communities, the market requirements of under-used forest products, the study of the properties and uses of non-wood forest products and the social and economic impacts of new technologies for adding higher value to production in or near forests (CIFOR 1993:26).

The World Bank

In 1996, the World Bank published an important report by Charles M. Peters, who in 1989 had published together with Alwyn Gentry and Robert Mendelsohn the article: "Valuation of an Amazonian Rainforest" (Peters et al. 1989). The authors´ findings comprised a definitive breakthrough from conventional thinking that regarded timber as the most important economic resource. Peters and his collaborators concluded that NTFPs could represent a more important income-generation alternative than timber production. The World Bank´s interest in these resources became more evident after it published Peter´s report "The Ecology and Management of Non-Timber Forest Resources" in 1996 (Peters 1996). The World Bank has also recognized the importance of non-timber or non-wood

products since the early 1990s. Projects such as the Rondonian Natural Resources Management Project (approved in 1992) or the Anatolia Watershed Rehabilitation Project (Approved in 2004) had as main objectives to:

> "develop integrated farming systems in areas suitable for permanent agriculture and agro-forestry, and systems for sustainable forest management and extraction of non-wood forest products in other areas which should remain under natural forest cover"

and the:

> "Rehabilitation of forest land including soil conservation by afforestation, protection and improvement of poor & degraded soils, gallery plantation, rehabilitation of oak coppices and of degraded high forests, participatory replanting and inventory of non-wood forest products" (Johnson 2011).

In recent times, the focus of international agencies has switched to actions that improve rural livelihoods as a whole, as many more recent project documents note. There is now a recognition of the importance of these products not only as sources of income generation in markets, but also as essential elements of rural livelihoods which may not always represent a source of income.

Another take on sustainable use of NTFPs and biodiversity conservation is the work is done in support of businesses that process and commercialize NTFPs. A branch of the World Bank, the International Finance Corporation, takes a business approach to biodiversity conservation by supporting business models that are "protective to nature" as well as "socially and economically beneficial". One of its finance models, "Tapping New Revenue Streams" works to "create a stronger, distinctive, and more visible global market for native, local, sustainably harvested natural ingredients and other non-timber forest products" (IFC n.d.). It does this through its Business and Biodiversity Offsets Program (BBOP), which is managed by a secretariat consisting of Conservation International, Forest Trends, and Wildlife Conservation Society. IFC also invests directly in projects that aim at conserving biodiversity, such as the EcoEnterprises Fund which is run by The Nature Conservancy, and Verde Ventures which is run by Conservation International.

Business and companies

In that same line, companies such as The Body Shop, Natura, Lush, and organizations such as Cultural Survival, the Rainforest Alliance, and Oxfam, have supported the production and sale of NTFPs by rural and indigenous communities in tropical countries. Some of these companies, such as The Body Shop, have controversial histories of their work with indigenous local populations; however, there have been other examples of successful support for local communities to create income-generation alternatives while contributing to forest conservation (Turner 1995).

Mexican forest policy after "sustainable development"

In 1987, the influence of the Bruntland Report (WCED 1987), in conjunction with the signing of important international conventions, a profound restructuration of the Mexican

administrative apparatus, and the passing of various environmental laws, gave way to a more holistic and integrated environmental policy in Mexico (Carton De Grammont 2012). The result was the passing in 1988 of the General Law on Ecological Equilibrium and Environmental Protection (Ley General de Equilibrio Ecológico y Protección al Ambiente, LGEEPA), which, for the first time, aimed at integrated environmental regulation (SEMARNAT 2006).

Internationally, an important shift in paradigm occurred in the early 1990´s. One of the most important influences on international environmental policy was the United Nations Conference on Environment and Development held in Río de Janeiro in 1992 (the Earth Summit), which had two important outcomes: the signing of the Río Declaration of the Earth Summit and the signing of the Statement of Forest Principles by 178 countries (http://www.un.org/spanish/esa/sustdev/agenda21/). The Earth Summit also encouraged the rise of social organizations that demanded to be included in the decision-making process regarding forest matters (Del Ángel-Mobarak 2012).

A crucial constitutional amendment in Mexico which has promoted land use changes since that time is the modification to Article 27 of the Mexican Constitution. Just before the passing of this amendment, the Mexican government created the National Rural Support Program (Programa Nacional de Apoyo al Campo, PROCAMPO) and the National Program for Ejidal Right Certification (Programa Nacional de Certificación y Títulos de Derechos Ejidales, PROCEDE). This was followed by the modification to Article 27 in 1992 that allowed *ejido* lands to enter the land market (whereas before they could only be passed on to members of the owner´s family).

In the institutional arena, the *Consejo Nacional Forestal*[14] was created in 1992, along with the *Consejos Técnicos Consultivos Forestales*[15]. In this process, the participation of non-governmental organizations was crucial[16] (Del Ángel-Mobarak, 2012). In 1992, the Secretary for Social Development (Secretaría de Desarrollo Social, SEDESOL) was also created, in an attempt by Mexico to respond to international pressures to link social and environmental matters while emphasizing poverty alleviation. The National Ecology Institute (Instituto Nacional de Ecología, INE) and the Federal Attorney for Environmental Protection Agency (Procuraduría Federal de Protección al Ambiente, PROFEPA) were created as products of SEDESOL´s decentralized directions. Also in 1992, the National Commission for the Use and Knowledge of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, CONABIO) was created, and charged with the

[14] National Forest Council
[15] Consultative Technical Forest Councils
[16] Among the organizations that were created in this process was the Consejo Civil Mexicano para la Silvicultura Sostenible (CCMSS) in 1993; other organizations that were involved in this process were: World Wildlife Fund (WWF), The Nature Conservancy (TNC), Greenpeace y Conservation International, the Centro Mexicano de Derecho Ambiental, Fondo Mexicano de la Conservación de la Naturaleza and Pronatura. Also regional organizations such as: GAIA in Oaxaca, GEA in Guerrero, GIRA in Michoacán, SENDAS in Veracruz, Consorcio Chiclero in Quintana Roo, ERA in Oaxaca and MABIO in Colima and Nayarit (Del Ángel-Mobarak, 2012).

collection and generation of information to support environmental policies and decisions (Carabias et al. 2008).

In 1994, SEDESOL[17] published the official norm, NOM-059-ECOL-1994, which established the various levels of risk of extinction for species and subspecies of flora and fauna in Mexico. This provided an important basis for the protection of biodiversity in Mexico (Carton de Grammont & Cuarón 2010).

Also in this year the Secretary on Environment, Natural Resources and Fishing (SEMARNAP) was created, pushed by a group of expert consultants, many from academic institutions, who sought a systemic vision of environmental management (Carton de Grammont, 2012). This new Secretary became responsible for environmental and also productive matters regarding Natural Resources, Fisheries, Water Resources, Research and Normalization and also Environmental Protection, and paved the way for the creation of programs such as the National Natural Protected Areas Program (Programa Nacional de Áreas Naturales Protegidas, PNANP) and the Forest Development Program (Programa de Desarrollo Forestal, PRODEFOR) (Carabias *et al.* 2008). This latter program had the objective of creating incentives for forest producers through temporary resource allocation, in hopes that this would propel productivity of forest ecosystems and the development of production chains with a business perspective (Anta et al. 2008).

Alongside the PNANP, the Regional Sustainable Development Program (PRODERS), was also created, with the objective of enhancing productivity through providing community development alternatives for rural and indigenous communities in and around Natural Protected Areas (SEMARNAP 1999). Also the National Reforestation Program (PRONARE) was created in 1995 with the aim of improving the conditions of rural populations, through…. In 1996, amendments to the General Law on Environmental Protection of 1988 integrated new concepts, including a definition of biodiversity and a set of criteria for the use and conservation of wildlife. In 1997, the Mexican Fund for Nature Conservation (FMCN) was created; in the following decade it had an important role within the National System of Natural Protected Areas (SINAP) (Carton de Grammont, 2012).

In 1997, the Sustainable Forest Resources Management and Conservation Project (Proyecto de Conservación y Manejo Sustentable de Recursos Forestales en México, PROCYMAF) was created as a program through which *ejidos* and forest communities could identify development alternatives based on the use of forest resources (SEMARNAT 2006). Although similar to PRODEFOR, PROCYMAF integrated a diversification element which allowed communities to explore alternatives such as ecotourism, Units for Environmental Management (UMA) establishment, or water bottling and NTFP enterprises (Anta et al. 2009). In SEMARNAP´s final administrative year, the General Law on Wildlife (LGVS) was published, which cancelled the Hunting Law (Ley de Caza) in force since 1952, and established the legal conditions for the establishment of 3,500 Units for the Conservation and Sustainable Management and Use of Forest Life (Unidades para la Conservación, Manejo y Aprovechamiento Sustentable de la Vida Silvestre, UMAs) (Carabias et al. 2008;

[17] Formerly SEDUE, changed into Secretaría de Desarrollo Social, SEDESOL in 1992.

Carton de Gramont, 2012). In that same year, CONABIO published the National Biodiversity Strategy (Estrategia Nacional sobre Biodiversidad en México), in response to Mexico´s signing of the Convention on Biodiversity (CONABIO 2000).

Starting in the new millennium, the National Commission on Natural Protected Areas (Comisión Nacional de Áreas Naturales Protegidas, CONANP) and the National Forest Commission (Comisión Nacional Forestal, CONAFOR) were created in order to administer NPAs and all forest-related issues, and are positioned under what is now SEMARNAT[18] (Carton de Grammont, 2012).

In 2001 CONAFOR published the National Forest Program (Programa Nacional Forestal 2001-2006) as well as the Strategic Forest Program (Programa Estratégico Forestal 2025)[19] (CONAFOR 2012b), and in 2003 it published the General Law on Sustainable Forest Development (Ley General de Desarrollo Forestal Sustentable). Also in 2003, a new conservation scheme was created, consisting of two Payment for Environmental Services Programs (Spanish translation, PSA), one focusing on Hydrologic Services (PSA-H) and the other focusing on Carbon Sequestration and Biodiversity (PSA-CABSA)[20]. An important amendment to the Ley Federal de Derechos (Federal Rights Law) in 2002 allowed for the collection, use, usufruct and extraction of resources in NPAs (Carton de Grammont, 2012). The development of the rules to the General Law on Wildlife (Ley General de Vida Silvestre, LGVS) was an important step for addressing the importance of subsistence and ceremonial uses. The Project for the Conservation of Biodiversity in Indigenous Communities of Oaxaca, Michoacán and Guerrero (Proyecto de Conservación de la Biodiversidad por Comunidades Indígenas de los Estados de Oaxaca, Michoacán y Guerrero, México, COINBIO), with funding from Global Environmental Facility (GEF) has also been a successful initiative that started in 2001.

Del Ángel Mobarak (2012) argues that Mexican environmental policy has been subject to two important contradictions: the first is a contradiction between the long-term processes of nature and the short-term cycles of the public policy agenda, particularly forest policy. Any action on forests is likely to have a long-term effect, given the long time span of forests, and so the results of that action may not be seen until years or decades later. The second contradiction is between development objectives as opposed to conservation objectives.

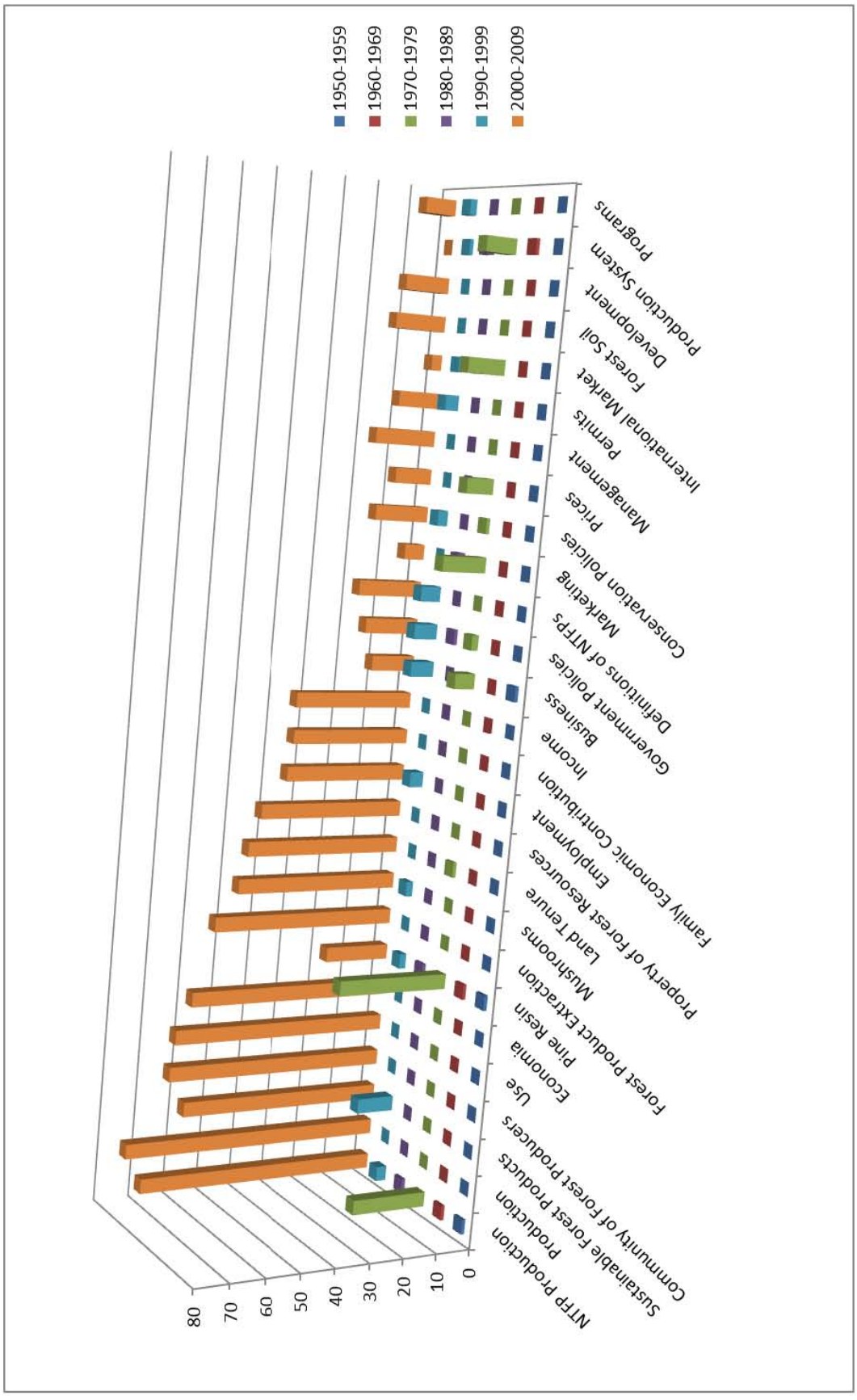
In 2007 a new program was created, the Program in Support of Sustainable Forest Development (also known as PROARBOL) (Del Ángel-Mobarak, 2012). PROARBOL merges environmental restoration with poverty alleviation goals, aspiring to promote economic development by fostering a sustainable forestry sector. An evaluation by the Consejo Civil Mexicano para la Silvicultura Sostenible (CCMSS) of the first PROARBOL period (2007-2012), reports an increase of financial resources assigned to the forest sector

[18] Secretaría de Medio Ambiente y Recursos Naturales.
[19] This responds to the work done in the Tropical Forest Action Plan to motivate countries to work on their own National Forest Action Plans (Liss, 1998).
[20] PSAH: Pago por Servicios Ambientales Hidrológicos; PSA-CABSA: Programa para Desarrollar el Mercado de Servicios Ambientales por Captura de Carbono y los Derivados de la Biodiversidad y para Fomentar el Establecimiento y Mejoramiento de Sistemas Agroforestales.

(from 1,973 million pesos in 2006 to 6,796 million pesos in 2012). 50% of these resources were assigned to forest and soil restoration, regardless of the poor results of its first four years. Forest exploitation on the other hand decreased by 9%, due to overregulation, a loss of competitiveness, and the integration of forest lands into PES programs (CCMSS, 2013).

Figure 2 provides a more complete view of the changes in forest and development policy associated to the forest sector.

Figure 2 Themes related to NTFPs and Forest Resources and the frequency of appearance in the media from 1950 to 2009


1950-1959
1960-1969
1970-1979
1980-1989
1990-1999
2000-2009
0
10
20
30
40
50
60
70
80
NTFP Production
Production
Sustainable Forest Products
Community of Forest Producers
Use
Economia
Pine Resin
Forest Product Extraction
Mushrooms
Land Tenure
Property of Forest Resources
Employment
Family Economic Contribution
Income
Business
Government Policies
Definitions of NTFPs
Marketing
Conservation Policies
Prices
Management
Permits
International Market
Forest Soil
Development
Production System
Programs

Conservation versus livelihoods

The recent history of conservation efforts around the world is closely related to the establishment of Natural Protected Areas. These efforts, associated with the "fines and fences" concept, were strongly influenced by experts in the biological science disciplines and a vision that conserving nature, meant the exclusion of humans from it. The first of these protected areas, Yosemite National Park in California, USA, was created in 1864 with this vision in mind.

However, by the 1960s and 70s, the social impacts of the "fines and fences" model began to be felt; in particular, those related to the eviction of local communities. A call was issued by academics, NGOs and international organizations such as the International Union for Conservation of Nature (IUCN) to establish protected areas that were more economically and socially inclusive. This gave rise to UNESCO´s Man and the Biosphere Program in the mid 1970´s, and this program led to the creation of Biosphere Reserves around the world. In the 1980´s, new conservation programs were created based on the recognition that the success of protected areas depends on the cooperation and support of local communities. Thus the conservation focus had changed from exclusion to inclusion of local communities (Carton De Grammont 2012).

Regardless of changes in the conservation discourse, this new focus of inclusion has turned out to be difficult to carry out in practice. The establishment of protected areas continues to be based on biological criteria, with social criteria falling to second place. Internationally, the government agencies in charge of more than half of the protected areas continue to restrict occupation by local people. Furthermore, the establishment of NPAs generally rises as an external initiative with local people continuing to be seen as obstacles to conservation. Evaluation of the effectiveness of conservation and development projects created in the 1980´s conclude that one of the reasons why these projects have not been successful is due to a lack of consideration of the importance of adapting conservation models to local conditions. Carton de Grammont (2012) concludes that the main limitation of the conventional focus on conservation is that is has failed to holistically integrate the social, environmental and spatial dimensions.

Here is where the livelihoods focus comes into play, adding complexity to the idea of conservation, and forcing a new paradigm where conservation begins to be seen as part of people´s livelihoods, and not as an activity that is done in isolation to other productive activities. In a section below (see published journal article, https://www.sciencedirect.com/science/article/pii/S1389934116301745), we discuss in more detail this new perspective of non-timber forest resource management which takes livelihoods as central for policy and development considerations.

How important have NTFPs been in the media of Mexico and Michoacán

Popular demands have the potential of influencing policy makers and producers in changing practices with the aim to better conserve natural resources. Some of these demands may appear in the media. In an effort to learn how important have NTFPs been in the local and national perception in the past decades, this work integrates the results of a

revision of local and national newspapers published from 1950 to 2009[21]. We also searched for other terms associated with aspects of NTFPs and forests, such as production, management, markets, etc. The results appear in Figure 2 (above).

As can be seen, during the 1950s and 1960s forest themes are not present in the media (this also has to do with the fact that the local and national media itself was in a phase of consolidation, with very few newspapers available). In the 1970´s, most of the news had to do with pine resin, including the production, marketing and international prices of the resin. The history related to this product has to do with an effort of the state government at that time to promote pine resin extraction and production, not necessarily as a forest conservation strategy, but as an economic and development strategy. Most of the projects and support was given to *ejidatarios* through cooperatives, and financial support was given to the opening of resin processing factories, some of which are still open today. In the 1990´s some mention is given to sustainable production and also to government policies associated to forests.

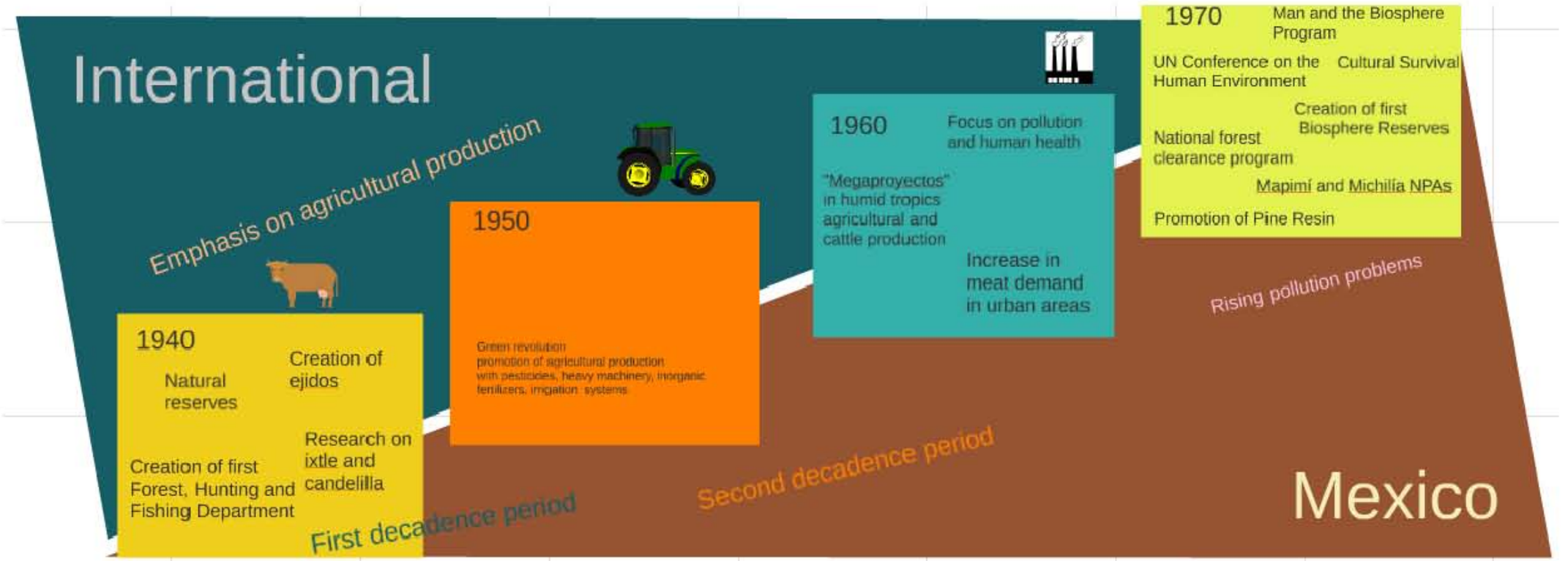
Entering the 2000s, more attention was given to NTFPs, production of NTFPs (including resin, which is Michoacan´s most economically important NTFP) and themes related to sustainability of forest resource management and production. Attention is also paid to employment of forests users, the economy of forest users, land tenure and ownership of forest resources, income generation and contribution of NTFPs to the local economy, among others. Pine resin seemed to have lost attention in comparison to the topics mentioned above.

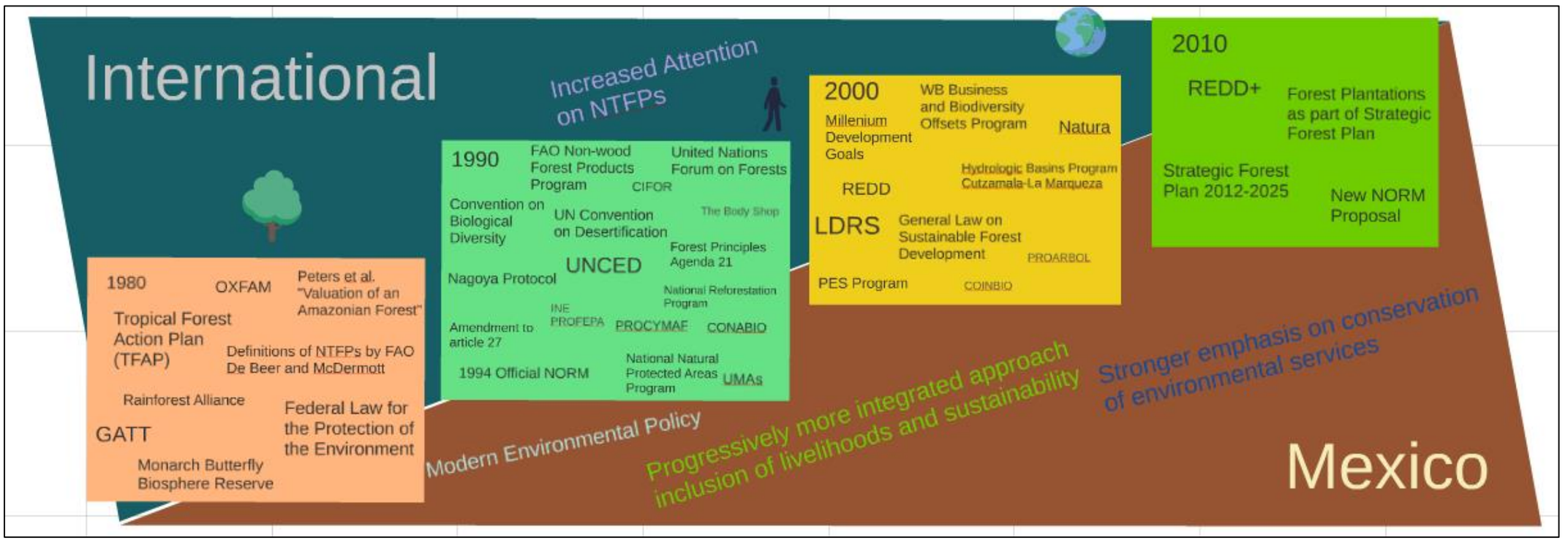
As discussed in a preceding section, the changes observed may be associated with international policy changes and also changes in consumer preferences and demands for more sustainable forest product extraction. The decreased attention to pine resin may be explained by the presence of a new conservation vision based on PES, rather than forest exploitation (which was the vision that promoted the production of pine resin in the 1970s). Pine resin however is very important for the local economy of many forest regions in Michoacán, while it is also very important as a forest conservation alternative. Why is this resource losing attention and support in states likes Michoacán?

A quick look at Figure 3 (below) allows to understand some of the most important changes of the foci of forest policy in Mexico and internationally.

Figure 3 Timetable of forest policy, both nationally (a) and internationally (b)

[21] This revisión was done with a group of students from the Facultad de Historia of the Universidad Michoacana de San Nicolás de Hidalgo, Habinabet Hernández and Isabel Maldonado. Andrea Coss also helped with the revision. The documents were consulted at the Historic Archive of the same university. Documents consulted were mainly newspapers.


International
Emphasis on agricultural production
1940
Natural reserves
Creation of ejidos
Creation of first Forest, Hunting and Fishing Department
Research on ixtle and candelilla
First decadence period
1950
Green revolution
promotion of agricultural production with pesticides, heavy machinery, inorganic fertilizers, irrigation systems
1960
Focus on pollution and human health
"Megaproyectos" in humid tropics agricultural and cattle production
Increase in meat demand in urban areas
Second decadence period
1970
Man and the Biosphere Program
UN Conference on the Human Environment
Cultural Survival
Creation of first Biosphere Reserves
National forest clearance program
Mapimí and Michilía NPAs
Promotion of Pine Resin
Rising pollution problems
Mexico


International
Increased Attention on NTFPs
1980
OXFAM
Peters et al. "Valuation of an Amazonian Forest"
Tropical Forest Action Plan (TFAP)
Definitions of NTFPs by FAO De Beer and McDermott
Rainforest Alliance
GATT
Federal Law for the Protection of the Environment
Monarch Butterfly Biosphere Reserve
1990
FAO Non-wood Forest Products Program
CIFOR
United Nations Forum on Forests
Convention on Biological Diversity
UN Convention on Desertification
The Body Shop
Forest Principles Agenda 21
Nagoya Protocol
UNCED
National Reforestation Program
INE
PROFEPA
Amendment to article 27
PROCYMAF
CONABIO
1994 Official NORM
National Natural Protected Areas Program
UMAs
2000
WB Business and Biodiversity Offsets Program
Natura
Millenium Development Goals
Hydrologic Basins Program Cutzamala-La Marqueza
REDD
LDRS
General Law on Sustainable Forest Development
PROARBOL
PES Program
COINBIO
2010
REDD+
Forest Plantations as part of Strategic Forest Plan
Strategic Forest Plan 2012-2025
New NORM Proposal
Modern Environmental Policy
Progressively more integrated approach inclusion of livelihoods and sustainability
Stronger emphasis on conservation of environmental services
Mexico

The section below is the result of a revision of legal documents which attempted to highlight the current focus of forest policy regarding NTFPs. The objective was to understand the role that NTFPs play in forest policy. The whole section was published as a research article in the Forest Policy and Economics journal. The article also highlights some of the changes that forest policy has gone through, as well as the current emphasis on ES, and the struggle to incorporate elements related to livelihoods and rural development goals.

Recognized but not supported: Assessing the incorporation of non-timber forest products into Mexican forest policy (Article published in the Forest Policy and Economics journal).

Abstract

Although non-timber forest products (NTFPs) are incorporated into forest policy in Mexico, significant problems related to the importance of NTFPs for rural livelihoods, the ecological impacts from their extraction, and their cultural importance, have not been well articulated. This article explores the integration of NTFPs into forest policy discourse in Mexico as a strategy to support livelihood, conservation and cultural goals. Building on the scientific global literature on the subject, we identified 13 prominent NTFP management questions, including the ecological impacts of marketing NTFPs, the distribution of benefits of NTFP production among local populations, and rights of access to NTFP collection. To structure the analysis of Mexican policy we addressed these questions and processed three general dimensions most relevant to policy implementation - these are associated with the oftentimes competing policy goals of supporting rural people´s livelihoods, environmental conservation, and strengthening culture (not only of indigenous peoples, but rural people in general). Subsequently we performed an evaluation of key forest policy instruments in Mexico, based on the three dimensions identified, in the effort to learn how successfully forest policy has integrated these dimensions. We conclude that although NTFPs are integrated into Mexican forest policy, drawbacks to their integration remain, related to the diversity in the nature, scale and marketing of these products, as well as to the diversity of local actors involved.

Keywords: non-timber forest products (NTFPs); forest policy; rural livelihoods; forest conservation; Mexico, local culture

1. *Introduction: NTFPs as a strategy to support livelihoods, conservation, and cultural goals*

Non-timber forest products have been harvested by human populations for thousands of years. Their use currently represents an important source for subsistence and income generation for a great number of people living in or near the world´s forests (Ticktin 2004) and particularly, for the poorest sectors of the rural population (Batagoda et al. 2006; Vedeld et al. 2007; Del Ángel-Mobarak 2012). Up until the 1980s, forest policy focused on the use of forests mainly as providers of timber, downplaying the importance of other products such as mushrooms, resins, medicinal plants, leaves or gums, perceiving them as

"minor" products. Attention to "other", "minor", or "non-timber" forest products increased in the late 1980s and particularly the early 1990s, following the 1992 United Nations Conference on Environment and Development (UNCED)´s "Earth Summit", in which NTFPs were identified as an important arena that required specific actions to fulfil their potential to contribute to economic development and income generation (UNCED 1992).
During the 1990s, increasing pressure on policy-makers, principally from NGOs and consumer groups, to regulate these resources generated new efforts to implement laws and regulations on good management (Wiersum et al. 2013), but according to Laird et al. (2011), in many cases these efforts have been counter-productive, by creating opportunities for corruption or incentives for overexploitation (Cañas & Ortiz Monasterio 2007). Policy interventions have also tended to criminalize the populations that depend on this activity, and undermine customary law and local institutions which were well-suited for regulating NTFPs. Moreover, in the regulation of NTFPs their cultural importance is seldom considered, although these resources still hold profound cultural meaning and importance for many people around the world (Cocks et al. 2011; Kim et al. 2012).

Forest policy in general has slowly shifted from a focus on conservation, to a focus on livelihoods, thanks in part to studies that demonstrate the importance that NTFPs have for rural livelihoods (Alexiades & Shanley 2004; Arnold & Ruiz-Pérez 1998; Godoy & Bawa 1993; Laird et al. 2009; Shackleton & Shackleton 2004). The term "livelihoods" itself has become central to the definition of sustainable forest management, as expressed by the United Nations´ Sixth Forum on Forests, which proposed as an objective, to "enhance forest-based economic, social and environmental benefits […] by improving the livelihoods of forest-dependent people" (UNFF 2006a). Chambers and Conway, (1992) define "sustainable livelihood" as:

> "The capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base."

Managing forests for livelihoods or markets however may not help achieve conservation objectives, because it may imply increasing extraction and production, which in turn, may affect ecological conditions (Arnold & Ruiz, 1998; Stockdale, 2005; Shackleton et al., 2011; Tapia-Tapia & Reyes-Chilpa, 2008; Wollenberg & Ingles, 1998). A prevailing underestimation of the socioeconomic and cultural importance of NTFPs for rural and urban households, added to the invisibility of goods important for subsistence uses and local trade (Shackleton & Shackleton 2004; Campbell & Luckert 2002), the political or cultural marginalization of communities that rely on forests (Dove 1994), and social conflicts that may arise from their extraction (Ticktin 2004), make it very difficult to generate realistic scenarios for the sustainable management of these products (Rist et al. 2012).

A livelihoods approach to sustainable NTFP management must encompass the elements of employment, poverty reduction, well-being and capabilities, livelihood adaptation, vulnerability, resilience and sustainability of the natural resource base (Scoones 1998),

whilst also incorporating cultural elements. The purpose of this article is to assess the integration of non-timber forest products (NTFPs) into forest policy discourse in Mexico as a strategy to support the goals of livelihoods, conservation and culture. In the following sections we explain our methodology in greater detail and later proceed to analyze forest instruments building on three analytical dimensions proposed.

2. Methodology and Research Framework

To begin, we performed an extensive review of scientific literature on the subject of NTFPs and management, to identify the topics that receive most attention. The review was based on a search of academic articles and publications, institutional reports and mainstream media publications in the past 60 years. Research into NTFPs is ample and as we speak, more work is being published. The literature review started with a broad search in scientific journals, through databases such as Sciencedirect and other Elsevier search engines, EBSCO, JSTOR, and also Google Scholar. A group of journals was selected based on the frequency with which articles on NTFPs had been published (see Annex I). A fast screening through each journal allowed us to make a selection of the articles that had strong relations with our interest, focusing on issues such as livelihood importance, conservation, forest policy, poverty alleviation, commercialization, culture and government support, all related to NTFPs. The search was performed in both English and Spanish. We selected a total of 136 documents, all of which were read and coded using the program N-Vivo 10, in which we created categories based on the issues identified (see table 1).

A parallel search was done within international institutions which in the past years have developed a particular interest oon NTFPs, mainly FAO (Food and Agriculture Organization of the United Nations) and CIFOR (Center for International Forestry Research,), and ssome documents published by the United Nations and the World Bank were also included (reports of their programs).

Once we identified these issues we grouped them into three main dimensions for policy analysis. In order to categorize these topics into dimensions we grouped them in terms of their associations and similarities. The resulting dimensions were: *NTFPs as a strategy to achieve conservation objectives; NTFPs as a strategy to improve rural livelihoods and enhance income generation efforts;* and *NTFPs as a strategy to support local culture and knowledge*. Reaching this dimensioning of the selected issues was complex, because some issues are considered in more than one dimension. For example, the source of the product is related to resource access, but at the same time to aspects of domestication (nature of the product) and to ecological impacts, thus, it could appear in the analysis of more than one dimension. This fact makes it difficult to come up with specific dimensions for the analysis of policies promoting NTFPs, yet it has been precisely this difficulty that has occupied the discussion of NTFPs and how to promote them as part of conservation, livelihoods, or poverty alleviation efforts (see Sills et al., 2011). Our approach was to organize the themes highlighted in the literature into dimensions that can form a basis for the generation of policies that focus on the issues most relevant for the NTFP literature in a more integrated way. Our thorough revision of the issues selected from the literature resulted in the three dimensions that seize the essence of the objectives highlighted in the NTFP literature, and which emphasize conservation, livelihoods and income, and culture and local knowledge as

the most important objectives for policy and programs promoting NTFP management, marketing and use.

Reaching a proper definition of what is an NTFP is of uttermost importance in the study of these resources; therefore, we offer a brief discussion of the difficulty of reaching a definition, and the influence of definitions on the management focus developed in policy instruments. Following the literature review on NTFPs, we identify those policy instruments that are most relevant in terms of their impact on NTFP management. By policy instruments we mean "all those means that an actor uses or can use to help achieve one or more objectives" intended by a policy (Bressers & Klok 1988). From the range of forest policy instruments in Mexico, we selected those that are closely related to management of NTFPs, and we excluded instruments that are only weakly linked with NTFP resources. The instruments analysed are forest plans, forest laws and their regulations, and, forest norms. We deliberately exclude wildlife laws even if fauna are also considered an NTFP; this decision has to do more with time and space constraints than with a lack of interest on these resources. We offer a brief note on Mexican forest policy related to NTFPs so as to contextualize our analysis.

Finally we analyse the relevant policy documents in order to review how Mexican policies incorporate the three main dimensions proposed. In Table 2 we determine the importance of each dimension within each policy instrument, based on how much emphasis each policy instrument gives to the various issues included in that dimension, for example: 'how much importance does each policy instrument give to 'marketing' in the dimension called "NTFPs as a strategy to enhance income generation"?′. The relative significance of the dimensions as they appeared in each policy document was assessed through a content analysis, that is, a thorough read of each document, and then, using the N-Vivo platform, coding each section in the policy document that referred to issues belonging to that dimension. The work was qualitative and therefore based on a subjective interpretation of the texts (as will be seen in the discussion). Although many of the issues appear in more than one policy instrument, some instruments give especial emphasis to specific themes. The purpose of creating a table of degree of importance (Table 2) is to offer a quick review of which Mexican policy instruments are particularly concerned with NTFPs, and on which themes they tend to focus.

3. Results and discussion

3.1. A brief note on Mexican policies associated with NTFPs

The incorporation of NTFPs into environmental and development policy has gone hand in hand with the development of a conservation/ development discourse that was increasingly integrated into conventional development lore. In 1987, the influence of the Bruntland Report, in conjunction with a profound restructuring of the Mexican administrative apparatus, the passing of various environmental laws, and the signing of important international conventions, gave rise to a more integrated environmental policy in Mexico (Carton De Grammont 2012). The incorporation of a poverty alleviation element has produced a new effort centered on rural livelihoods which responds to a new vision in the international arena, which sees rural livelihoods as comprised of various elements, of which NTFPs and other forest resources are essential (World Bank 2010). The work of NGOs has

been vital in promoting sustainable NTFP management in Mexico and also in advocating for better informed environmental policies. A publication[22] from academics and NGO representatives (Illsley et al. 2012) regarding a recent effort to amend the norm that regulates use of NTFPs, argues that the application of different laws and regulations to the same resource contributes to the marginalization of rural inhabitants, and even generates black markets that compete with sustainably managed resources. The demand made in this document is for better integration of local and indigenous knowledge as well as the experience of NGOs working on the subject (Illsley et al. 2012).

3.2. Selection of issues, policy dimensions and policy instruments for analysis

Table 1 presents the issues identified in the literature on NTFPs. In the right-hand column, we present the three dimensions proposed for the policy analysis. These dimensions group the issues highlighted in our literature review (in the left-hand column). For example, the scale of production of an NTFP product has a strong link to the nature of the product, while income generation is related to the ownership of the resource and to marketing opportunities.

Table 1 Key NTFP Issues grouped into analytic dimensions

NTFP Issues identified from the literature	Policy Dimensions
• *Source of product* • *Nature of product*[23] • *Scale of production of product* • *Certification* • *Ecological impacts of extraction* • *Land tenure*	*NTFPs as a strategy to achieve conservation objectives* (Supported by Stockdale 2005; Wiersum & Shackleton 2001; Ticktin & Ticktin 2004)
• *Ownership and distribution of benefits and impacts* • *Marketing* • *Income generation* • *Land tenure*	*NTFPs as a strategy to improve rural livelihoods and enhance income generation efforts* (Supported by Tapia-Tapia & Reyes-Chilpa 2008; Peters et al. 1989; Alexiades & Shanley 2004; Alexiades et al. 2013, others).
• *Land tenure* • *Access to resources* • *Rescue of traditional/local knowledge* • *Gender dynamics*	*NTFPs as a strategy to support local culture and knowledge* (Supported by Batagoda et al. 2006; Belcher 2003; Casas et al. 1996;

[22] A group of these organizations founded the Consejo Civil Mexicano para la Silvicultura Sostenible: http://www.ccmss.org.mx/, which has become a reference for policy advocacy and critique.

[23] For most definitions "nature" refers to the physical characteristics of the product, that is, is it woody or non-woody, is it an animal product, is it a service or is it a product such as gravel or soil. The "source of the product" refers to the spatial characteristics of where the product is produced or grown, that is, is it from a plantation, from mixed arboriculture, etc.

• *Indigenous rights*	Guariguata et al. 2012, others).

Similarly, the policy instruments included in this review were selected based on the degree of association they hold with NTFPs. A short explanation of the aims of each instrument will help understand our analysis in the following sections. With its origins in the Mexican Constitution, the National Development Plan (PND) sets out priorities for the medium term. Strategic Plans are created to project the PND through sector plans, such as Forestry. The Strategic Forest Plan (PEF) is intended to guide decisions regarding forest policy for aa period from 2012 to 2025. All LRLaws, Regulations and NNorms designed and amended during this period must incorporate the strategy outlined in this PEF Plan. Each LLaw is implemented through rules created specifically for that law, and LLaws are founded on a body of NNorms. In order to operate the General Sustainable Forest Development Law (LGDFS), a platform named PRONAFOR was created, and it is through this platform that interested parties can get support from Forest Programs. Usually TCTechnical Consultants are hired to fulfill forest program application procedures. The National Program on Natural Protected Areas (PNANP), as well as PRONAFOR, are both under the jurisdiction of SEMARNAT (Secretariat of Environment and Natural Resources) and in some instances, support each other. References to the names and acronyms for each instrument included are presented in Table 2.

Table 2 Key IInstruments of Mexican FPForest Policy, and the policy dimensions to which they relate in their documented discourse. Based on their published documentation, we assess the degree of importance of each dimension in the instruments.

Name of Policy Instrument	Acronym (in Spanish)	Strategy Dimensions to which Instruments apply		
		NTFPs as a strategy to achieve conservation objectives	NTFPs as a strategy to improve rural livelihoods and enhance income generation efforts	NTFPs as a strategy to support local culture and knowledge
Strategic Forest Plan	**PEF**	High	Medium	Low
General Law on Ecological Equilibrium and Environmental Protection	**LGEEPA**	Low	Low	Low
General Law on Sustainable Forest Development	**LGDFS**	Medium	Medium	Medium
General Law on Sustainable Rural Development	**LDRS**	Low	Medium	Medium
Regulations of the LGDFS	**RLGDFS**	Medium	Medium	Medium
Proy-NOM-005-SEMARNAT-2012 (onofficial norm)	**PROY-NOM-005**	High	Low	Low
National Forest Program	**PRONAFOR**	High	High	High
National Natural Protected Areas Program	**PNANP**	High	High	High

As can be observed in Table 2, the instruments that allocate most importance to the three dimensions proposed in our analysis are: The Natural Protected Areas Program (PNANP) of the Commission for Natural Protected Areas (CONANP), PRONAFOR, and the project for the Official Norm for the use, extraction and marketing of NTFPs (PROY-NOM-005) expedited by the Secretariat on Natural Resources and Environment (SEMARNAT). The PNANP and PRONAFOR both include important programs to support NTFP management, and both base their support on the compliance with the Official normnorm. In the analysis below we will find how these instruments treat NTFPs in relation to the dimensions of

analysis we propose.*3.3. Defining NTFPs, and the implications for livelihoods, conservation and culture*

An obstacle to an effective integration of these resources into forest policy is the difficulty of reaching a coherent and integral definition of "NTFP". The term "non-wood forest products" was coined by FAO to differentiate between wood and timber products and all "other" products (Chandrasekharan 1995). Later, "non-wood forest products" were defined as: "goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests" (FAO 1999). This definition excluded services, and included products derived from both natural forests and plantations. De Beer and McDermott (1989) defined NTFPs as those products that "encompass all biological materials other than timber, which are extracted from forests for human use". The main difference identified between "timber" and "non-timber" was that timber is managed on an industrial scale for interests located outside the forest, while NTFPs are "extracted using simple technologies by people living in or near forests". As can be seen, definitions are varied, they incorporate different concerns which depend on the interests of users or the policies being implemented. Therefore, Belcher (2003) suggests that defining *what an NTFP is* may not be as important as defining other questions associated with how the resource is grown, where it comes from, and who are the people that benefit from its production, or, in Belcher´s terms, the *nature*, and *source* of the product, the *scale* and *nature of production* of the product, and the *ownership* and *distribution of benefits* of producing the product.

The Mexican Forest Law (LGDFS, DOF, 2008: Chapter II, Art. 7, XXVII) however emphasizes the distinction of NTFPs from other forest resources by defining them as: "the non-woody part of forest ecosystem vegetation and which is subject to extraction and includes lichens, moss, mushrooms and resins, as well as forest soils". Consideration of the source of NTFPs is largely missing from Mexican forest policy documentation. In the PEF, the main consideration of the nature of the product is when it refers to the necessity to produce NTFPs in plantations (the nature of production) (CONAFOR, 2012:9.1.1). It however does not refer to the importance that wild products have for smaller scale producers and collectors (the scale of production). Padoch & Pinedo-Vasquez (1997) suggested that simply distinguishing between timber and non-timber products does not reflect the way in which most forests are managed in the tropics, and that a distinction considering the scale and intensity of the production system is a more realistic and useful distinguishing parameter. It is also important to consider the diversity of NTFP production systems that may interact in rural landscapes, and which have implications for production, marketing, and certification (Wiersum et al. 2013).

For example, FAO´s (1999) inclusion of plantations in the definition of "forests" caused disagreement, particularly among those with a conservation focus. Their argument was that NTFP production is desirable precisely because it has been considered to be compatible with natural forest conservation, whereas promoting plantations may cause large-scale forest clearing in the effort to increase production (Belcher, 2003). Although the PEF (CONAFOR 2012b) states the importance of promoting the establishment of plantations with NTFP species, such as *Camedor* palm (9.1.1), the LGDFS (DOF 2008) does not include specific incentives or actions to establish plantations based on NTFPs. The argument that cultivation of domesticated resources can: reduce pressure on wild products, give higher yields, improve quality, allow better control over timing of harvests, and

provide overall commercial benefits, is supported by the discourse in the PEF. However, the environmental and social trade-offs implied in this type of discourse are not considered, nor are prevention or mitigation incentives proposed. Promoting large-scale plantation production of NTFPs may have serious social implications such as the exacerbation of economic inequalities offering financial support to those who already own land, while excluding those who lack production resources (Rico García-Amado et al. 2013). The source of the product also determines the rights of access to the resource and even to markets (Wiersum et al. 2013).

Mexican FForest legislation is rather ambiguous when referring to the scale of production of NTFPs, for it assembles everything into a single category. The LGDFS emphasizes developing economic incentives to help forest proprietors –be it *ejidos*[24] or private land owners-- develop management skills in the utilization and marketing of new forest products (timber or non-timber). This is supported by the creation of programs that consider all phases of the production cycle, i.e. collecting or growing, processing, and marketing (DOF 2008, Art. 139, Sec. VIII). Whereas large-scale plantation-based production of NTFPs may facilitate conservation efforts by decreasing pressure on forests (Trauernicht & Ticktin 2005), it may instead promote large-scale clearing of forests to establish such plantations (Belcher 2003) whilst marginalizing small-scale collectors who depend on access to lands that may formerly have been open-access and are now under a private plantation regime (Source: fieldwork observations in Michoacán state). Commercial companies which respond to increased product demand with large-scale plantations of NTFPs (such as the case of rooibos tea in South Africa reported by Downes & Laird 1999) can also displace small-scale collectors who formerly benefitted directly from production and trade but cannot compete. Promoting plantations also affects biological diversity (Trauernicht & Ticktin 2005), which in turn has implications for local knowledge regarding biodiversity.

3.4. Mexican PPolicy approaches to the main dimensions of NTFPs

Incorporating NTFPs into forest policy has proved to be difficult, starting with the implications of having many competing definitions of NTFP resources for livelihoods, conservation and culture. Shifting the emphasis from a legislative focus on the definitions of NTFPs, to an emphasis on the livelihoods, conservation and cultural goals of forest policy should liberate alternative visions for improving rural communities´ living conditions, their cultures and environments. We proceed with an analysis of how the three dimensions proposed have been incorporated into forest policy instruments in Mexico and the potential implications for the concerns involved.

3.4.1. *NTFPs as a strategy to achieve conservation objectives*

In the NTFP debate, a predominant perspective has been that NTFP extraction generates less harmful effects on ecosystems than does timber extraction (Marshall et al. 2006). In Mexico, the influence of this idea –embodied in the concept of "multiple use of forests", has become an important element of the PEF as well as the LGDFS discourse. The PEF considers it important to identify alternative production strategies that do not alter the supply of environmental services, among which NTFPs are included (PEF, 130, 138).

[24] In Mexico *ejido* is a category of land tenure in rural areas.

However the itiesfspecificities of how these resources can be integrated are not well established.

A central preoccupation of various authors and organizations is that the over-extraction of NTFPs to meet market demand, in many cases, is the principal source of ecosystem degradation (Delgado-Lemus, Torres, et al. 2014; Illsley-Granich et al. 2001) and resource-population degradation (Ticktin et al. 2002; Ticktin 2004). Mexican policy currently regulates NTFP use based on a simplified management program (PMS)[25], which is a study done as a pre-requisite for obtaining a permit from SEMARNAT to extract NTFPs. Only those NTFPs under a special protection status (CONAFOR 2005: Art. 55) require a PMS, which is based on the Official Norm (SEMARNAT 2012b). For other NTFPs, a simple notice to SEMARNAT suffices. Significant problems with these instruments are that they bundle resources with different management characteristics into a single group, and they require detailed studies by qualified and certified technicians. Most NTFP users do not comply with these legally-required instruments, and rather perform their activities "illegally" or "informally" (Illsley et al. 2000). This is partly due to the costs implied in performing technical studies required to obtain permits for use and extraction, and also due to the high bureaucratic demands which usually take place in central offices, away from rural populations that use NTFPs.

Some authors (Illsley et al. 2012; Laird et al. 2011) also argue that as forest policies become more complex, there is an overregulation of the use of resources such as NTFPs, which increases the complexity of community-based NTFP governance (Wiersum et al. 2013). Deregulation of extraction and marketing of these resources may have positive effects, especially by reducing transaction costs and easing trading (Mahapatra & Shackleton 2011). One way in which PRONAFOR attempts to diminish the ecological impacts of NTFP extraction is through offering support to NTFP managers to generate PMSs, as an incentive for communities to incorporate better management practices. PRONAFOR also offers support for biodiversity conservation activities (CONAFOR, 2013: Component I; Component IV). The basic idea behind these incentives is that products will gain value through certification, and therefore producers will seek such incentives, consequently improving management practices.

3.4.2. NTFPs as a strategy to improve rural livelihoods and enhance income generation efforts

The "conservation by commercialization" hypothesis (Evans, 1993 in Arnold & Ruiz, 1998) proposes that the potential income derived from sustainable harvesting of NTFPs could be higher than income generated through other production systems, and consequently, people would have a preference for sustainable harvesting. There have been initiatives to expand markets for locally produced NTFPs, with the intention of obtaining higher economic benefits from forests (Arnold & Ruiz, 1998:17). However, many barriers exist to commercialization, such as low availability of the resource in its wild state (Purnomo et al. 2009; Tapia-Tapia & Reyes-Chilpa 2008), the lack of commercial contacts,

[25] Simplified Management Program for the Use of non-Timber Resources, also called Estudio Técnico or technical study.

limited access to credit for processing and packaging, and competition from imported substitutes (Marshall et al. 2006; te Velde et al. 2006). Doubts of authors like Arnold & Ruiz (1998) of the argument that "the increased values […], as a result of higher commercial demand for NTFPs, necessarily encourage conservation of the resource" (p. 20) are substantiated by studies such as Purnomo et al. (2009), who found that regardless of its profitability at the market end of the product, the ecological availability of the resource, and increased benefits for rural producers are hardly guaranteed. The regulatory, institutional and policy framework promoted by governments and stakeholders affect the production and trade of NTFPs,, therefore, governments are called upon to create a favourable business climate to ensure the economic growth of NTFP enterprises (Tieguhong et al. 2015). In this promotion effort, policy should make a particular distinction for sectors of the population who are more dependent on wild resources, given the context of vulnerability, not only of the resources, but also of users.

Following this line of argument, the PEF questions the sustainable production of NTFPs due to the obstacles above. Yet it establishes marketing of NTFPs as part of a strategy to promote sustainable use of biodiversity by rural communities (Subsection 143). The LDRS devotes a whole chapter to marketing of rural products, which includes actions such as promoting the development of rural production and marketing chains, and instrumental measures to prevent the import of subsidized products (LDRS, Chapter X, Art. 109, 110). The law however needs to be more specific as to which forest resources merit support (Chapter X, Art. 109). As a step forward, CONANP, in its PNANP 2007-2012 (CONANP/SEMARNAT 2007), proposes the consolidation of production and marketing chains through working with development and social sectors, so as to secure access to sustainable product markets (5.2.1.), and PRONAFOR supports the construction of infrastructure to improve access to resources (Concept PP.4) and build production and marketing facilities.

Market values seldom reflect the externality costs involved in a market chain, ilwhile increasing market demand may lead to overexploitation and even local extinction of specific resources, such as the well-publicized case of *Agave* species in Mexico (Delgado-Lemus et al. 2014) to make *mezcal*. Efforts to create certification schemes that incorporate externalities in NTFP production are based principally on sustainable forest management, biodiversity conservation, or reduction of CO_2 emissions. These include the Forest Stewardship Council Chain of Custody Certification, or the Gold Standard for a range of products. Another type of certification focuses on fair trade and fair labour conditions, and these also include indigenous rights. Under Mexican forest policy, certification is considered an option for improving incomes and environmental conditions. PRONAFOR offers support to undertake certification processes, yet significant constraints that NTFP producers encounter when attempting to access programs have to do with land tenure and the size of the area managed, given that they require a minimum plot size that ranges from 20 to 250 hectares (either individual household or a community). These are requirementshard to meet for most Mexican rural households, whose average tenure size is less than 5 ha. Evidence supports the Pierce et al. (2008) argument that certification faces many obstacles, of which land tenure is a major barrier (Shackleton & Pandey 2014).The PEF (59), as well as the LDRS (DOF 2001, Art. 15, Sec. XIII) identify the inadequate distribution of land and resource tenure as a cause of conflict within, and between,

communities. They also identify the lack of secure land tenure as a problem that affects long-term production strategies. Poor forest dwellers often do not have access to the more valuable NTFPs, which may be located within areas that are privately owned (Alexiades & Shanley 2004; Tapia-Tapia & Reyes-Chilpa 2008), and poor access to markets can also be a barrier for improving income-generation efforts (Wiersum et al. 2013). This may be particularly important when referring to the processes of domestication of NTFPs and the development of plantations of newly-domesticated resources (Belcher, 2003). In the case of Mexico, lack of formally-recognised land tenure also limits people´s access to government programs and support (Rico García-Amado et al. 2013), and this also restricts access to other resources, such as training, knowledge-sharing, and access to markets, factors which may be essential for effective domestication of NTFPs. Securing land tenure is therefore crucial not only for domestication, but also for complementing conservation and income generation efforts (Belcher 2003). Surprisingly, the LGEEPA (DOF 2014, Art. 63) emphasizes the need for FSFederal, State and MGMunicipal Government participation in the regularization of land tenure within NPAs, but does not specify how this will be done.

On the question of the integration of concepts related to livelihoods into forest policy the inconvenience begins with the difficulty of translating a term like "livelihoods" into Spanish. A search for related terms such as "subsistence" and "auto-sufficiency" returned only one quotation - and this is unrelated to NTFPs (DOF, 2008: Art. 105). No mention is made about impacts of managing for subsistence uses or how to mitigate these ecological impacts, nor on the other hand, how to support efforts to better manage forest resources for subsistence needs. This is a significant policy vacuum, given that international forest policy now sees managing for livelihoods (within which subsistence activities are included) as a prerequisite for attaining sustainable development in rural populations, while the evidence points to important ecological consequences of managing resources on which local populations are very dependent (Steele et al. 2015). Integrating terms associated with livelihoods in forest policy discourse would reinforce efforts to recognize and incorporate into forest policy the impacts linked to livelihood uses.

3.4.3 NTFPs as a strategy to support local culture and knowledge

Management of NTFPs often uses traditional knowledge that has been passed on through generations. The use of NTFPs has been at the core of indigenous groups' struggles for the recognition of traditional and local knowledge and use of NTFPs. Recognition of traditional uses offers a platform to empower local populations based on the argument for their right to "equitable sharing of benefits arising from the utilization of genetic resources", as stated in the Convention on Biodiversity (CBD) Nagoya Protocol (UN 1992). In the late 1990s Amazonian countries like Brazil opposed an international forest convention with claims that it favoured the timber industry over other forest sectors, such as NTFPs. These groups instead proposed the creation of a United Nations Forum on Forests (UNFF) which after several meetings, included among its objectives the enhancement of livelihoods of forest-dependent people. More recent efforts have achieved recognition of indigenous rights over genetic resources and local/indigenous knowledge (Nagoya Protocol-2014, UN Declaration on the Rights of Indigenous Peoples- 2007; World Intellectual Property Organization-WIPO, among others). The LGDFS (DOF 2003) in its Article 105 argues for the promotion and support of traditional biological knowledge of *ejidos* and indigenous peoples, while the LGEEPA calls for using this knowledge to promote a more sustainable management of

wild flora and fauna (DOF 2014, Art. 83), while PNANP calls for the creation of a Knowledge Information System for rescuing traditional indigenous knowledge. LGEEPA also considers the participation of rural communities with traditional biological knowledge to be important in the creation of biodiversity programs (Art.79. X). However, traditional and local decision-making institutions have not been successfully integrated into policy-making regardless of the international agreements which demand their incorporation, and this is important to highlight, because it is through integration of these institutions that local knowledge may also be protected and recognized

Another group that receives special attention in the NTFP literature are women, who in many cases have limited access to resources and decisions associated with land tenure, or use of specific areas or resources of the forests (Marshall et al., 2006; Vázquez García, 2002). Interestingly, the LDRS in its aarticle 154 establishes that special attention must be paid to the different segments of the population, including indigenous groups, women, youth and the landless, and LDRStailors programs to meet the particular needs of these populations. PRONAFOR in its regulations (Art. 10) as well as CONANP in its PNANP argue for equity in access, regardless of sex, age and ethnicity (CONANP/SEMARNAT, 2007, Art.10), while the PEF notes that NTFPs are of particular importance to women (134); however these documents do not propose approaches for improving the access of women to these resources. As we discussed earlier, the problem, not only of resource access, but also of access to programs and government support, is tightly linked to land tenure, marginalizing a large sector of the rural population: the landless and women in particular. Therefore, improvingaccess of vulnerable groups to government programs that support NTFP production, processing, marketing and certification, necessarily needs a change in the program application requirements for the populations that benefit directly from these programs, as suggested by Illsley et al. (2000).

4. *Conclusions and recommendations (of article only)*

When NTFPs are examined in relation to sustainable livelihoods, three main dimensions of analysis are emphasized: the objective of forest conservation, the economic goals related to income generation, and the objectives related to protecting cultural knowledge about local uses and guaranteeing benefit distribution of indigenous and local NTFP users.

This paper has highlighted the constraints and challenges that integrating such a wide range of resources, scales of production and management, and groups of users, pose for efforts towards reducing the ecological impact of NTFP management and improving rural livelihoods, while at the same time, sustaining local culture and knowledge.

Mexican FPForest Policy needs to reformulate the focus on these resources through new forms of interaction between scientists, professionals and practitioners (Arts & Babili 2013), rural communities, NGOs and governments, to set priorities and working mechanisms to design sustainable development programs, tailored to the needs of different groups of users in the diverse ecological settings of rural communities in Mexico. Mexican policy needs to better consider the issues discussed in this paper through a shift from a focus on regulation to incorporating better management practices through programs aimed specifically at the sectors of the population that depend the most on these resources,

specifically the landless and women. It also needs to focus on specific resources that deserve special attention in their actual context of vulnerability, by establishing how these resources can be better integrated, considering the nature of the products as well as their sources.

[End of article]

Specific examples of conservation programs related to this study

The Monarch Butterfly Biosphere Reserve

Approaching the end of the 1970s, and due to pressure from academia, Mexico took a new breath regarding conservation, by creating two important Biosphere Reserves (Michilía and Mapimí), while becoming a member of the UNESCO´s Man and the Biosphere Programme (Carton De Grammont 2012). A highlight in the creation of these Reserves was the consideration of human populations in the process of their establishment, as well as the incorporation of productive strategies that would allow local populations to decrease their impact on the Reserves´ ecosystems. In Michilía the strategy incorporated NTFPs as important elements of the productive-conservation strategy. Within the reserve, beekeeping, production of strawberry jam and marmalade, production of wooden packaging materials, and produce industrialization was promoted. As an alternative to overgrazing, hunting ranches were proposed, in which ranchers could exploit wild turkey, wild hogs, peccaries and deer, and the harvesting of *nopal* as feed for cattle (Simonian 1995,1999).

The Monarch Butterfly Biosphere Reserve has been a story of conflict, but in many other, less studied ways, it could also be called a story of success. Many studies have criticized the creation of this NPA. On the social side, studies have been performed following the declaration of the Natural Protected Area in 1986 and its expansion in 2000. These studies (Brenner 2009; Chapela & Barkin 1995; Merino 1995; Merino 2004) make a special emphasis of the social impacts of the the Reserve, such as the impacts of conservation policies on community organizations and institutions, arguing that the lack of community participation in the creation of the Reserve has caused reactions such as extended illegal timber extraction, conflicts between communities due to illegal logging, and more recently, competition for resources derived from Payment for Environmental Services (PES) programs (personal observation). Moreover, the success of conservation measures such as the establishment of Natural Protected Areas has been questioned, given that environmental degradation in these areas continues to expand; for example Ramirez & Zubieta (2005) have observed an increase in deforestation following the 2000 decree ofestablishing the Natural Protected Area, while Brenner (2009) notes that local resistance to such measures is still present. Employees of the NPA, on the other hand, acknowledge a positive change in attitude in communities located within the NPA. Although there is much to be done, they observe that the productive focus has changed and that today inhabitants are more likely to consider alternatives to logging.

The Lerma-Cutzamala PES Program in the Monarch Butterfly Region

The importance of healthy and functional ecosystems is widely recognized, for these play an important role in the provision of environmental services (Costanza et al. 1997; Deal et al. 2010; Daly 1997; de Groot et al. 2002). A broad definition of ecosystem services

proposed by the Millennium Ecosystem Assessment (MEA 2003) is "the benefits people obtain from ecosystems", although a great part of these services, such as climate regulation or pollination, have not yet been recognized by the general public (Maass et al. 2005).

Payment for Environmental Services programs are defined as "a voluntary transaction between at least one environmental service buyer and at least one environmental service provider where a well defined environmental service is paid only if the provider consistently provides the defined ES over time" (Wunder 2005). Thus, these payment programs are for the actions that are required in order to maintain a steady flow of one or more environmental services (Rico-García et al. 2011). According to Rodríguez et al. (2011) the main characteristics of PES design are: that it is a market based intervention in which a payment amount is transferred to a number of payment receptors previously identified in a target exercise, if they fulfill a number of conditions aimed to internalize an externality[26] (Rodríguez et al. 2011) that is, if they assure the sustainable use and management of natural resources in general, in order to guarantee the provision of ES.

Pagiola & Platais (2007) suggest that the scope for the application of PES responds to only a narrow set of problems, those in which ecosystems are mismanaged because many of the benefits obtained from them are externalities from the perspective of ecosystem managers and also from service and benefit users (for example, the increased costs of using organic fertilizers vs. cheaper chemical fertilizers, or on the consumer side, the increased costs of buying organic versus conventional produce). Since these externalities are not rewarded by market forces, it becomes necessary to internalize environmental externalities generated by individual landowners due to their under-provision of environmental services (Muradian et al. 2010; Pagiola & Platais 2007), through a direct payment or reward to individual landholders (or communities, in some cases), facilitating the supply of improved environmental conservation outcomes (Rodríguez et al. 2011). Yet, there are many institutional preconditions that must be met for PES programs to be successful. A critique of these payment schemes is that not all externalities can be internalized through PES; other causes of mismanagement, such as the lack of the managers' authority to manage ecosystems or their lack of awareness or information on improved land-use practices, may have other more appropriate responses, such as clarifying and ensuring proper land rights or education and awareness-building efforts (Pagiola & Platais 2007).

The best known PES programs in Mexico are those that focus on hydrologic services. CONAFOR´s Forest Restoration through Hydrologic Basins Program was created in 2009, as a way to transition from the conventional reforestation programs to an intensive reforestation program in key micro-basins. Its objective is to restore and reforest degraded microbasins in "priority zones", that is, zones that have a hydrologic deficit and which are also found near important urban centers, such as Mexico City, with the main aim of providing environmental services while also creating employment for rural communities. The principal activities of this program are linked to soil restoration and reforestation. It is a

[26] El MEA (2005:13) defines an externalities as "the external consequences of the framework in which decisions are made…these do not take part of the claculations included in making a decisión. Externalities can have either positive or negative effects" (Personal translation).

PES program that besides paying "the opportunity cost", also requires those who get support to comply with specific activities, such as reforestation, fertilization, fencing, fire lines, surveillance and trenches to improve infiltration, among others (CONAFOR 2012a). The first reforestation and conservation project under this program was the Cutzamala-La Marqueza project which started in 2009. At its start, the two main criteria were integral multiannual projects and payment for the opportunity cost of the land conserved (Del Ángel-Mobarak 2012). The Cutzamala basin provides 26.5% of Mexico City´s water (Perevochtchikova & Beltrán 2012); therefore, it holds a very high conservation priority. Very few studies have been done on this program. However, it can be compared to other PES programs such as REDD+.

The Proarbol (now PRONAFOR) reforestation program

The ProÁrbol reforestation program was created in 2007 during President Calderon´s administration. One of ProÁrbol's objectives was to organize in a single mechanism all the different programs and support to conserve, restore and sustainably manage forests. It implied a transformation of the responsible entity, CONAFOR, because it merged several programs that already existed[27], but which needed better integration and coordination, and worked on trying to achieve coordinated objectives. A legal platform had been created the previous year, in 2006, and the "Operation Rules" developed for this new government support platform. (this new platform would change to PRONAFOR in the next administration lead by President Peña Nieto). What was new is that general rules were applied to all the programs that had been incorporated into the ProÁrbol reforestation program.

ProÁrbol focused on municipalities with high and very high marginalization indices, preferably those with indigenous populations. Within its "Conservation and Forest Restoration" category, it included reforestation (Del Ángel-Mobarak 2012). In the last "Rules of Operation" document published in 2012, before ProÁrbol became PRONAFOR, the "Conservation and Forest Restoration" category included support for the following actions: reforestation, maintenance of reforested areas, soil conservation and restoration, maintenance of infrastructure and soil conservation practices. It also included payment for hydrologic and biodiversity environmental services (CONAFOR 2011b).

The budget allocated to ProÁrbol for the period 2007 to 2011 was lower than the previous ones, even though in 2007 it was one of the programs that had received the most publicity (Del Ángel-Mobarak, 2012:182). However, in that same period the program that received increasing budgets was PROCOREF or the Program for Conservation and Restoration of Forest Ecosystems (Programa de Conservación y Restauración de Ecosistemas Forestales), which included a strong PES component.

[27] Among which were: Forest Development Program (PRODEFORProdefor), Commercial Plantation Program (Prodeplan), Conservation and Restoration of Forest Ecosystems Program (Procoref), Payment for Hidrological Environmental Services and Carbon, Biodiversity and Agroforestry Program (Cabsa), Management and Production of Germplasm and Special Reforestation Programs, Fire Preventionprevention and Combatcombat, Promotion of Sustainable Production of Forest Ecosystem Productivity and Programs for Forest Administration and Technical Assistance.

Despite being presented as an innovative program, ProÁrbol received a number of critiques, although it did simplify bureaucratic requirements for forest producers applying for government support. Few actual studies have been performed regarding ProÁrbol´s efficiency (effectiveness?) as a whole. CONEVAL (2013) concludes that the program was important for promoting sustainability of the forest sector; however, because ProÁrbol is an integrated program, CONEVAL found it difficult to evaluate every single one of the programs included. Critiques by the media are more abundant and critical, such as ExpokNews (2011), which reported a survival rate for ProÁrbol´s reforestation efforts of only 55%. Another study (Santos et al. 2015) reports that ProÁrbol did not only not induce additional reforestation efforts, but it also contributed to a decrease in reforestation in the state of Michoacán. One reason may be that even though "the main goal of PES schemes is to induce additional environmental benefits […] the socio-economic criteria of ProÁrbol might shift eligibility to areas where environmental benefits are not additional, so that areas assessed by the payments in Michoacán may not be well targeted."

Other studies (Sheinbaum & Masera 2000) report low survival rates in large reforestation projects in México, due to the handling of large numbers of seedlings at a time. For more than a decade, federal and local authorities in Mexico have promoted large reforestation programs, of which ProÁrbol is an example; however, the survival rates are low even though large quantities of money are spent. Reforestation programs are a source of income for local populations. Local inhabitants who participate in reforestation programs receive a payment for each seedling they transplant, or they are paid per hectare: in 2012 they were receiving between $1,155 and $2,417 Mexican pesos/ha, as reported by Santos et al. (2015). Thousands of seedlings are transplanted each year; thus, government and private agencies can claim high reforestation successes. However, due to many factors, the survival rate is actually low, as reported by Jaramillo-López et al. 2015). The latter authors argue that some of the factors that affect survival of reforested seedlings have to do with participating parties´ lack of interest in caring for the seedlings, which is partly due to economic interests related to receiving payments for reforesting those same areas the next year (a lack of additionality problem as reported by Santos et al. (2015); monitoring by forest advisors is low because it takes too much time and there is little monitoring of outcomes; funding agencies can report quantities of trees planted, but not quantity of trees that have survived (Jaramillo-López et al. 2015). What these authors propose instead are reforestation schemes based on greater community participation and monitoring, starting with fostering the community´s own interests in growing their own seedlings and taking care of the resources they themselves grow.

PROCYMAF (Proyecto de Conservación y Manejo Sustentable de Recursos Forestales en México; Sustainable Forest Resource Conservation and Management Program)

As mentioned earlier in this chapter, PROCYMAF was an attempt of CONAFOR to approach themes related to forest resources and the populations that depend on them. The purpose of the program was to diminish the poverty and marginalization indices of communities in forest areas, through better use and management of natural resources, and also through promoting economic development from the sustainable use of forest resources in dry, arid and semi-arid forests The program only operated in a small number of states (Campeche, Chiapas, Chihuahua, Durango, Estado de México, Guerrero, Jalisco,

Michoacán, Oaxaca, Puebla, Quintana Roo and Veracruz), with the aim of strengthening their processes of community forest development. The idea of forests as being important for income generation was key, resulting in the introduction of production components in the program, in addition to conservation and management components (Segura Warnholtz & García-Peña 2001) This included support for specialized studies on how to implement better management of NTFPs, as well as support for constituting and registering community forestry enterprises (CONAFOR 2011a).

PROCYMAF was a different program with a new approach that focused on improving not only forest conservation, but also the communities´ livelihoods. This program, partially financed through World Bank resources, also considered it important to involve forest owners in decision-making processes regarding forest management (Segura Warnholtz & García-Peña 2001). The final program evaluation reported on NTFP projects in Durango, Guerrero, Michoacán and Oaxaca. Outstanding projects focused on bottling of spring water, edible mushroom production, UMAs for white tail deer (venado cola blanca), handicrafts and tourism (CONAFOR 2004). Other less prominent projects were orchid production, *pita*[28] fiber production, *barbasco*[29] processing and transformation, and the production and marketing of rainbow trout (Segura Warnholtz & García-Peña 2001). PROCYMAF ended in 2003 and there have been no evaluations of the program other than those reported here (at least, no results have been found from an internet search). PROCYMAF served as a precedent to current programs, such as the UMAs, and other programs concentrated in PRONAFOR´s platform such as programs supporting NTFP research, processing and production. More about the incorporation of NTFPs into conservation and development programs? will be discussed in a section below.

UMAs (Unidades de Manejo Ambiental; Environmental Management Units)

The conservation and management of wildlife is a subset of NTFP conservation and management, and has been integrated into environmental policy through the Sustainable Wildlife General Law (Ley General de Vida Silvestre, LGVS), passed in 2000. The regulations to this law were subsequently passed in 2006 (Carton De Grammont 2012). The LGVS set the legal precedent for the creation of Sustainable Wildlife Conservation and Management Units, and defines them as "the grounds and facilities registered that operate under an approved management plan, and within which the state of the habitat and populations or individuals that live in it are monitored" (SEMARNAT, 2012a: Title I, Art. 3°). The manual for UMAs similarly defines them as the hatcheries, nurseries and greenhouses that allow the growth or dispersal of wild fauna, and also the production of resources that may be sold in legal markets.

The UMAs are reserves where wild fauna are raised and maintained. Thus their main objective is to create conservation areas where wild fauna can be used as a means for local communities to generate income, either through the production, renting or harvesting of wild fauna, while guaranteeing the preservation of these wild populations or resources.

[28] Pita is a fiber extracted from some types of *Agave* species.

[29] Barbasco is the name given to some plants species used in the pharmaceutical industry to extract steroid precursors (http://www.revistaciencias.unam.mx/es/46-revistas/revista-ciencias-89/251-el-barbasco.html).

There are different types of UMAs, extractive ones in which fauna are harvested (through hunting, or intentional capture for economic purposes), non-extractive ones where wild fauna can be seen through ecotourism, or where they are maintained for research purposes, or mixed (SEMARNAT 2009). The area of the UMA can vary and depends on the management plan and also the objectives (whether is extractive, non-extractive or mixed).

The SUMA is the system of UMAs throughout the country of Mexico. Most of these UMAs are located in the north states, due to the existence there of large areas of land that do not have other productive uses and also due to large private investments in extractive (or hunting) reserves, many of which are visited by foreign hunters. The most popular fauna hunted are deer, wild turkeys and peccaries. Other UMAs concentrate on breeding animals such as deer or ostrich, on growing and selling plants such as orchids or on the production of items such as textiles, cosmetics or other products derived from wild flora and fauna.

There are great differences between the economic benefits derived from UMAs in the north and south of Mexico. In the north, it is estimated that UMAs generate around 2,900 million Mexican pesos, while in the south the estimate is only 2.6 million pesos (Anta et al. 2009). Interestingly, the state of Michoacán is one of the states with the greatest number of breeding UMAs. More UMA promotion is needed in the south, however, due to many factors, such as the marginalization of rural communities in the south, and other factors such as security issues, growth of the SUMA in the south has been hampered. Anta et al. (2009) identify the need for more and better monitoring of the performance of UMAs, better identification of the products and subproducts with the greatest demand in the markets, and more investment in the processing of these products. They conclude that the SUMA has proved a good strategy for the conservation of wild species and a beneficial option for rural communities wishing to generate income, and they emphasize the need to promote more of these projects in the south of Mexico while making efforts to maintain those which have been successful in the North.

Why these programs are important for NTFPs

The programs described in this section are very relevant for the management, use, conservation and marketing of NTFPs. Some of them may have implications for NTFP harvesting restrictions, such as the NPA and Cutzamala PES programs, while other incorporate components for the production, processing and marketing of these products. All of these programs share a common goal of forest conservation, however their approach to conservation differs greatly. NPAs and PES, for example, are more restrictive of the activities allowed within their areas, whereas UMAs, while still being conservation programs, hold a stronger economic component with income generation as one of the principal focci. PROCYMAF is an example of an interesting experiment in Mexican forest policy; it tried to be an integrated program that included not only forest conservation objectives and activities, but also the production and processing of forest products. PROCYMAF had a strong NTFP management, production and marketing component, in the CONAFOR era it was the first program that integrated NTFPs as an income generation alternative. Some of these ideas were later integrated in the ProÁrbol and later PRONAFOR programs, as activities that can receive government support, including the harvesting, production, processing, marketing and certification of NTFPs. In the case study

chapters we will come back to these programs and how they relate to or impact NTFP management in these communities.

Conclusions: how effective has policy been at incorporating NTFPs as a strategy for income generation, forest conservation and enhancement of rural livelihoods and cultures?

Forest policy has evolved from a focus on production (forest exploitation) to a more holistic focus on the wellbeing of the populations that depend on forest resources. Since the 1970´s this integration has had a growing emphasis on the conservation of forests. This has led to the implementation of programs such as the Natural Protected Areas program as a strategy to conserve these ecosystems. This perspective however has turned out to exclude the human populations that depend on forests, limiting their acces to important resources derived from these systems.

Demands from forest dwellers and NGOs have succeded in changing forest policy to incorporate the human element into forest management, with an aim of enhancing the wellbeing of forest peoples. Slowly, forest policy has become more inclusive of the economic importance that forests have for the local people who depend on them, and many development programs have aimed at improving the economic situation of forest populations, through production programs, not all of which are necessarily focused on the use of forest resources.

A stronger stance has been the conservation of forests through Payment for Environmental Services programs, such as those derived from REDD and more recently REDD+. The challenge of this new perspective is to integrate forest resource management, marketing and processing as activities that can complement and even strengthen forest conservation, while also enhancing rural livelihoods. In our case studies, we look at the importance of these activities, and our final general discussion will offer an in-depth analysis of the importance of incorporating these activities into forest policy, in order to create a stronger foundation that benefits both the forests as well as the forest users.

CHAPTER 4. The Marketing of NTFPs

Summary

The commercialization of NTFPs is a topic more complex than has been suggested by enthusiasts who propose that NTFPs can be important income generation alternatives. Aspects that may complicate commercialization are: the difficulty of sustaining production when the NTFP species occur in low densities, with irregular distribution patterns and uneven yields per area (Panayotou & Ashton 1992); the labor-intensive nature of harvesting which makes these products susceptible to substitution with synthetic derivatives (García-Fernández et al. 2008); the concern that commercialization may work as a ´driving force´ for change in management strategy leading to higher environmental impact (as in the case of domesticated monospecific plantations) (Boot & Gullison 1995); and finally, the concern that NTFP commercialization may imply high opportunity costs and an uneven distribution of benefits among rural populations (Godoy et al. 2000; Peluso 1992; Ruiz-Pérez et al. 2004).

Other issues that affect markets include consumer preferences, socioeconomic status of harvesters? (Kilchling et al. 2009), proximity to forests (Kroeber-Riel and Weinberg, 2003, cited in Kilchling et al. 2009) and the dynamism of international markets (Angel 2002; Belcher 2003; Belcher & Schreckenberg 2007; Marshall et al. 2003). In order to assess the importance of NTFPs as real income generation alternatives, all these issues must be studied and evaluated in case-specific contexts, such as is suggested for other subjects related to natural resource use (Berkes 2004; Pinto-correia et al. 2006). This chapter reviews and discusses a number of important themes related to NTFP marketing as a strategy for conserving forests and generating income for forest-dwelling, rural people. It then discusses the specific case of small NTFP sellers in the local markets of Morelia, the capital of the state of Michoacán, México, looking at how the themes analyzed in the first section pertain to this local case.

The importance of NTFPs for subsistence and as an income-generation activity

There are two important aims for the collection of NTFPs: one is for marketing, that is, to generate income from their collection; and the other is for subsistence, that is, to use them within the household sphere without aiming to generate economic benefits from them. Sometimes, the extraction of some resources for marketing is accompanied by some extraction for subsistence purposes. Studies such as those by Cavendish (2000), point to the idea that rural populations not only generate income from on-farm activities, or off-farm activities such as temporary employment or remittances, but that they also generate "environmental income", that is, contributions from non-cultivated lands such as natural forests, mangroves, rivers or other wild areas (Wunder et al. 2014:2). Other studies have also observed that resources from these non-cultivated lands serve to fill in the gaps in time between the cultivation and harvest seasons of the agricultural cycle (Angelsen & Wunder 2003; De Beer & McDermott 1989).

Although commercialization has seemed an attractive possibility for conserving forests through promoting forest-related activities such as extraction of NTFPs, success stories are dispersed and depend on many factors that cannot be generalized. Sometimes what makes

these resources attractive for the poor as options to fight poverty may also pose obstacles to their commercialization or accumulation (Wunder et al. 2014), such as the low densities in which these resources occur, their irregular distribution patterns in space and time, and their small yields per area, among others (Panayotou & Ashton 1992).

What has prevented a paradigm shift to viewing NTFPs as important sources of income? Wunder et al. (2014) name some possible reasons why this shift has not happened. First, they argue that with "environmental extraction"[30] there is no potential for technology to increase productivity, although impact can be minimized and management improved. Second, forest-rich areas coincide in most cases with other conditions that make it more expensive or difficult to implement policies to improve management or to reduce poverty; these conditions may include low population densities, very complex natural systems which demand more complex interventions to improve management, difficult to access areas, etc. Third, the benefits of extraction are spread over many products, each of very low individual value, which are collected for subsistence throughout the year, making it difficult to reach approximations of their economic value. Fourth, most extractive products have little business development potential, and those successful stories are basically those supported primarily by civil society or NGOs that promote them as a way to conserve the forest and improve rural livelihoods. The potential benefits to local communities have also been questioned, for they imply high opportunity costs, with the distribution of benefits among the population still being uncertain (Dove 1994; García-Fernández et al. 2008; Peluso 1992; Ruiz-Pérez et al. 2004). It has been noted, for example, that as market chains become more specialized, particularly for highly elaborated or perishable products, there is a greater concentration of power in certain sectors of the commodity-chain (Marshall et al. 2006).

Adding to all these problems, Wunder et al. (2014:3) are critical of optimistic studies that have thrown estimates of environmental incomes that may be higher than what is actually perceived, stating that these seem to be more like "wishful thinking" about the potential for obtaining significant incomes from the forests.

The economic contribution of NTFPs to rural livelihoods

The economic contribution of NTFPs to rural livelihoods however is significant, particularly if we concentrate on specific groups of the population. A study by Sosa-montes et al. (2013) of a rural community in Oaxaca, Mexico, observed an economic contribution of NTFPs that ranged from 3% to 42% for some families. However, of the entire population, these families only comprised 10% to 15% of all *ejidatarios* interviewed. Marshall & Newton (2003) report that in El Terrero, in the state of Jalisco, Mexico, it is women who do most of the collecting and selling, and for up to 30% of the women interviewed it is their main source of income. Resources such as pine resin alone may constitute up to 18% of annual income in places like Michoacán, where pine resin extraction is common among *ejidatarios* living in temperate forests (Francisco-arriaga & Kido-Cruz 2011).

[30] With the term "environmental extraction" they broaden the term to include many sources of NTFPs, not only forests.

In other parts of the world Steele et al. (2015:284) report even higher incomes coming from NTFPs, of up to 90%. In their review of studies of the contribution of NTFPs to rural incomes, Wunder et al. (2014) find that in the Angelsen et al. (2014) study, more than a quarter of the income in the sample (27.5%) come from extractive sources, a similar result to the previous data by Vedeld et al. (2004), who reported 22% of total income.

Income from the forest is of particular importance to the poorest sectors of the population, as in the example by Francisco-arriaga & Kido-Cruz (2011), who conclude that NTFPs constitute up to 80% of the annual income for the poorest collectors. Therefore, incomes from forests may help improve the conditions of the poorest sectors of the rural population when it is compared to remittances. However, it is less important when compared to income or other public sources of economic support (López-Feldman 2014). In their study Sosa-montes et al. (2013) interestingly find that government aid also provides an important source of income, sometimes even more significant than incomes from extractive sources. Sosa-montes et al. (2013) also find significant that some of the most important contributions to rural income in Mexico are government programs such as "Oportunidades" (presently PROSPERA) which contributes 34% of average income and "70 y más", for the elderly, with a contribution of 63% of family income. Together, these programs represent 51% of annual income that comes from activities outside the household.

One of the strategies that have been included in policies to increase and improve income generation efforts in rural communities are tree plantations (CONAFOR 2012b). Promoting plantations of NTFPs, such as those of camedor palms (*Chamaedorea* spp.) in Mexico through opening markets or implementing government programs, is a strategy with many implications, some of which may not be necessarily beneficial to the rural poor. Rico-García et al. (2013) examine the process of changing from wild extraction to domestication of wild palms with the aim of establishing plantations. They conclude that as market demands grow and availability of resources decrease, there is an effort by mostly local or middle-income elite (at the local level) to invest in establishing palm plantations, while the poorest sectors of the population (the landless), who were the original harvesters of wild palms, are left out of the benefits generated by plantations and are pushed to remain as subsistence farmers hired by land owners. Therefore, promoting cultivation of NTFPs can be a solution that is proposed to address poverty which actually has negative consequences.

Regardless of the seemingly contradictory findings, Wunder et al. (2014:7) conclude that "Consequently, 10,000+ years of agriculturization seem to only have taken us just so far in substituting the human hunter-and-gatherer activities from forests and wildlands, which in developing countries thus remain essential sources of smallholder welfare." Additionally, a large share of the rural populations´ economy (even if not all in monetary form) still depends on extractive resources.

The market as a promoter of forest conservation

Beginning in the 1990´s there arose a new concept, the so-called "Rainforest Crunch" phenomenon, promoted by international companies, international NGOs, researchers and an educated public, that focused on conserving the rainforest, particularly the Amazon forest, through increasing the value of NTFPs (such as Brazil nuts) so that these could enter markets, and as a result, local inhabitants would have an incentive for conserving their

forests (Turner 1995; Assies 1996). This idea was supported by the new sustainable development paradigm which we have discussed in another chapter, and studies such as those by Peters et al. (1989) and Peters (1996) which tried to demonstrate that marketing of NTFPs could produce more profits than conventional timber extraction and also prevent deforestation. Other supporting arguments were that NTFP extraction could be less ecologically destructive than timber extraction or other productive systems, and also that NTFPs were an important contribution to rural livelihoods, more so than timber extraction (Arnold & Ruiz-Pérez 1998).

Important to this paradigm were local movements which called attention to the importance that non-timber forest resources had for rural populations. The rubber tapper movement lead by Chico Mendez in Brazil was a movement to defend forests from encroaching cattle ranchers (Nepstad & Schwartzman 1992). The rubber tappers´ main source of income was wild rubber from forests whose production had been historically important in international markets. However, changes in international commerce and also national policies modified the marketing and also the land tenure context for rubber production (as described by Assies (1996) in another section of this chapter). In this context, other activities became more important as sources of income, one of which was cattle raising, which was a direct menace to the Amazon forest, because, contrary to rubber tapping, it involved felling trees.

In a time of high Amazon deforestation rates, international NGOs such as Cultural Survival (www.culturalsurvival.org) called attention to the possibility of conserving forests while still generating local incomes through NTFP extraction (hence the Rainforest Crunch). These ideas have been critiqued by many authors, while others still support them. The problem is that NTFPs as a category is very broad, it includes different types of resources, while contexts differ in many ways (Shackleton et al. 2011). Opening and supporting marketing of certain products can be a factor that leads to increased extraction (Blancas et al. 2013; Delgado-Lemus, Torres, et al. 2014), or the domestication of wild resources with the aim of producing them in plantations (Rico-García et al. 2013), which in turn may promote deforestation to establish these plantations. However in cases such as that of pine resin in the state of Michoacán, it is evident that forest owners (*ejidatarios or comuneros*) themselves are the first ones to engage in conserving the forests, because resin extraction does constitute an important source of income throughout the year (Francisco-arriaga & Kido-Cruz 2011).

In the following section we discuss briefly some examples of how markets can influence NTFP management, making it more or less apt for conservation purposes.

The market as a factor that increases extraction and environmental impact

Because NTFPs are so diverse, it is difficult to state that their extraction poses risks for ecosystems, or on the contrary, that they can be a forse for forest conservation. Assies (1996) and Marshall & Newton (2003), for example, suggest that the collection of Brazil nuts, wild rubber, blackberries or linden flowers may not be prejudicial to forests, because extraction is not guided by market demand, but is rather part of a very diverse spectrum of rural activities. In the case study presented by Sosa-montes et al. (2013) the conclusions are that the extraction of NTFPs is sustainable, given that the *ejidatarios* make collection decisions based on the availability of the resources they collect. However, the resources

studied by Sosa-Montes et al. (2013) are extracted and managed as one of many other subsistence or income-generation activities, rather than as a principal source of income; what changes is the type of activities that each do to contribute income to the household. Yet, as alternative uses of labour become more attractive, utilization of the forest is increasingly concentrated on higher value NTFPs (Godoy et al. 2000).

On the contrary, other examples, such as that of certain species of *Maguey* (*Agave* spp.) extraction (Blancas et al. 2013; Delgado-Lemus et al. 2014; Torres et al. 2015) or palm (*Brahea dulcis*) (Illsley-Granich et al. 2001) in the state of Guerrero, Mexico, show severe ecological impacts not only on the populations of such species, but also on the general environment itself, impacts such as erosion and forest degradation. Dynamics such as forest degradation in general (related to firewood extraction and cattle raising among others) however, may confound the impact that these NTFP extraction systems have on forests. Therefore studying the complex interactions between different dynamics within the extraction systems becomes significant for understanding the ecological impacts of NTFP extraction.

Babigumira et al. (2014) suggest that implementing policies that aim to fight poverty through increasing market access and integration of forest products may weaken efforts to conserve forests. One of the impacts that markets may have on extraction is that as commercial demand for a product increases, output first expands, then as the quality and quantity of sources decline, prices rise (Homma 1992; Homma n.d.). This rise in prices may be a factor that accelerates resource decline (Steele et al. 2015). When there is high demand and resource availability decreases, one of the consequences can be an effort from local people to domesticate the resource with the aim of raising it through plantations (agriculture), or in other cases there can be an incipient substitution of a product by synthetic alternatives (Arnold & Ruiz-Pérez 1998), a consequence that ends up directly affecting those who initially depended on the *wild* resource. As Steele et al. (2015) report, the greater the dependency and demand for NTFPs, the higher possibility of greater impacts to the local environment.

Whether a resource is sustainably managed depends on many factors, among which the ecological characteristics of the resource, such as abundance and distribution, regeneration, parts used, etc. can be counted (Belcher 2003; Belcher & Schreckenberg 2007; Delgado-Lemus et al. 2014; Godoy & Bawa 1993; Illsley et al. 2000; Rico-García et al. 2013; Steele et al. 2015; Ticktin et al. 2002; Ticktin 2004; Stockdale 2005 and many others). There are however other factors that influence sustainable management, which concentrate more on the influence of markets (the topic of this chapter) or the influence of social institutions (to which we will return later in this chapter and also in the case studies).

Other factors influence market demand and flows

Learning about the chain of production of a product is important, because it allows those who are making decisions about the product itself (either as producers, consumers, retailers, wholesalers, governments) to make better informed decisions about what they produce, how they produce it, how to value it and assign costs, and which policies to apply to its production. It also lets us know what are the market channels used for marketing a product, and whether there exist opportunities to improve marketing channels in which more than

one product is marketed, or which can incorporate other products that follow a similar chain of production-to-consumption.

Belcher (1998) describes what he calls the "production-to-consumption systems approach" for rattan and bamboo in Asia. Rattan and bamboo are two of the most important NTFPs produced in Asia, although their markets may differ in many ways to other NTFPs around the world, they are examples of NTFPs with very successful international markets (each with its own ecological and social implications). To analyse these systems, Belcher proposes three dimensions: a vertical dimension, which looks at the flow of material from its production in a biological system to the final consumer; a horizontal dimension, which refers to the firms (or actors) that operate at a particular point and the relationships among them, and a third dimension, which looks at intensity of production, specifically at the amount of labour and capital needed to produce the product. This may be a simplification of what actually happens in a production-to-consumption chain; however, these models do help to highlight information that is important for those involved in the chain.

The history of an NTFP market, as well as its chain of production, is important for understanding what other factors influence markets for that product. The case of rubber and Brazil nuts in Brazil is a clear example of how markets can vary at the local, state and international levels due to factors such as state intervention and policies, the rising of new producers or similar products and international commerce agreements, among other factors. As presented by Assies (1996:97) rubber and Brazil nuts depend on a symbiotic relation with the forests, both can be harvested without harming the ecological system, if harvesting is kept to a sustainable level. However, the rubber tapping system, which relied on the conservation of forests, was affected by factors such as the rise of rubber plantations outside the Amazon region as well as neoliberal policies, which in turn caused a decrease in prices. As a result, rubber production collapsed in the 1990´s.

During this time, many expectations were set on Brazil nuts, and social and economic changes followed a boom in Brazil nut extraction (the "Rainforest Crunch" era). What followed in Brazil was a new, but similar, context of economic competition created by the appearance of new Brazil nut producers in the region. Brazil nuts started to be produced in Bolivia, partly because it was being bought by importers at a much lesser price than nuts from Brazil, and partly because it received support from international organizations such as the World Bank to introduce new economic development options to fight poverty and balance the country´s payments (Assies 1996:98). The result for Brazilian nut producers was the demise of their Brazil nut production, while agriculture, small-scale cattle raising and logging grew as economic alternatives.

The case of the rubber tappers is well known and has even served to support a new forest conservation and development paradigm that sees NTFPs as a way of conserving the forests and promoting income generation for poor forest dwellers. However, due to international market dynamics and state policies, it is also a challenged case that makes explicit that markets are not only driven by demand, but that there are many other factors that affect the successful marketing of a product.

Product quality and availability

When thinking about international markets, product quality becomes an essential consideration and in most import cases, a precondition for entering another country´s markets. Usually countries that import NTFPs, such as medicinal plants, are developed countries with high quality demands for their internal industries. Angel (2002) reports, for example, that in the early 2000´s, countries like Germany and the United States of America, stopped importing resources from Latin America and were instead looking at other countries within Europe, for example, for resources of higher quality. Some of the factors that affect the quality of resources, he argues, are the loss of the resource in its region of origin and the consequent substitution with similar plants which do not possess the same quality as those that have decreased in availability.

A more thorough revision of which resources are exported from Mexico, could guide a national policy that concentrated on those resources which have greater marketing potential or which, due to the high demand, require better management practices to prevent their loss. This data is hard to obtain, though, because most NTFPs are lumped together as a single category in national forest inventories, except for the really economically important resources such as pine resin.

Cultural changes and consumer preferences/ forest transitions

Problems with marketing relate not only to the ecological availability of the products, but also to socio-economic and cultural dynamics, such as economic liberalization and cultural globalization. From a socio-cultural perspective, the use of NTFPs has a long tradition in all forested countries and is therefore associated with local knowledge and social practices that are worth preserving. Well-known examples are the use of forest herbs and tree leaves for tea, and the use of berries, mushrooms, and game.

Societal trends toward preserving traditions and using natural medicinal products could support the marketability and profitability of NTFPs (Kilchling et al. 2009; Harrison et al. 2002). These market trends depend highly on consumer preferences (for an example of consumer preferences in this thesis see Chapter 5, Table 8 Times collected and income (in pesos) generated per season per product.), and these preferences depend on aspects such as the consumer´s socioeconomic status, their proximity to forests and national market trends, as well as other external dynamics, such as the international demand for exotic products (such as Açai or other tropical fruit juices as reported by Assies, 1996).

A survey conducted by Kroeber-Riel and Weinberg (cited in Kilching *et al.* 2009), for example, shows a positive connection between the frequency of forest visits and the consumption of NTFPs in Switzerland. This is an important finding, for, as O´Brien (2001) also suggests, promoting forest visits and activities in the forest such as ecotourism could enhance the marketing of NTFPs, and also strengthen consumers´ environmental awareness.

Another important finding of consumer surveys is that consumer preferences for forest products rise with their income, which indicates a potential target group among well-off urban residents, among whom women comprise the greatest percentage of consumers (Kilchling et al. 2009). These findings reiterate the importance that forest products may

have for urban consumers, and also a trend for increased consumption of those products in countries and populations where income allows consumers to buy products which people consider the most beneficial to their health and to the environment.

This last issue relates to the "forest transition" concept, which proposes that there is a ´turning point´ where forests stop shrinking, due to a country´s higher economic development stage, consolidated markets for timber and non-timber products, well defined and secure tenure rights, clear extractive regulations, good governance and institutional incentives. However, some of these factors, i.e. secure tenure or improved market access, can also act as deforestation drivers (García-Fernández et al. 2008**).** These studies point to the need to consider the level of demand for NTFPs when designing NTFP management programs, as well as the importance of communication between traders and managers regarding changes in market demand (Marshal et al. 2006).

The presumed relationship between sustainability and NTFP commercialization is not straightforward (Stockdale 2005). Considering these impacts, commercialization should be approached with care, and the involvement of the forest communities themselves, who should be recognized for their traditional knowledge and for their forest livelihoods (BTFP, 2002, cited in Stockdale 2005:42).

Identified barriers to commercialization of NTFPs

Regardless of the increased consumer preferences for NTFP products, there remain in most parts of the world, and particularly in developing countries, important barriers to NTFP trade. Meeting market demand for many NTFPs may mean high transaction costs, making NTFP commercialization less attractive for those living in poverty. The other wealth generating options available (agriculture, tree plantations, PES programs, etc.) make it even less likely for the rural poor to base their income-generating activities solely on NTFP commercialization. Thus, NTFP commercialization does not necessarily provide development opportunities for many of the rural poor in or adjacent to forested areas (Arnold & Ruiz-Pérez 2001).

Economic and political dynamics such as those associated with globalization pose a dual impact on rural producers, for it creates new livelihood opportunities for those who have the resources needed to take up new strategies (Kull et al. 2007; Sloan 2008). This dynamic suggests that the Latin American 'globalized countryside' will be characterized by increased social polarization in which the livelihoods of poor producers and traders will be 'squeezed' by economic globalization while already wealthy rural entrepreneurs will benefit from new ways to 'amass wealth' (Woods 2007). This is true for many NTFPs in Latin America, where an elite group of producers are able to concentrate most of the local trade in their hands, and only a few producers are seen to advance in the value chain due to a lack of capital to buy, store, and transport the products and to develop producer, market and consumer networks.

Valuation of NTFPs

Assigning value to NTFPs is not an easy task, because producing, harvesting and marketing these products may be part of a complex system of activities that may not only involve, for example, harvesting wood, but also harvesting other non-wood resources during the same

trips (García-Fernández et al. 2008; Godoy et al. 2000), or because products may be composed of several NTFPs. The value of a product depends partly on its market chain. It is through these chains and the relationships among chain actors (harvesters, producers, intermediaries, traders, policy makers, etc.) that a product gains or decreases in value. Many factors can increase or decrease the value of a product in a market, such as the cost of harvesting, processing, transporting, retailing, exporting and selling. Other aspects can also affect value chains, such as corruption, certification or regulations around a product. Therefore, valuing the market chain of a product can help clarify the dynamics of commercialization (Jensen 2009).

García-Fernández et al. (2008) refer to the Total Economic Value (TEV) as a way to assign value to an environmental product or service by dividing forest TEV into extractive value (or consumptive value), non-extractive value and preservation value (see graph below). This is particularly useful in the case of forest resources that are managed in conjunction with a variety of other resources, such as NTFPs. In Figure 4, below, taken from García-Fernández et al. (2008), the x-axis represents various forest benefit categories, depending on the extent to which they have consolidated mechanisms to allocate economic value. The y-axis represents the degree to which these forest benefits are driven by financial returns.

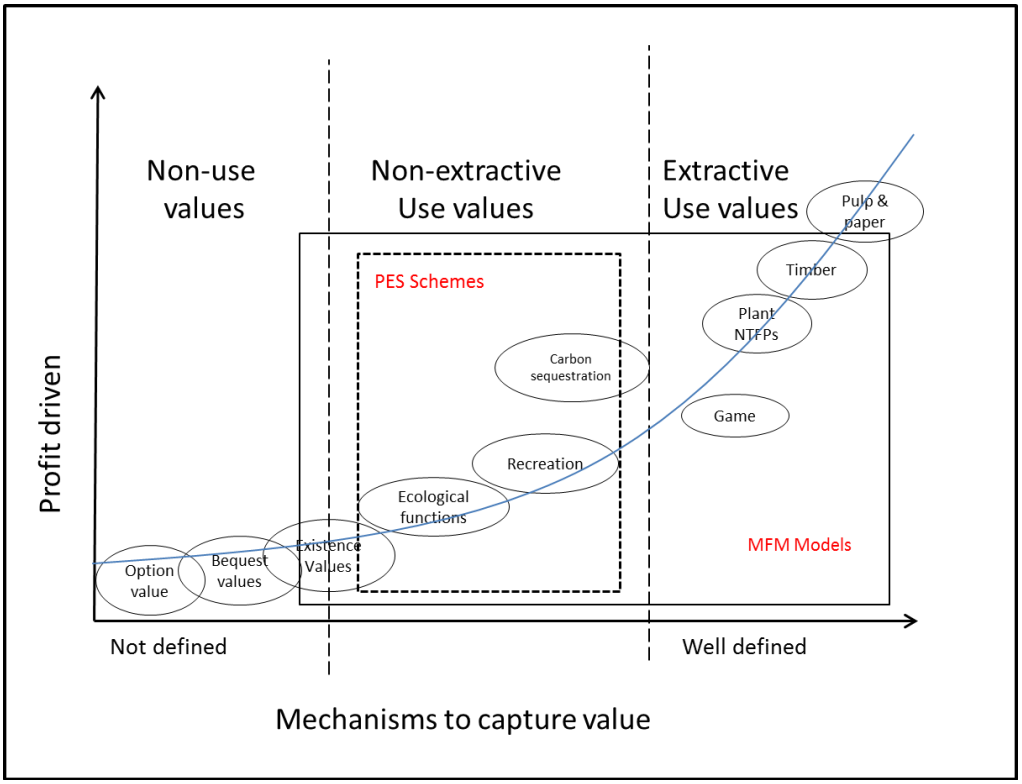


Figure 4 Forest benefits, profit orientation and value capture mechanisms. Table redrawn from García-Fernández et al., 2008 p. 1471.

As can be seen in this figure, the benefits that have higher, well-defined values are those which have well-developed markets. Non-extractive values, such as carbon sequestration and ecological functions, imply a category where economic values (tradability) are in a

process of being developed (PES programs, for example). Non-use values are those benefits that have up to today not been reflected in market prices (García-Fernández et al. 2008). This is important to consider in the discussion about the potential of NTFPs for trade, generating income, or conserving forests. García-Fernández et al. (2008) suggest that the forest conservation potential of Multiple-use Forest Management (MFM), a management system which incorporates both timber and non-timber uses, depends not only on the value assigned to a resource or service, but also on other factors, such as technical factors at the species level, the exigencies of economies of scale in forestry planning, production and marketing, and structural conditions favouring commodity specialization in developed countries.

In many tropical countries, market chains can be very inefficient in terms of benefit distribution due to factors such as corruption. Chupezi et al. (2015) find that in Cameroon, corruption in the permit system (both for NTFP extraction and marketing) creates high transaction costs, reduces government revenue and negatively impacts the environment by promoting illegal logging or extraction. Therefore they consider improvements in governance imperative if value chains are to benefit all the actors involved.

Another reason why NTFP collection and marketing is not reliable as an income-generation option is that, for many products, the principal component of costs is labour, which adds very little value to the product (Gómez & Angón 2004). Therefore, value depends also on the importance that producers give to the products they produce (that is, the value they give to their labor will determine the value they give to their product. But there will also be other values implied, such as cultural or religious values).

Differences in users, tenure rights, and their influence on organization around NTFP management and marketing

Who manages and destroys, conserves or modifies forests is a complex topic, for it not only incorporates the characteristics of users, but also how these users are organized, how they define access and rights to resources, and also how these resources are incorporated into production and marketing chains. Among the characteristics that influence access rights are gender, ethnicity, age, land tenure or household assets.

Household assets, for example, may be more important than economic need as a driver of forest clearing, because a minimum level of assets may be required for clearing forest to profit from market opportunities (Babigumira et al. 2014). Therefore, one of the strategies that has been proposed to guarantee more equal access to forest benefits is to generate other income opportunities that can help families increase their assets. However, this can have contradictory effects, as mentioned in a section above, by promoting land use changes made possible through increasing household assets.

Regarding gender as a differentiating characteristic of users, Ticktin et al. (2002) and Vázquez García (2002) observe important differences between resources collected by women and those collected by men. Important spatial mobility restrictions are imposed on women in some communities (Vázquez García 2002), while more freedom is allowed in others (Ticktin et al. 2002). Gender has been an important topic in NTFP discussions, because a generalized idea permeates the debate that NTFPs are of particular importance

for women and the poorest sectors of the populations, which in many contexts, coincide. Therefore, the policies proposed to improve rural women´s livelihoods have to do with changes in social institutions that allow for the increased participation of women in decisions regarding access to forest resources, and also access to markets. Contrary to common assumptions, Sunderland et al. (2014) find that, in the case of income derived from NTFPs, men contribute just as much to household incomes as do women. Thus the argument that women have more dependence on NTFPs and a closer relationship to the forests does not apply to all contexts and situations. It appears rather to be a combination of factors, some having to do with the type of users, their assets, land tenure and also marketing channels, social institutions and social organization, and local, regional, national and even international policies (such as those that define rules for certification, as discussed in a later section).

Some studies, for example, have found that some communities are more likely to organize themselves to protect and manage forests if the resources have sufficient economic value (Hobley & Shah 1996). A very unexpected but important observation made by Clements et al. (2014) regarding the effects of NPAs on local communities´ access to resources, has to do with the possibility that people who live within NPAs may have access to better conserved ecosystems, which directly benefits local inhabitants who use these resources for subsistence or marketing purposes and who have an advantage over people who live outside NPAs (here, the importance relies on where the user lives or comes from).

Wiersum et al. (2013) look at how production and marketing systems interact, and highlight concerns that require attention in the discussion of NTFP governance. First, there are concerns about the sustainability of the production base, which refers to abundance, threats to the resources, tolerance to harvesting, among other ecological factors. Second, there are concerns as to how access to specific resources and their markets is organized. Thus, the way in which NTFPs are managed, and the institutions around their management, depend on the nature of access rights to NTFP resources (Wiersum et al. 2013). These access rights are strongly determined by rules and norms that regulate access to public or community-owned land. Access rights also vary with the resource used, the timing, the user and also the purpose.

The differences between the type of resources marketed

Many useful plants are marketed in Latin America for different purposes and at different scales. Angel (2002) suggests that a high percentage of medicinal plants used in different product industries come from wild sources. One of the aspects that define NTFPs is the diversity of systems through which they are produced. The range of production options goes from harvesting products from wild sources to multiple use management to agricultural intensified production systems. Many NTFPs have been brought from forests to intensive production systems that may include genetically modified cultivars, through a gradual domestication process (Wiersum et al. 2013). This process of production intensification not only affects the conditions, but also implies social adaptation to new production alternatives, and also social impacts related to which sectors of the population have sufficient assets to profit from intensification (Rico-García-Amado et al. 2013).

Regardless of the possibility of intensification of NTFP resources, domestication has not become yet a necessity or has not been possible for many NTFPs. These resources may be at an incipient domestication stage or, due to their ecological requirements, may be extracted from wild sources only. Plants with the highest market demand may be the first to go through a process of domestication, a process that may also be supported by conservation programs to stop their illegal extraction from natural habitats. Other plants are dispersed through propagules, or left standing on the sides of agricultural fields (Blancas et al. 2010). Or, their growth may be enhanced through eliminating competition or promoting specific ecological conditions, for example, through the use of fire in the case of some grasses and palms (Blancas et al. 2010; Illsley-Granich et al. 2001). Still others are weedy plants that are left standing during weeding. These are usually edible or medicinal plants.

Many hypotheses exists around why some plants are more intensively managed than others. Blancas et al. (2010) refer to those of Casas et al. (1999) and Casas et al. (2001), who suggest that the degree of interaction between humans and plants (i.e. the degree of domestication or intensification) depends on: 1) the resource´s role in human subsistence, 2) their availability in relation to human demands, 3) the quality of the useful products and 4) the viability of manipulating propagules, populations and communities, which in turn depend on ecological characteristics of the resource, such as the length of life cycle or how adaptive the resource is to disturbed environments.

These are not the only aspects that affect domestication, another important factor is how the access to specific resources and their markets is organized. The impacts of overharvesting or of intensification of production through agricultural systems that may incorporate the use of harmful chemicals are risks that must be socially regulated (Belcher 2003Wiersum et al. 2013).

The role of intermediaries (middlemen)

Intermediaries play a very important role in the marketing of NTFPs. *Pita* (*Aechmea magdalenae*) intermediaries, as described by Edouard (2004), incur very high transaction costs through transporting *pita* some 2000 to 3000 km from the place of extraction and production to the retailers. These retailers in turn take on risks by lending the intermediaries money to buy the product from producers far away. These transactions imply a lot of trust between retailers and intermediaries, who are themselves at risk of not finding *pita* of good quality, and spending large quantities of resources on transportation costs. Intermediaries however are crucial to this market chain; without them, producers would not be able to get their product to retailers, as they could not cover the transportation costs from the small profits each producer can obtain from their *pita* production. In contrast, the intermediary, by collecting *pita* from many producers at a time, can cover the transportation costs.

Intermediaries perform other important tasks, such as developing a net of retailers or buyers. These middlemen not only organize the buying and the selling of a product, they also assume the associated search and transaction costs, plus other costs incurred from damaging the goods *en route*, from the deterioration of perishable goods, and also trading illegally harvested materials (Belcher 1998). Marshal *et al.* (2006) observe that because of their proximity to consumers, traders (and intermediaries) also have a determining influence on what, where, when and how are NTFPs produced, as well as the prices at

which they are bought, a fact that highlights the need to involve traders in sustainable NTFP management strategies, particularly when long marketing chains are involved.

Certification as an alternative to sustainable management of NTFPs

Although timber will most probably remain the most important forest product, the price for sustainably produced timber will not likely match the incremental costs of sustainable forest management and certification. However, forest certification appears to be one of the most successful alternative to promote sustainable forest management, including NTFPs. Certification of forest products is a means through which the cost of externalities is incorporated into the cost of production, so that the costs lie on consumers, who knowingly accept paying extra in order to influence the impacts caused by the production process. Certification is becoming a standard requirement for timber suppliers in many developed country markets. In 2006, 270 million hectares of forest were certified globally, which amount to only 7% of global forest area.

Although very little is known about consumers´ willingness to pay for certified products, certification works as an important incentive for producers to enter important international markets, because in many instances it is a requirement to enter those markets (García-Fernández et al. 2008). It also defines better management practices for trading companies, including those that have to do with cultural rights and the use of indigenous peoples' images[31] (Bolton 2012; Wiersum et al. 2013), illustrating the promise of certification as a tool for improving many aspects of forest management and conservation as well as rural or indigenous livelihoods.

Wiersum et al. (2013) suggest that the growing interest in forest certification is the result of the previous emergence of community-based forest management concepts, together with the increasing and vital participation of civil society and marketing organizations in forest policy-making. One of the important changes around the world has been the decentralization of forestry policies and the devolution of forest management responsibility to local communities; or at least, to officials at the local or regional administrative levels. In the past 40 years, according to these authors, perspectives on the benefits of stimulating community-based forest management has changed, from seeing community forestry as a way to conserve the forests while assuring that forest communities are included in the decisions made about forest management, to a broader and ever more inclusive vision that also integrates cultural and labor rights. In recent years, community forestry has expanded its influence to global forest certification schemes, through an adaptation of community forest management practices into certification schemes and vice-versa.

Although certification is an important sustainable resource management strategy, technical and legislative factors limit the application of certification to NTFPs, as certification requires that producers have legally-recognized land titles or traditional rights (Bolton

[31] As discussed by Turner (1995), in the Fair Trade experience of the Body Shop, issues arose related to the use of images of indigenous peoples in publicity campaigns. The Rainforest Alliance standards for NTFP certification now include an addendum which considers that local communities have to receive "fair and adequate benefits for any use of their name or image in marketing of NTFPs" (Bolton, 2012: Principle #2, Section 2.2.NTFP. 1).

2012) and (Pierce et al. 2008). In addition, auditing teams do not have enough experience and training to comprehend the complex livelihood implications of NTFP extraction (Rist et al. 2012). Certification standards are also very complex, with very strict requirements regarding management, type of ecosystems managed, fair labor, relation to agricultural production, transportation systems, etc. (see the Rainforest Alliance´s Standards and Requirements, Bolton, 2012). To top this list, the costs of certification are frequently high, although this lso depends on the type of product and producer.

NTFP markets around the world

Finding global statistics about NTFPs is a task that needs more investment from international agencies. Searching for NTFP statistics in the most recognized world agency through its NWFPs department (FAO's Forestry Department's Non-Wood Forest Product Division) yields very little current data about NTFPs (http://www.fao.org/forestry/nwfp/78836/es/khm/). This is due to the lack of importance of NTFPs in national accounting. Most countries do not account for NTFPs, and when they do, they account for only the most important NTFPs such as bamboo and rattan in countries like China or Indonesia.

Other efforts, such as FAO´s Forestry Department´s Global Forest Resources Assessments, include information about the value of traded NTFPs (NWFPs), which are all lumped together as a single category, making it difficult to know which products are most traded or valued. The most recent assessment (FAO 2015) reports 3.33 million USD per year as the total value of the most important commercial NWFPs. Most of this value is generated in Asia. Mexico reported in 2007 a value of approximately 21 million USD (at the time´s exchange rate). The resources reported in Mexico were: resins, fibers, gums, waxes, rhizomes, and "others". The "others" category is a bundle of many resources, such as mushrooms, berries, mosses, leaves, soil and many others, that are extracted both for subsistence and marketing purposes. Efforts to improve data collection must be strengthened, however, most of these "other" resources, which are often traded or consumed at the local level, are resources that do not enter formal markets; therefore, very little information exists about their trade and importance to rural livelihoods (Shackleton et al. 2007).

It is also difficult for national or international forest agencies to differentiate between what to include or not in the NTFP category. For example, FAOSTAT (http://faostat3.fao.org) includes Brazil nuts and rubber in its searchable database, but it does not include bamboo. Bamboo, however, is considered one of the most important NTFPs traded in Asia, with organizations such as the International Network for Bamboo and Rattan (INBAR) supporting producers and traders from many countries not only in Asia, the place of origin of bamboo, but in other countries involved in the chain of production and marketing (http://www.inbar.int/). Some other important products, such as rubber and Brazil nuts at the international level, and *pita* and *camedor* palm at the national level, have already been mentioned in the prior sections.

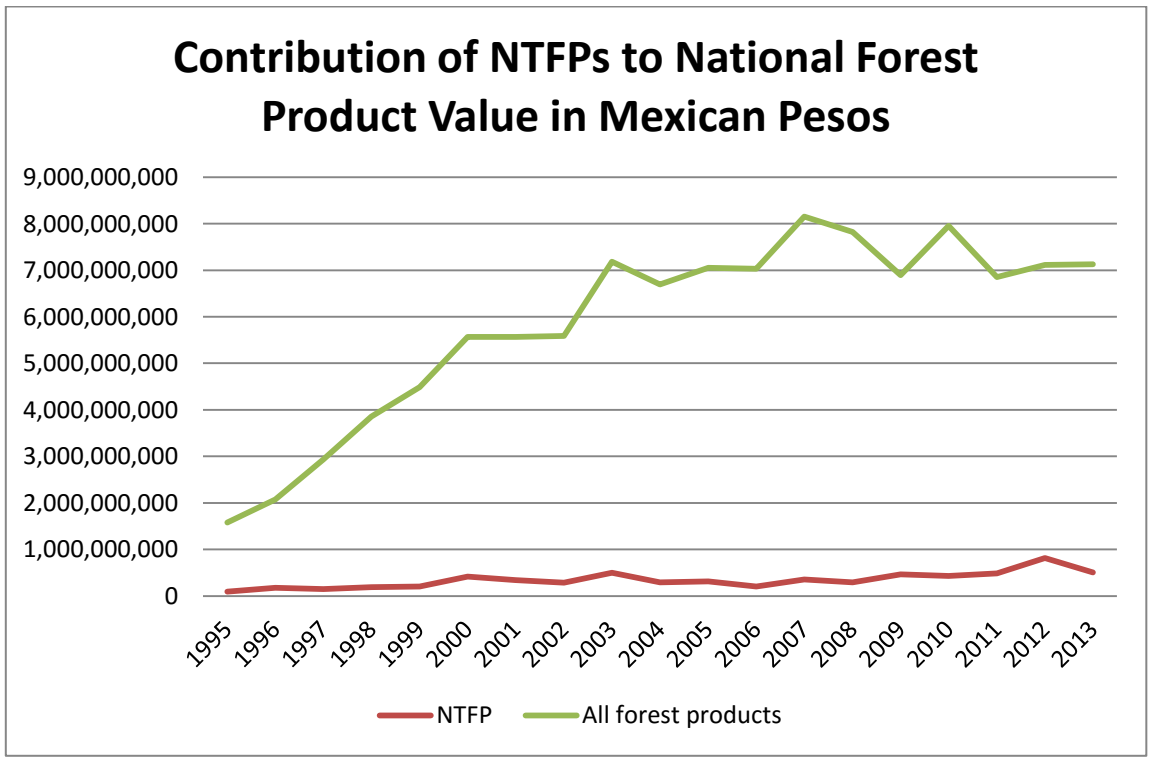
NTFP markets in Mexico and Michoacán

Mexico ranks fourth among the most biodiverse (megabiodiverse) countries in the world. In Mexico, we can find almost every ecosystem found in the world. Therefore, the country's

forest resources form a very diverse and abundant group. Sarukhán et al. (2009) estimate that in Mexico there exist from 3,000 to 6,000 medicinal species, while hundreds of NTFPs are derived from 5,000 to 7,000 plant species. Firewood from many species, for example, is a very important non-timber forest product. Estimates indicate that the volume of firewood extracted from forests is 3 to 4 times the level of timber that is extracted, and that around 5 million households use firewood as their main source of fuel in Mexico.

Although the contribution of NTFPs to national forest product value is apparently very small, this is in part due to what has already been mentioned, that NTFPs are difficult to account for because many of them do not enter formal markets. Figure 5, below, shows the contribution of NTFPs to national forest product value in Mexican pesos. The contribution of NTFPs, compared to all forest product value, has not showed a significant increase in the past years, indicating the need for a better understanding of the potential of these resources for the national economy, and also for economies at the local and regional scales (See Figure 5 below). As was noted above, inventories of NTFPs at the national level do not specify which resources are included in the "other" category. Therefore, calculations of national income derived from NTFPs refer specifically to those resources which generate the greatest income, such as pine resin).

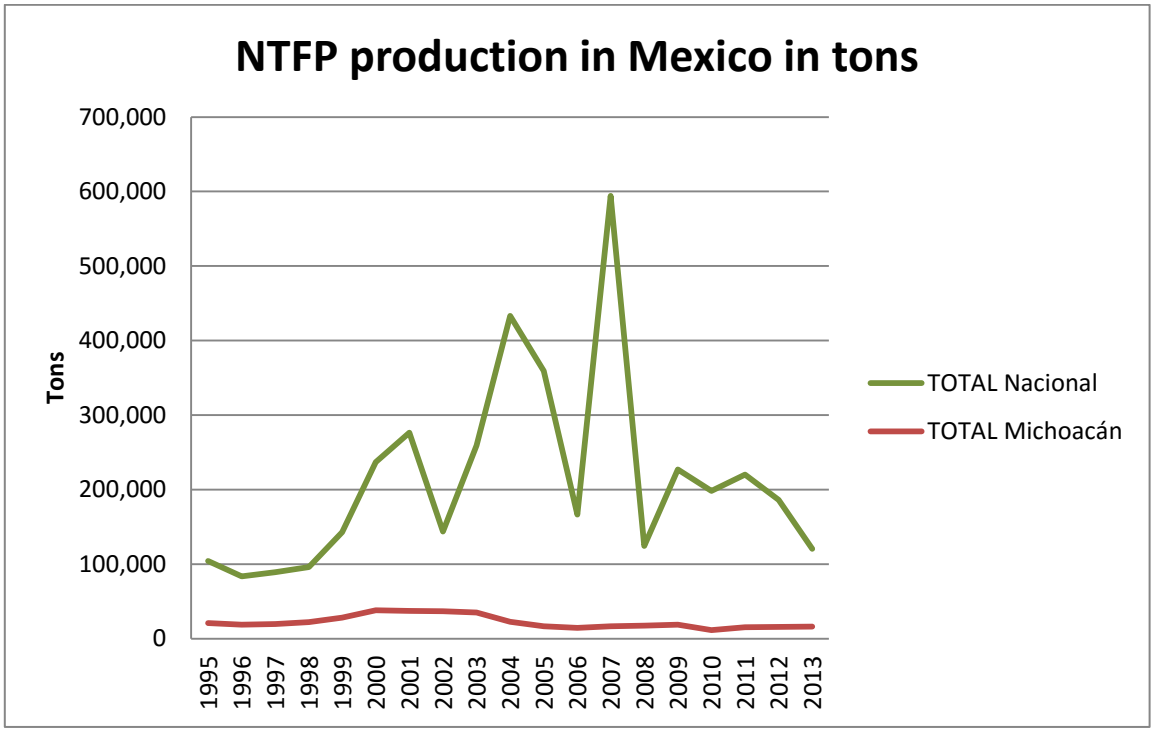
Figure 5 Statistics taken from national forest inventories from 1995 to 2013. Source: http://www.cnf.gob.mx:8080/snif/portal/economica/anuarios-estadisticos-de-la-produccion-forestal



NTFPs in Michoacán

Michoacán contributes around 2.4% of Mexico's combined timber and NTFP value and 35% of all NTFP production (SEMARNAT 2013). Figure 6 below shows how NTFP production declined in the period from 1995 to 2013.

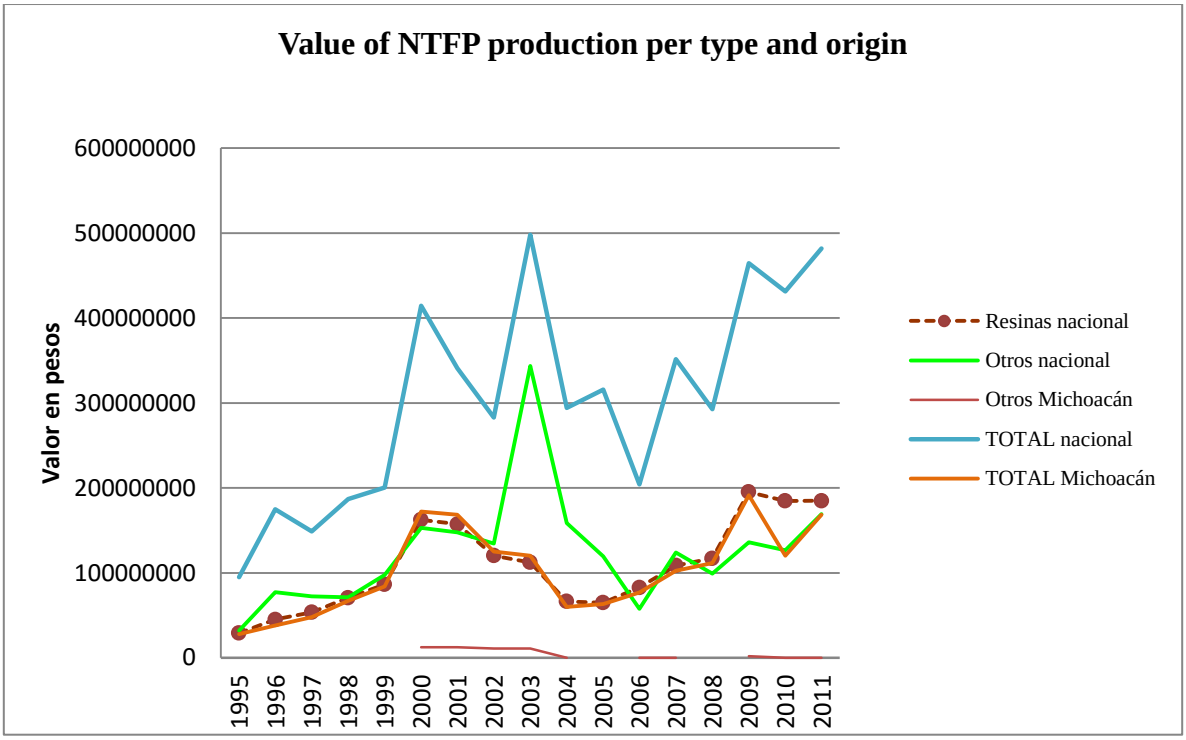
Figure 6 Contribution of NTFPs in Michoacán to the national share



This major NTFP contribution from the region is due to pine resin production (See Figure 7). Pine resin is one of the most valued NTFPs in Michoacán. We will discuss the importance of pine resin to rural livelihoods in Michoacán in our Nieves case study. As we can see in Figure 7, below, the category "others" (in green) represents hundreds of different products, from medicinal plants to resins, gums, plant parts such as leaves, etc.

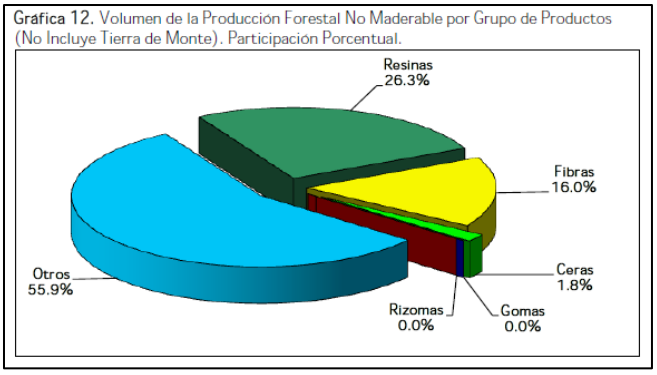
Resinas nacional = Resin national level; Otros nacional ="other" category national level; Otros Michoacán = Other NTFPs from Michoacán only; Total nacional = Total NTFP national level; TOTAL Michoacán = NTFPs from Michoacán only.

Figure 7 Value of National NTFP Production per Product Type



Other resources extracted from the temperate forests are various species of edible mushrooms (*Amanita caesaria, Lyophyllum decastes, Ramaria flova, Boletus edulis, Lentinus lepideus, Helvella crispa, Hypomices lactifluorum*) and medicinal plants such as arnica (*Heteroteca inuloides*), licorice (*Tagetes filifolia*), toronjil (*Tagetes micrantha*), quiensabe (*Satureja laevigata*), nurite (*Clamintha macrostema*), cenicillo (*Hielanthenum glomeratum*) and laurel (*Satureja macrostema*) (Francisco-arriaga & Kido-Cruz 2011)[32].

[3232] The volume and value of these resources produced is, however, seldom represented in national or global inventories, because of the small contribution that each of these resources makes to the whole. As a group of resources, they are however of even more significance to the national whole, as can be seen in the graph below, taken from the latest Mexican forest inventory (SEMARNAT 2013).



In other climate zones of the state, other resources are used, such as palm leaves (*Sabal Pumos)* in the Tierra Caliente region, used for making hats and mats, and chuspata (*Schoenoplectus sp.*) in the Patzcuaro Lake region, also used for similar purposes. Honey is also extracted in many areas, although not all communities or zones have a tradition of collecting honey. These products are sold in the nearby towns (market centers) such as Pátzcuaro, Uruapan, or Zamora, during the Sunday markets.

Pine resin is another important resource that generates about 18% of annual income for those households that own forests and extract resin (Francisco-arriaga & Kido-Cruz 2011). However, pine resin markets function differently to the other products mentioned (the chain of production to marketing of pine resin is discussed in chapter 6).

A brief case study: NTFP markets in Morelia

In a literature review, focusing on the libraries of public universities in Morelia, only one study about NTFP markets in the region was found. The study by Gómez & Angón (2004) concentrated on the five established markets in Morelia. Other itinerant markets (farmer´s markets) exist around the city; however, people who sell NTFPs from Morelia´s rural surroundings usually concentrate on those five markets. In each market, there are about four or five stands that sell products used in traditional medicine and ceremonies. In these stands one can find not only plants, but also products such as shells, fats, furs, animal feet, blood, and other products; more than 150 different plant species are sold there, according to Gómez & Angón (2004).

It is important to say that these established businesses are not necessarily owned by people who collect NTFPs. The owners rather buy from other larger markets in other cities (such as Mexico City), or they may also buy them from collectors who, depending on the quantity, take the products directly to these established businesses. The above authors also conducted case studies of NTFP collectors in two communities that used to be considered close to the city and that have now been, in at least one case, almost surrounded by the city (one community is only 6 km from downtown Morelia, where most of the established markets are located). The collectors interviewed in the study reported that they usually do not sell the products they collect to these traders, unless they have collected large quantities or the traders themselves have asked them to gather these products especially for them. Collectors stated that they do not sell to established traders because they would receive lower prices.

These collectors go to the established markets during the “plaza” day, usually a day when for diverse reasons, more people go to the market. Because product quantities may be small, they prefer to sell the products themselves, also because they can sell at higher prices. These collectors go directly to the markets to sell their collected NTFPs, but because of the small quantities of NTFPs they collect, they complement their supplies with other products that they buy, which can also be NTFPs or other agricultural products. Most of these products are linked, according to the authors, to religious Catholic festivities, such as palms and *nopales* (cactus leaves) for Palm Sunday, moss for Christmas; others are simply linked to the flowering or fruiting season, such as orchids and blackberries. Very few products are offered around the year, the exceptions are forest soils (tierra de encino) and firewood. The NTFP categories defined by Gómez & Angón (2004) are medicinal plants

(16 species), forest soil, ornamental plants (15 species that are associated with religious festivities, such as moss and pine seeds, and 11 species that are sold depending on the season, such as orchids), edible products (16 species), fuel (various pine species), live animals such as canaries, and "other", such as resins, or a type of rock used for scrubbing pots.

Results from the questionnaires applied in this study

Policies and research about NTFPs tend to concentrate on rural dwellers. However, resources collected at the local and regional scales can also be an income generation option for the urban poor (Stoian 2005). The goal behind this very brief study of NTFP sellers in two of Morelia´s markets was to learn how important are NTFPs for rural or urban people who are engaged in their trade.

In our study, 16 questionnaires were completed in two of the oldest established markets in Morelia. Both of them are located in the downtown area of the city, and are recognized as markets where consumers go in search of things like mushrooms, moss and other wild products. The sellers are people from the city or small towns occuring in a radius of 30 km from downtown Morelia. Their age ranges from 16 to 73, with an average age of 49 years old, and they are mostly female. These sellers have been selling their products in these markets for an average of 26 years, and more than half of them have been selling for more than 20 years in that same location. For some sellers, this is an activity that was carried out by their parents.

These people sell medicinal plants like anise collected from the wild, arnica, wild coriander, and "cola de caballo" (*Equisetum* sp.). They sell other plant parts, such as corn or reed leaves for making "corundas", a type of corn cake cooked with steam. They also sell orchids from the wild (whose harvest is prohibited by law because of evidence of diminishing abundance in the region) wild blackberries, moss and hay, all collected from forests. During the Christmas season, some of them make wooden houses for the Christmas Nativity decoration.

Few of them grow the products they trade, most of them either collect the products (for example, corn leaves that grow nearby their houses) or buy them from someone who collects (in the case of moss, hay and orchids, these are resources with restricted abundance which must be collected from forests inder strict regulation). 75% of the sellers make from 80 to 100 percent of their income from selling these products, while 25% generates only one-quarter of their income from this activity.

Other NTFP products extracted from forests in the region are sold by either the collectors themselves, by people who buy these resources from the collectors, or by people who have relatives who collect resources in the wild and bring the products to the city. Collectors of forest soils (tierra de monte) bring the soil packed in sacks, on the back of mules, donkeys or horses. Moss and hay are mainly collected by a few individuals, who then bring them to the city and sell them directly to small traders in the market itself. The same happens with wild blackberries. People who are both collectors and sellers are people who sell products that can be harvested in places near their homes, such as *milpas* (mixed agricultural plots), or the sides of rivers or roads.

One of the moss traders mentioned that the moss she was selling at the time (in the weeks before Christmas) was sold to her by a cousin who collects it from the forests. This type of trade is possible when urban families have relatives that either live in rural areas or who know rural areas well due to their collection activities. She however notes that before present times it used to be easier to extract moss; she would extract this forest product herself, despite being an outsider to the nearby forest communities. This extracting activity was something that her father used to do, as collecting is often an activity that is passed on from one generation to the next.

An interesting comment made by this seller is that presently, people from rural communities take better care of their resources and have even "seized" trucks full of moss from collectors who are outsiders. She says that now it is people from the community themselves who collect the resource and take it to the market to sell it to other small retailers. Some of the people who buy directly from the community collectors also serve as intermediaries for people who sell in other parts of the region. Selling the product is difficult, because many people are selling the same product at the same time, and this forces prices down (Gómez & Angón 2004 also observe this situation). Consumers are also not very aware of the extraction of these products from forests, and tend to bargain for lower prices, a dynamic that forces prices down even more.

Discussion: Markets vs. livelihoods

As presented in this chapter, the idea that marketing of NTFPs can be a way out of poverty and also an added incentive for forest conservation is controversial. Although some NTFPs, such as pine resin, rattan or bamboo, generate substantial incomes for families that depend on the extraction, processing and selling of these resources, in other cases, NTFP marketing may represent a very small amount of family income, and is more important as a complement to other subsistence activities. Promoting NTFP production can also have adverse effects on forests, by increasing NTFP demand, leading to overextraction. Through certification and other forest conservation and development programs, consumers can advocate for the improvement of harvesting conditions, so that the products are not depleted and forests are conserved. Whether a product can have potential for marketing, conservation or rural development, depends not only on the characterisitics of the product, the user or the market, but also on the type of social arrangements and institutions that exist for managing these products.

It is difficult, therefore, to reach a conclusion on the matter of whether NTFPs are important as a strategy for generating income in rural communities. A more certain way to approach this is to focus on the study of a specific resource´s production-to-consumption chain, without losing sight of other resources that are being produced and marketed in that same chain of production, as well as the importance of social institutions that regulate the use, production and marketing of these resources. The following case studies will further discuss NTFP marketing, and how it is influenced by the factors and dynamics particular to each social, environmental, economic, cultural and political setting.

CHAPTER 5. NTFPs in rural communities: resource conditions, social organization, and management in Crescencio Morales Indigenous Community

Introduction

Forest resources remain of high importance for a great number of rural inhabitants in Mexico. However, diverse dynamics (social, economic, environmental) have provoked sometimes undesirable changes in rural livelihoods, while impacting NTFP availability, distribution, use and value. The sector of the population that depends wholly or partially on their extraction and marketing (or exchange) may be strongly affected by these changes. However, the degree to which these changes affect specific sectors of the population may also be related to socioeconomic factors, such as the type of NTFP or other forest resources they use, and other productive activities.

This chapter describes the context in which NTFPs are managed in the Crescencio Morales *indigenous community* and *ejido*, including the impact that the Monarch Butterfly Biosphere Reserve has on NTFP management and rural livelihoods in the area. In order to understand the specific conditions of the case studies, this chapter will first provide a general description of the regional setting, focusing on two important aspects: the presence of the Monarch Butterfly Biosphere Reserve (MBBR), and the impact that this reserve has had on forest management in general. The second part of this chapter presents a more specific description of the communities (*localidades*) studied, and the specificities of NTFP management, availability, distribution, marketing, and the social organization around them. This section is organized according to the main topics discussed in the introductory chapter of the thesis, as well as in the policy and marketing chapters. These issues serve as a guide for an in-depth discussion of the most important problems and opportunities for NTFPs.

This chapter not only describes the current context of NTFP management, but it also analyses the issues outlined in the introduction so as to exemplify, through the case studies, the relevant discussions around NTFPs, livelihoods, conservation and development policies, and culture. It also identifies the principal changes in NTFP management during the past 30 years, analyzes the causes of change, and discusses the impact that these changes have on rural livelihoods, where NTFP management may be an important element.

Objectives fulfilled in this chapter:

1. Develop an understanding of the role of NTFPs in rural livelihoods in Crescencio Morales, with a focus on the Rural Production Unit (RPU).
2. Identify changes related to NTFP extraction, availability, management, and their impact on RPUs in the last 30 years in the Crescencio Morales *comunidad* and *ejido*.
3. Examine and explain the possible causes that provoke the changes in NTFP management identified in Objective 2 (markets, climate change, policy, tenure), using the proposed model resulting from Objective 1 as a reference to study these factors.

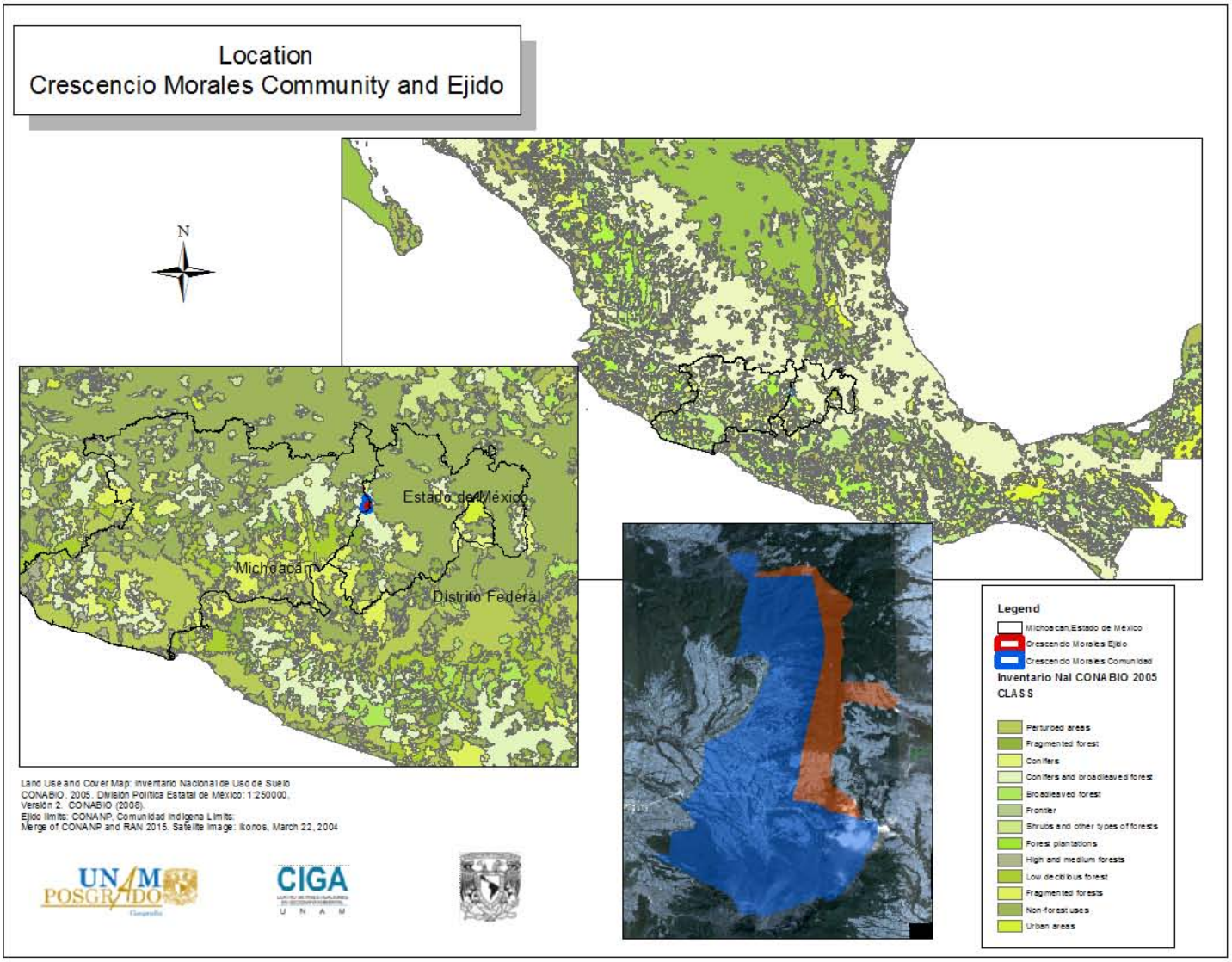
Social context of the Monarch Butterfly Region

The Monarch Butterfly region, where one of the case studies for this thesis is located, is a very important region in terms of conservation programs, due to the presence of the Monarch Butterfly Biosphere Reserve (Brenner 2006). The region has also been an important timber production center, long before the presence of the Reserve. The strong presence of indigenous populations adds more complexity to the area, as well as its proximity to two important urban centers: Mexico City and Toluca (capital of the State of Mexico), both of which depend strongly on this area for their water supply. In this area NTFPs are an important source of food, medicine, and income for rural populations, and thus, a very important part of their livelihoods. At the same time, these forest resources, and their availability, distribution and management, are being impacted by dynamics that have to do with: population growth and shift, cultural change, economic growth, nature conservation programs, and more. Salas-Canela (2013:20) describes the context of the MBBR, stating that 63% of the 27 municipalities in the region have high population densities. According to INEGI (2010), 67% of the municipalities have a "medium" social marginalization index, 29% have "very high", and only 4% have a "low" index, while 67% of the population lives in rural areas.

The Monarch Butterfly Biosphere Reserve (MBBR)

Each year the Monarch butterfly (*Danaus plexippus*) arrives in the Biosphere Reserve area to overwinter. The butterflies congregate in dense clusters called colonies (Brower 1995), a phenomenon that attracts thousands of visitors each year to experience this sight (Honey-Rosés 2009). In 1980, there was a first attempt at declaring protection zones for the areas where the Monarch butterfly hibernates and reproduces, however, no specific area was assigned. In 1986 a new decree was issued, to establish a protection zone constituting 16,110 hectares which would be located across the boundaries of Michoacán and the State of Mexico. The MBBR region covers adjoining parts of the states of Michoacán and the State of México, as shown in Figure 8 below.

Figure 8 Location of Crescencio Morales Communidad and Crescencio Morales Ejido. The Monarch Butterfly region is located across the boundaries of the states of Michoacán and the State of México



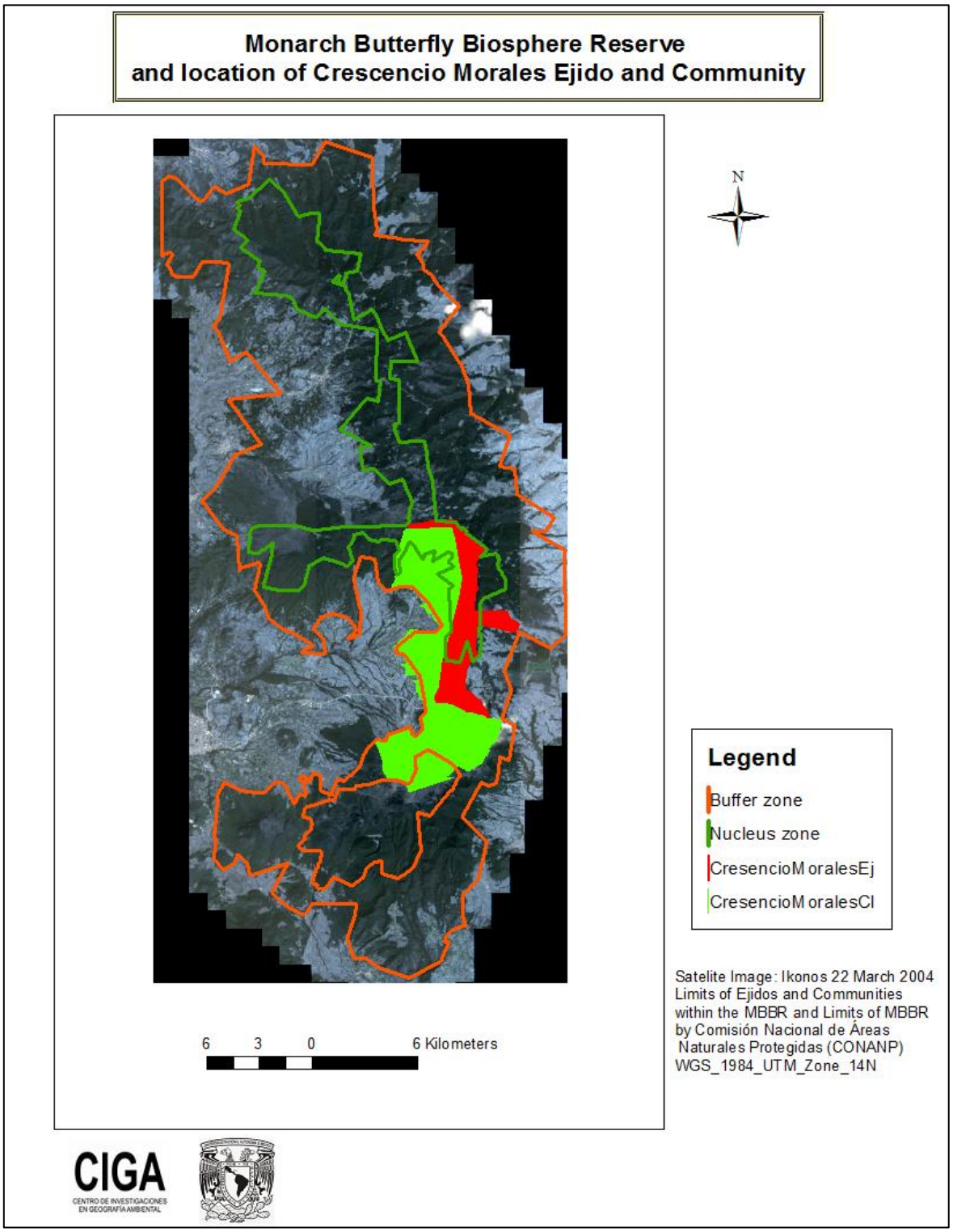
This decree prohibited the use of forest resources, including forest sanitation activities. In 2000 this NPA was upgraded to a Biosphere Reserve, broadening its area to 56,259 hectares (see Figure 9 below) (Murillo 2009). The MBBR has a high population compared to other NPAs in Mexico, close to 100,000 inhabitants. The reserve is distributed among at least 100 properties, of which 70 are communal (59 *ejidos* and 13 indigenous communities) and 21 are small (private) proprietors (*pequeños propietarios*) (CONANP 2001; Murillo 2009).

The Reserve is located in an important water-catchment basin that provides water to important urban centers, such as Mexico City and the city of Toluca (Brenner 2009), a reason why this area has acquired even greater political importance. Within the Cutzamala Basin, the *Sistema Cutzamala* or Cutzamala System has been established, to capture water and perform conservation activities to assure that environmental services such as water catchment are maintained. Many communities participate in the Cutzamala System´s PES Program (Personal observation and interviews). Another PES program is that of the Fondo para la Conservación de la Mariposa Monarca (or Fondo Monarca, FM) (Murillo 2009).

Illegal timber extraction has been identified to be the most important cause of deforestation within the NPA (Honey-Rosés 2009; Ramírez et al. 2003). Significant deforestation and degradation rates seem to be increasing (Murillo 2009), regardless of the establishment of the NPA and efforts to preserve its forests. Navarrete et al. (2011) have observed an annual loss rate of dense forest of 2.28% within the NPA, due mostly to illegal logging. The problem of illegal logging has affected the area for many decades and continues to be an obstacle to forest conservation (Chapela & Barkin 1995; Merino-Pérez n.d.; Merino 1995; Merino 1999; Murillo 2009; Navarrete et al. 2011; Rendon-Salinas et al. 2003; Savko 2002; Valera-Bermejo et al. 2005; Van der Meer 2007).

When the NPA was declared in 1980, forest resource extraction, including forest sanitation activities, was prohibited within the nucleus zone. The MBBR has a Management Plan that has not been revised since 2001, when it established the type of management allowed in each zone. The reserve has two types of management zones: the buffer zone and the nucleus zone, although each type of zone has several polygons throughout the reserve (see figure 9). When in 2000 the NPA was upgraded to a Biosphere Reserve, and expanded in size, permittable management activities were also expanded to include extracting dead and diseased wood from the nucleus zones (Murillo 2009). There is also a protected area that is located outside the main reserve (the Cerro Altamirano buffer and nucleus zones).

Figure 9 Monarch Butterfly Biosphere Reserve.



Physiography, Hydrology and Geology

The MBBR is located within the Transverse Volcanic Belt, which is a discontinuous mountain system, intensely dissected by strong tectonic processes, consisting of a set of hills and hillocks that make up 77% of the total area. These mountains are separated by small intermontane valleys representing 12% to 6% of the surface. The highest elevations of the region are located mostly in the MBBR (CONANP, 2001).

Because of the mountainous terrain that characterizes the area, the lithic composition of landforms and the presence of steep slopes and scarcity of alluvial deposits, the area is considered an important aquifer catchment area, where several water bodies, springs and reservoirs can be found. Thus, it is very important for the water supply of cities such as Mexico and Toluca, both with large urban populations (CONANP, 2001).

The dominant soils are andosols, acrisols and luvisols; all are soils unsuitable for agricultural production, and better suited for forests. At lower elevations there is a transition area from forest areas to agriculture and livestock (Navarrete et al. 2011). It is important to note that regardless of the region´s unsuitability for agricultural production, agriculture is one of the main productive activities, as will be illustrated below.

Forests

Michoacán has an area of 5,883,695 ha and a forest area of 1.69 million hectares (29% of the state). Most forests are coniferous, but there are also important tropical deciduous and evergreen forests. A high percentage of the forest area has experienced some degree of degradation (Merino 2004). The causes of degradation are multiple; however, the change in land use to avocado orchards is, according to Navia & Barsimantov (2007), the main cause of deforestation in the temperate forests of Michoacán. In the MBBR, the principal causes of perturbation and deforestation were, in 2003, timber extraction and land use change to agriculture and cattle herding (Ramírez et al. 2003). In the eastern part of the state, where the MBBR is located, the predominant vegetation is *oyamel* or sacred fir (*Abies religiosa*) forest, in co-dominance with pine (*Pinus* sp.), oak (*Quercus* sp.), and cedar (*Cupressus* sp.) (CONANP 2001). Most of the timber industries of Michoacán are in this region, and are represented as small industries.

Productive activities in the MBBR

According to CONANP (2001), the main economic activities of the population are primary sector activities such as agriculture, cattle herding and forestry. However, the importance of the primary sector as the basis of social production has decreased in recent decades, while the secondary and tertiary sectors have gained importance. Tourism, which is mostly associated with the butterfly sanctuaries within the MBBR, is an important economic activity in some communities, although not in Crescencio Morales because there are no sanctuaries in this community.

INEGI (2010) reports that only 25% of the population is economically active and employed. Results from this PhD research show that the main economic activity is agriculture (64%), followed by "other activities" including local trade (19%), masonry work inside and outside the community (9%) and embroidery and crafts (11%). A large

proportion of the male population migrates temporarily to Mexico City to work, mostly in the construction sector. These men usually work during the week in Mexico City and return to Crescencio Morales (or other communities in the region) during the weekend. Others migrate for several months and return to their community for activities related to agricultural production (April to September). 5% of the employed population raise minor livestock or work in avocado orchards (7%).

Avocado orchards are becoming a new production opportunity. Michoacán is the state with the highest avocado production in Mexico, and Mexico is the major avocado producer in the world (SE 2012). This new market opportunity has nourished the idea that many people in rural communities hold, that avocado can be a very profitable product. This situation has an important impact on land use change, particularly in the temperate forest areas, where great tracts of forests have been deforested to establish avocado orchards (Navia & Barsimantov 2007). The Monarch Butterfly region is no exception; more and more people in this area are also turning to avocado production. Some people even hold the opinion that avocado orchards generate important income, and some even think that it is a good alternative to forests, since they allow the land to keep a "green" cover.

Although the majority of respondents are engaged in a single activity, there are those who perform different activities, either seasonally or throughout the day. Many state and federal support programs have been implemented with the intention of taking pressure off forest resources through alternative production systems, or income generation systems such as ecotourism; however, their success has been questioned by several authors (Brenner & Job 2006; Chapela & Barkin 1995; Martin 2001; Merino 1995; Van der Meer 2007).

Agriculture

For understanding agricultural production, it is important to have knowledge of the area to which inhabitants have access for productive activities. The average land area owned by inhabitants in the region is 1.2 hectares per household, according to this PhD research survey, ranging from 0.5 to 2 hectares, according to CONANP (2001). Agricultural production is mainly carried out with animal traction, given the financial constraints as well as the topographic limitations for tractor use. Corn varieties are native and are derived from the selection of seeds from previous harvests. In the same parcel with corn, other products are grown, such as zucchini (*Cucurbita* sp.), *chilacayote* (*Cucurbita* sp.), and beans (*Phaseoulus* sp.). Chemical fertilizers are used without technical supervision and although yields are very low, agricultural production represents a strong element of rural livelihoods. Natural fertility conditions show variations in slope, depth of A horizon, the chemical composition of soils as well as the quantity of rainfall. Farming in the area has low levels of productivity and high incidences of losses, resulting in uncertainty for producers. Although there is backyard production of fruits, medicinal and ornamental plants and small livestock (chicken, duck, sheep, etc.), the lack of financing, of training to process products, and of markets to sell them in, are among the factors that limit the possibilities for these activities to generate significant revenues (CONANP, 2001). Most of the goods produced are for subsistence purposes only.

Animal husbandry

Livestock production is intended mainly for self-consumption or for agricultural production (to supply animal traction and manure), and only a small proportion is sold in the local markets. The cattle that are raised here are known as "Creole", meaning they is not a specific cattle breed, but a mixture of breeds. The cattle are raised in rustic barns, while pigs and poultry are raised in backyards. Livestock production, coupled with the production of vegetables, and ornamental and medicinal plants, provide an additional source of income in situations of economic necessity (CONANP 2001).

Community Management of Forest Resources in the MBBR

In *ejidos* and indigenous communities in the MBBR, forest zones are still managed collectively. This characteristic of management may lead to the "Tragedy of the Commons" (Hardin 1968), especially in cases where no one seems to own the resource and no proper management exists. However, when clear limits and rules are defined, people may act to prevent this tragedy. In some communities, forest areas are taken care of by the group of *comuneros* or *ejidatarios* who come together to perform conservation activities promoted by government programs, such as ecological restoration; however, there are very few incentives for patrol activity (Merino 2004). Other times, it is within the *ejidatarios´* or *comuneros´* community duties to perform maintenance activities to keep the forest free of debris, to prevent fires and to participate in reforestation efforts (source: personal observation). In many cases inhabitants may receive monetary rewards for performing conservation activities, paid by external funds that have been created through an intergovernmental and NGO effort to fight illegal timber extraction, such as the Monarch Butterfly Fund (FMCN 2012). Reforestation is an activity that is done periodically, despite the low survival rates observed and the high costs involved (Jaramillo-López et al. 2015). In some instances, local people receive a small payment per tree planted ($0.08 USD per tree). This money is for the transplanting of trees, but no money is given to take care of the trees once they have been transplanted. People may perceive this payment as income generated from this activity, although the payment is designed only to cover the planting costs.

Coordination of actors and programs in the MBBR

In order to understand the sociopolitical complexity of the region, (Brenner 2009) identified the most important actors influencing forest management. Among the most important are the Federal Secretariats such as SEDESOL (Social Development Secretariat), CONAFOR (National Forest Commission), CONANP (National Natural Protected Areas Commission), international NGOs such as WWF, and local organizations such as Alternare and Biocenosis, as well as community groups and representatives, such as the *comisariados* and community (*ejido asamblea)* members.

Some problems that have been identified include the great number of insufficiently coordinated actors and programs. Federal programs seldom consider local conditions in their design, and there is a prevailing lack of internal community organization. Support for primary activities such as agriculture or forest conservation is usually given to sectors of the population with formal land tenure, that is, *ejidatarios* and *comuneros* (*Ejidatarios* belong to *Ejidos*, while *comuneros* belong to *Indigenous Communities*). For other sectors of the rural population (mostly *avecindados*) it is difficult to access these programs, given that they lack legal tenure which is often a requirement for participation in the programs. Some

communities in the area are more proactive in involving these more marginal sectors of the population (eg. women, *avecindados*), or in distributing resources among a wider group of people. In other communities, interviewees observe that resources stay within a reduced group of people, mainly those who form the *mesa directiva* (*ejido* Board of Directors) and their close friends and relatives. It is interesting, even humorous, to hear comments made by former members of the Board, about current members of the Board in the tone of "the current *comisariado* only keeps resources for himself and his friends, he doesn´t distribute them". Yet, when other people are asked about the former Board members, they will hold the same opinion. This opinion is most strongly felt within the *avecindados*, who sometimes do not even know about the programs active in their communities.

Presence of indigenous communities in the MBBR

A distinctive characteristic of the MBBR region is the presence of a large indigenous population. The ethnicities represented are mostly Mazahua and Otomi (the specific name for the Otomi population living in this area is *hñahnu* according to INALI, 2015). The indigenous population in this region has a "high" and "very high" fertility rate as well as a high and very high infant mortality rate. Indigenous communities also have "very high" and "high" marginalization indices (CDI 2010). Migration is an important phenomenon in indigenous communities in this region (CDI-PNUD 2006), and is seen in the temporary migration of men to large cities such as Toluca or Mexico City, where they work in the construction industry during the week, returning in some cases to their native towns for the weekends. The presence of indigenous communities in the region, and particularly within the MBBR, adds a cultural dimension that makes this region also a target for special projects from institutions such as the Comisión Nacional para el Desarrollo de los Pueblos Indígenas (CDI), and NGOs whose target groups are these populations. The degree of marginalization of most indigenous groups in Mexico is high, as they face many obstacles to their economic, political and cultural development. These obstacles intensify conflicts within communities, amplifying the pressure put on natural resources.

Land tenure in the MBBR

In the case of the communities in the Monarch Butterfly region, common lands are managed by assigned groups of *ejidatarios* or *comuneros*; consequently, resources assigned to conservation activities are either distributed among those who participate in these activities, who are mainly the land owners, or used for purposes that benefit the entire community. Given the nature of social relations in many rural communities, government funds are usually distributed among the group of *ejidatarios* who are members of the community Board of Directors (*consejo*) and their close relatives or acquaintances. The perspective of those who are not part of this group (*avecindados*) is that they are being excluded, yet, when there is a shift in power relations and a new council is voted in, those who become part of the privileged group seem to forget that they once complained about inequalities in the distribution of government resources.

Comuneros and *ejidatarios* own their own plots of land, which average 1.2 hectares per *ejidatario* or *comunero.* This area is used mostly for subsistence agriculture, for growing maiz, beans and squash.

Social context and organization for the management of NTFPs and other forest resources in the case studies

This section describes the specific characteristics of forest resource management in the two *localidades* (translate these highlighted words) studied, El Rincón and San Mateo, which are part of the Crescencio Morales *comunidad indigena* and *ejido.*

Crescencio Morales consists of 14 locations (INEGI, ITER 16XLS10, 28.9.2013) in the territories occupied by the e*jido* and/or by the *indigenous community*, although the *comisariados* mention 17 locations. Crescencio Morales is a large area of 8,121 hectares which, however, is divided into two different territorial legal entities: the *ejido* Crescencio Morales and the *comunidad indígena* (*indigenous community*) Crescencio Morales (see Figure 10). What is interesting is that inhabitants, when asked, talk about one single community, ”Crescencio Morales”, yet, as territorial conflicts begin to appear in the conversation, they talk instead about the *ejido* or the *community.* To add to the complexity, there are people who live in either the *ejido* or the *comunidad,* but who are owners of lands in both the *ejido* and *comunidad,* so that they are both *ejidatarios* and *comuneros*. The 17 communities or *localidades* are distributed within the *ejido* and *comunidad indigena*. The largest communities are San Mateo (one of the study sites), Macho de Agua and El Tigre (see Table 6 below).

Table 6 Communities within the Crescencio Morales ejido and comunidad indigena.

Type of agrarian nucleus	Name of locality	Number of Inhabitants
Ejido	Loma de Aparicio	51
	El Lindero	299
	La Dieta	514
Comunidad Indígena	El Capulín	269
	El Tigre	1029
	La Viguita	193
	Río de Guadalupe	769
	El Tigrito	290
	Los Escobales (La Barranca)	887
	Boca de la Cañada	655
	El Espinal	136
	Agua de la Rosa	52
	Los Encinos	23
	Macho de Agua	1686
	Albergue Shalom	10
	La Cumbre	389
	San Matero-El Rincón	1,925
	Total	9,177

The *ejido* Crescencio Morales was established on September 20, 1927. It has an area of 1,709 hectares, distributed amongt 27 *ejidatarios*, 22 *avecindados* and 250 *beneficiarios* (see Glossary). The parceled area is 605 ha, the common use area is 1,099 ha, and the area occupied by residential settlements is only 14 ha. The indigenous community (*comunidad indigena*) Crescencio Morales has an area of 7,022 hectares with 2,073 *comuneros*. It has not been registered in PROCEDE[33] (RAN 2014).

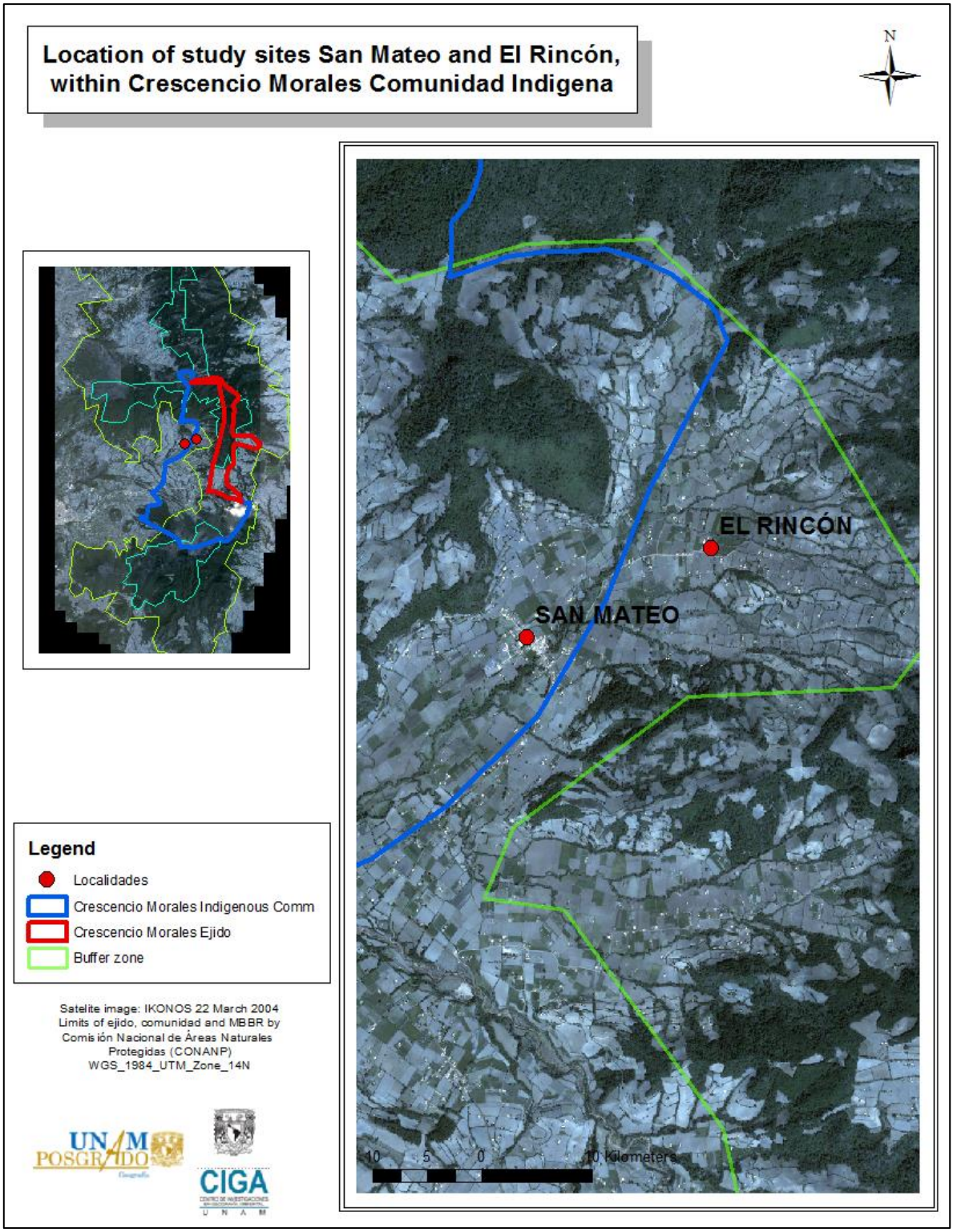
Together the *comunidad indigena* and the *ejido* have 9,177 inhabitants (INEGI, ITER 16XLS10, 28.9.2013), although the *comisariados* report a higher number, close to 10,000.

Given the territorial extent and the large population, this study concentrates on only two localities of the Crescencio Morales *comunidad indigena* (See figure 10), but due to their proximity and similarities, the two localities are taken as one area of study (see Figure 10). These localities, San Mateo and El Rincon, are located next to each other and are close to both the forest and the NPA. The two localities have 1,925 inhabitants who live in 368 households. Of this population, 1,396 (72%) are indigenous of Mazahua ethnicity (INEGI,

[33] The Programa de Certificación de Derechos Ejidales y Titulación de Solares or PROCEDE is a program that aims to regularize social land tenure, that is, land which is owned by ejidos and communities. It has been active since 1992 (RAN 2003).

ITER 16XLS10, 28.9.2013). San Mateo has the setting of a small village, while El Rincón is composed of settlements spread more widely across the surrounding area.

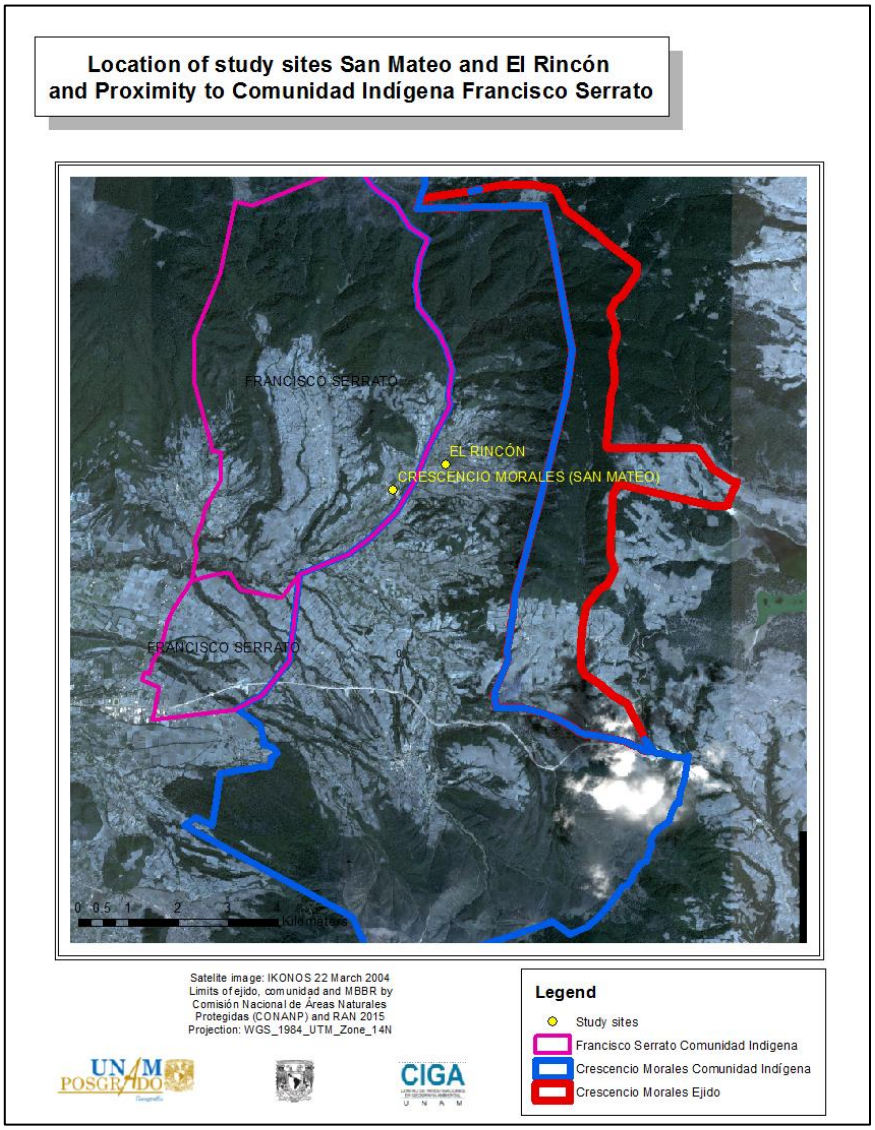
Figure 8 Location of study sites San Mateo and El Rincón, Comunidad Indígena Crescencio Morales



Resources used and common uses

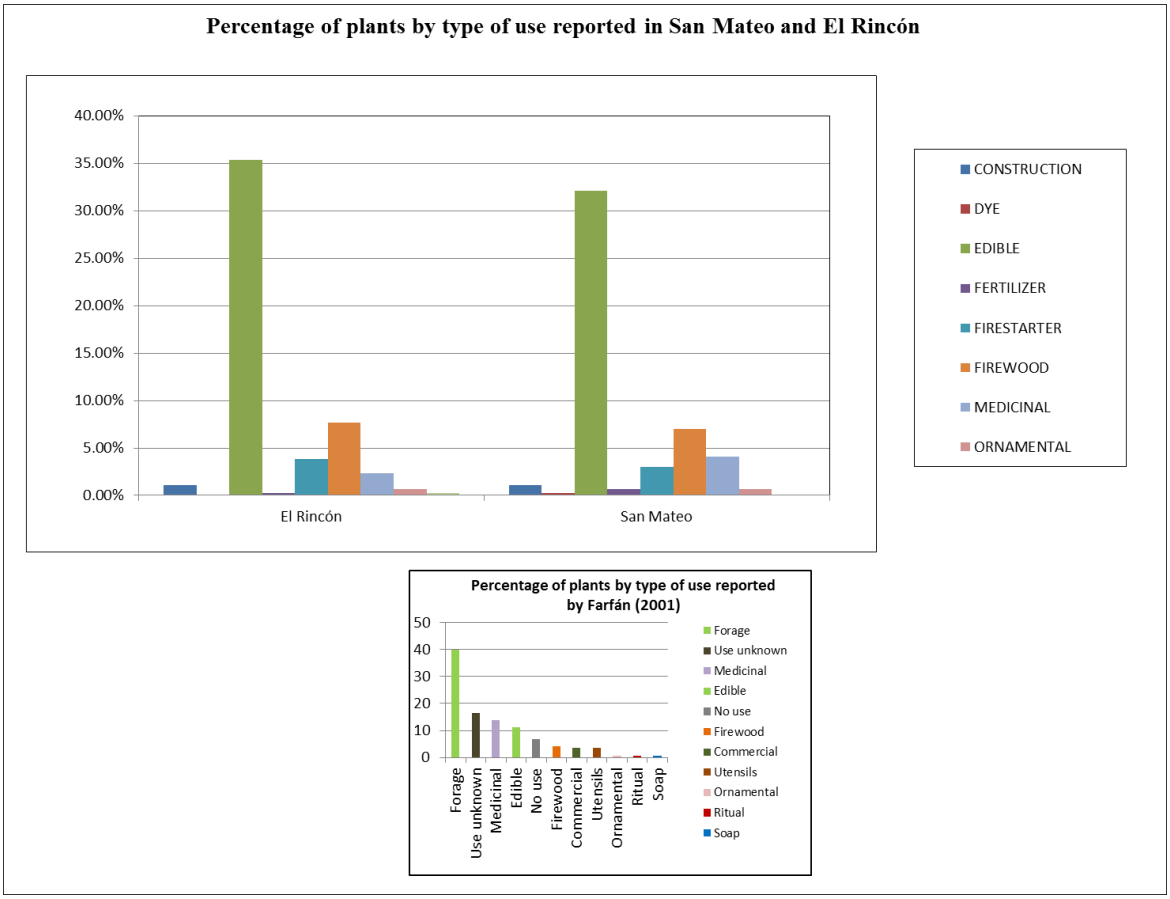
An important source of information regarding NTFP availability and uses in the area is Farfán (2001), an ethnobotanic work concentrating on spatial distribution, availability, resource uses and the Mazahua nomenclature of plant resources. This information is complemented by work of this Ph.D. thesis, in the two case studies in the Crescencio Morales indigenous community. It is significant that the work by Farfán was done in Francisco Serrato *comunidad indigena* which borders with Crescencio Morales on the San Mateo side (see Figure 11). Therefore, due to its proximity, Farfan´s (2001) work is a good approximation to the contexts of San Mateo and El Rincón.

Figure 9 Location of localidades studied in Crescencio Morales



Farfán (2001) registered 190 plant species (50 families, 130 genera), and information from this researcher´s questionnaires reported 35 families, and 47 genera. Farfán (2001) also distinguished plants based on their uses. She identified 10 uses and a group of plant species that had no particular use. This information is synthesized in Figure 12, below. The figure shows in the large graph a comparison of plant uses reported in San Mateo and El Rincón, and below a smaller graph that shows the uses reported by Farfan (2001) for Francisco Serrato.

Figure 10 Plants reported in San Mateo and El Rincón, Crescencio Morales Comunidad Indigena, by type of use. The inset graph shows those reported by Farfán (2001) in the neighbouring Francisco Serrato Comunidad Indigena.



Annex II shows the combined results of the data collection efforts: group interviews, questionnaires, and a literature review on NTFPs in El Rincón and San Mateo. The group interview in La Viguita was taken as the primary reference, to which the information from questionnaires and key informant interviews was added, and lastly a consultation with Farfan´s (2001) work. Other sources of information were also consulted - Rzedowski & Rzedowski (2005) and internet sources such as CONABIO (2012) and the UNAM (2009) web repositories of Mexican plants (wild and domesticated) with their common names and their uses according to the regions or indigenous groups that use them. These sources were helpful in finding scientific names. When the species name could not be determined, the genus level of identification was kept. Another solution was to the common names used, but this is problematic, given that many common names are similar, or may refer to different species in different parts of Mexico.

I would also like to see more discussion of th fgure, for example, highlighting the most important uses in both communities, and how they compare to one another or to Farfan's community.

Analysis of the most important issues in the NTFP literature

After the above introduction to the environmental and social context of the MBBR region and the communities studied, this section offers a more in-depth discussion of the issues highlighted in the thesis introduction, and their relevance in the context of the Crescencio Morales communities selected. The reason for this was to concentrate our discussion on the outstanding issues regarding the potential of NTFPs in these rural communities, as alternatives to generate income, to support conservation efforts, and to contribute to the reproduction/rescue of traditional knowledge and cultural practices related to NTFPs as part of a wide livelihood spectrum.

The source of the product

Forest resources used

Until the 1950s, forest exploitation in the study area was limited to domestic use, today it plays an important role in the regional market economy, given the increase in population, the lack of employment opportunities, and increasing demand for wood products (Brenner 2009). Timber is not extracted in large amounts, but through constant small-scale forest clearance, which results in various levels of forest degradation. The principal commercial species extracted are *Pinus*, *Abies*, and to a lesser degree, *Quercus* and other broadleaved species (Murillo 2009).

Two types of forest exploitation exist today: in the first, local communities are permitted to legally extract timber and wood products in small quantities. These products are used for cooking or construction purposes within local communities and are seldom sold to external actors (Brenner 2009; personal observation). The second type of extraction is performed illegally, during the night, and is either carried out by local inhabitants or people from urban areas who immediately sell the logs to the sawmills of local timber merchants (in Ciudad Hidalgo, Toluca, Zitacuaro, Ocampo, Angangueo, San José del Rincón). Efforts to stop illegal logging have been unsuccessful. However, in certain cases, communities such as San Juan Zitácuaro have been able to slow down this activity. Some factors that may determine a community's ability to fight illegal logging are the community's history of organization, its level of social homogeneity, and the existence of agreements between the local elites and foreign actors (Martin 2001). Still, the region has the potential to generate wealth through more sustainable forest management, as has been demonstrated by three communities in the area (San Juan Zitacuaro, Carpinteros, Donaciano Ojeda), which in recent years have received the Forest Merit Award of CONAFOR (2012 and 2013) and a `Nature Conservation` prize from SEMARNAT.

Despite efforts to sustainably use forests, illegal logging remains a serious problem. An important factor to consider is that, although communities may be interested in regulating timber extraction, the legal requirements are a major obstacle to the implementation of better management practices. As Merino (2004) argues, these rules affect the quality of timber extracted, given that permits may take a long time to be approved, thus pushing the

harvest dates into the rainy season, with a direct impact on timber quality, or on the other hand, promoting corruption to speed up the process.

Despite the economic importance, local industries have not been able to add value to forest products. Timber production is partially done without legal authorization. In 1998, it was estimated that the processing capacity of the industry in the area exceeded by 300% the authorized volume (Merino 2004).

The forest resources most commonly extracted are "greenwood", "dead" wood, pine resin, mushrooms, wild plants (mostly medicinal) and pine needles, although very few of these are sold in external markets (Martin 2002). Farfán (2001) reported the use of 190 plant species in the community of Francisco Serrato, next to Crescencio Morales; and CONANP (2001) reports edible species such as: *Cucurbita ficifolia, Amaranthus hibridus, Brassica campestris, Medicago sp, Malva parviflora, Nastartium officinale, Cucurbita sp., Opuntia ficus indica, Agave sp,* a diversity of mushrooms, and fruits such as wild blackberry *Rubus sp, Prunus mexicana,* and *Crataegus* spp, among others. Traditional knowledge exists related to the use of medicinal plants such as: *Satureja* spp, *Ternstroemia* sp, *Gnaphalium* spp, *Chenopodium ambrosoides, Tagetes lucidum* and *Tagetes micrantha*. (Annex II presents a list of plant species found in the Crescencio Morales area, their uses and distribution). Among the wild animals consumed are species such as: *Didelphys virginiana*, *Sylvilagus floridanus*, *Scuirus aurogaster*, *Dasypus novencinctus, Mephitis macroura*, *Crotalus triseriatus, Columbina inca*, *Columba fasciata,* and *Zenaida macroura*.

Merino Pérez (2004) reports that in the core zone of the reserve, tree diameters range from 2.7 to 89.5 centimeters; however, those between 30 and 50 cm are the most frequent, while those with diameters greater than 60 cm constitute only 5% of the tree population. The middle shrubby stratum is not very dense, and in some areas it is missing altogether. The most common species found in the shrub stratum are *Senecio sp., Baccharis conferta, Cestrum thyrsoideum* and *Eupatorium mairetianum.* In the most perturbed areas, *Ternstroemia plinglei* (Tila; linden flower) is found in greater relative abundance, particularly in the shrubby stratum. These observations, based on samples from Donaciano Ojeda and Cerro Prieto, point to the possibility that perturbation may actually be beneficial to the collection of NTFPs such as *Ternstroemia pringlei,* given that this species appears at higher frequencies in perturbed zones, just like other NTFP species reported by Arnold & Ruiz (1998). Thus, fallow land and perturbed zones may even be valued by some people for the higher abundance of certain NTFPs, such as in the example described by Lowenhaupt (2016), where people in Japan perturb the forest on purpose in the hope of seeing the fungus called *matsutake* grow.

Within the buffer zone, forest management is allowed; however, it must be done under a conservation regime, such as the Mexican System of Irregular Ordination of Forests (MMOBI) which is based primarily on extraction of wood through selective felling of individual or small groups of trees (Murillo 2009). These measures were implemented without a scientific understanding of? the regeneration needs of these specific forests, according to Merino (1999). However, as Lowenhaupt (2016) suggests, more than science may be necessary to understand the importance of human-nature interactions, which may

define a specific type of forest, and produce forest resources that may be particularly valued by the people who manage those forests.

Nature of production of the product

The `nature of production' of a NTFP has to do with where the product comes from, whether it is collected in forests or in other non-forest environments. A product, even though it may only be collected, passes through a "production" process, that is, the type of management necessary to take the resource to its place of consumption. The 'nature of production' of the product is related to the management activities that are carried out to produce a sellable or usable product. These management activities are associated with the tools, spaces and machinery needed to process the resource to convert it into a "product".

Thus, this section deals with all of these issues: where resources are found or grown, and how are they collected, transported, transformed or packaged. Although this term, the `nature of production', may be confused with the 'scale of production', there are subtle differences. The scale of production refers to whether a product is produced in small scale, such as home packaging, or whether it is transformed into a secondary product and packaged in large factories. The section on scale of production will provide examples to illustrate the differences between the nature of production and the scale of production of a product.

Availability of resources

Through participatory mapping, group interviews, and questionnaires, it is possible to learn about the availability of NTFPs; that is, the quantity of resources available for extraction. As mentioned before, the study did not include vegetation samples, but rather collected information through ethnographic methods based on the perception of participants.

The availability of resources in general has decreased in the past years (the time horizon used in the interviews and questionnaires was 30 years). The reason respondents gave for this decline was an increase in the number of people who collect NTFPs, particularly mushrooms, which are the most important resources in Crescencio Morales, together with blackberry (*zarzamora*). Illegal logging also impacts mushroom availability in particular, because the whole environment is affected when illegal loggers extract wood. One of the informants (Doña Lupe) claims that illegal logging is responsible for a decrease in forest humidity, which is necessary for mushrooms to grow. She also says that illegal loggers affect the linden flower tree by cutting it directly, or by the impacts of tree felling in general. These small shrubs are also being cut for firewood by people from the community.

Figure 11 Area where a tree has recently been cut and extracted, found in a visit to the buffer zone near El Rincón.

Collection of dead wood for firewood is a factor that affects the availability of mushrooms, since many of these mushrooms grow on decaying wood. People now collect more firewood or travel to zones that had not been used previously for firewood collection, but are now under more extraction pressure, due to the population increase and the degradation of other forests.

Population increase, as well as the lack of employment opportunities, may be affecting the availability of mushrooms and other forest resources, as observed by one of the interviewees:

> **Respondent**: *Pus estos últimos años que he ido ya hay menos, porque ya han entrado otros a recolectar.* (Well, in the last years that I have been there, there are fewer (mushrooms), because other people have begun to collect there).
> **Interviewer:** *O sea ya hay más gente que se dedica a recolectar hongos.* (So, more people now are collecting mushrooms?)
> **Respondent:** *Sí* (Yes)
> **Interviewer:** *Y por eso hay menos.* (And that is why there are fewer).
> **Respondent**: *Ya hay menos ya. Porque ahora se va todo el pueblo y antes éramos tantitos.* (There are fewer now. Because now all the town goes there and before we were just a few).
> **Interviewer**: *¿Y tú por qué crees que ahora van más?* (And why do you think more people go there now?)
> **Respondent**: *Pus no ha de haber trabajo en otra cosa.* (Well, I think there are no jobs elsewhere).

> **Interviewer:** ¿*Y las otras personas que los juntan también los venden?* (And the other people who collect them, also sell them?).
> **Respodent**: *Sí.* (Yes).

There is also the problem of people ignoring boundaries in order to access these resources. In Crescencio Morales there is a strong feeling that people from the neighboring State of Mexico (which borders with the Ejido/Comunidad Crescencio Morales) enter their territory and extract resources such as mushrooms, as well as timber and firewood. It is, however, not always easy to know who are the people extracting these resources illegally: if they are from Crescencio Morales, or if they are in fact from the State of Mexico.

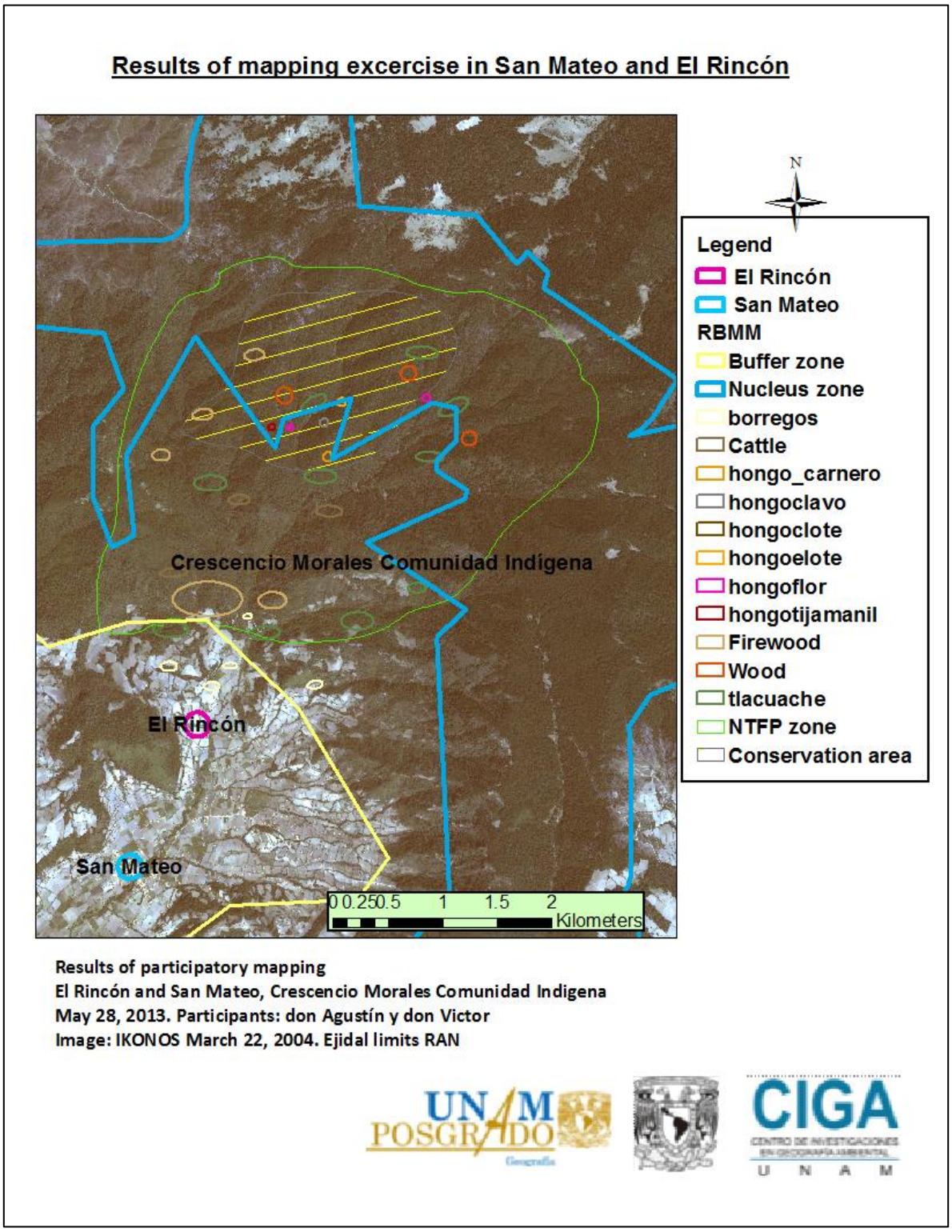
Areas where NTFPs are found (land cover) and distance to their sources

Figure 14 shows the results of a participatory mapping exercise in El Rincón. The areas with names such as *hongo carnero, hongo clavo*, etc., refer mostly to areas for the collection of mushrooms (*hongos*) of different species, *tlacuache* refers to the area where *Didelphis marsupialis* can be found, 'other' is the name given to areas where wood and firewood and most other NTFPs are collected, including medicinal plants, and 'conservation' refers to areas that participants considered important for conservation purposes. The map also shows the boundaries of the MBBR nucleus and buffer zones.

In El Rincón and San Mateo, the areas used for collection of NTFPs are: roadsides, gullies, streams and nearby forests. On average, people invest less than two hours per day in collecting a variety of resources, and most resources are collected in areas close to their homes. The group of resources collected in the forests includes firewood as the most important resource, followed by mushrooms, with other resources collected in lesser quantities, such as *té de monte* (*Satureja macrostema*). According to participants taking part in the mapping session in El Rincón, the above resources are mostly collected in the area delimited by green lines in the map below (Figure 14), which corresponds to a forest area partly within the buffer and nucleus zones of the NPA.

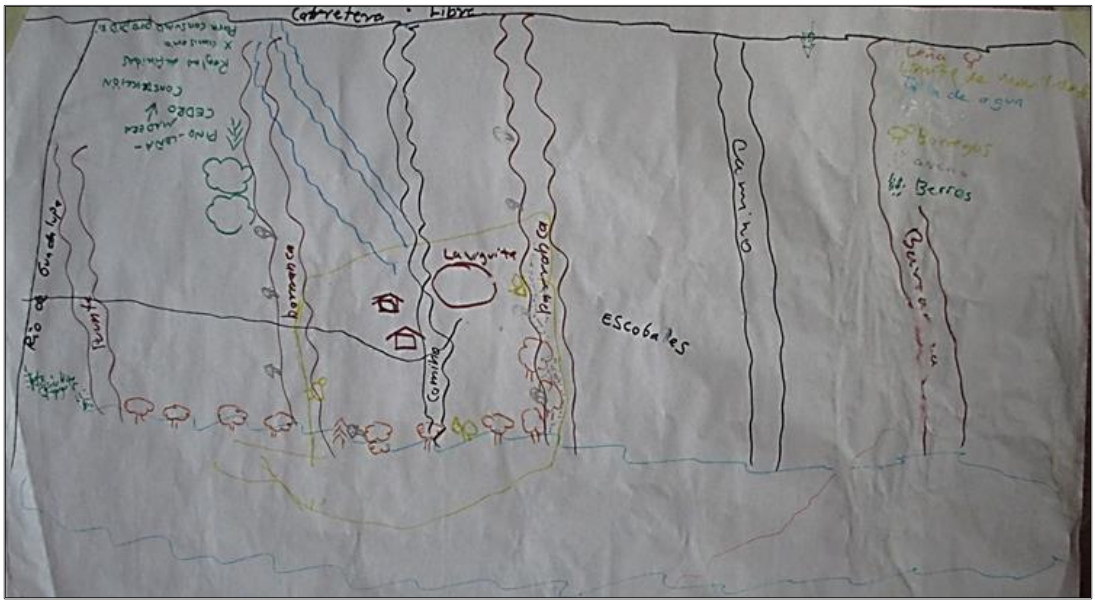
Another resource of economic importance to a sector of the population is *zarzamora* (blackberries, *Rubus* spp.), which are mostly collected on the roadsides, streams and gullies of the community. Blackberries are weedy plants that grow naturally on the sides of roads. There is no special management given to these plant; they are open-access resources which anyone can collect. Just as is the case of any other resource collected in the area, those people who arrive earliest in the day are usually the ones who collect larger quantities of blackberries, firewood or mushrooms. People who arrive later cannot find ripe fruits and collect what has been left over. In this study´s interviews, there was no mention, however, of plants being maltreated to the degree where they can no longer produce fruits. This is in contast to the Nieves case, where people mentioned that blackberry bushes are not treated well by extractors from outside the community, and therefore these plants die or take more time to produce extractable fruits in the season.

Figure 12 Results of a participatory mapping session in El Rincón.



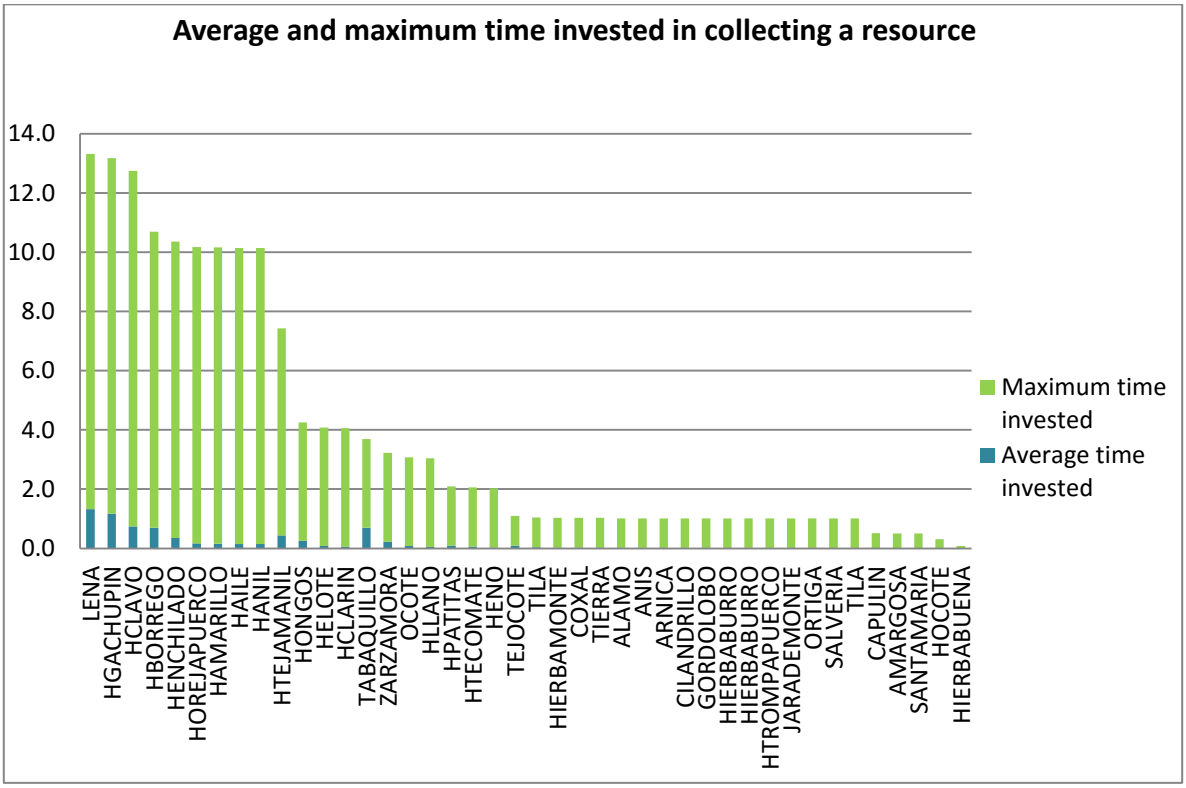
In La Viguita, the resources used are collected in the gullies close by. La Viguita is a community that is far from the forest, yet it is crossed by many gullies (barrancas), as the map below shows (this map was drawn by women from La Viguita). The most important resource collected in the gullies is firewood (*Pinus* spp, *Cedru*s spp). However, the gullies are also used for feeding sheep and in some instances for collecting medicinal plants. Edible species are collected in the margins of the streams, *berros* (Latin name) being the most important species. Figure 15 shows a mental map drawn by women from La Viguita.

Figure 13 Mental map from the Group Interview in La Viguita



There are differences in terms of the distances that people from these two communities walk to get to the NTFP collection zones. El Rincón is a community that is closer to primary forests than is La Viguita; therefore, people in El Rincón still have the habit of going to the forest to collect wood, and on the way, they also collect other resources, such as *Té de monte*. Contrary to what may be found in La Viguita, people from El Rincón go to the forest specifically to collect mushrooms during the summer months (the rainy season, even as late as December). Figure 16, below, shows the average time that people invest in collecting different NTFPs, as well as the maximum time. The maximum time refers to the maximum time reported by an individual for collecting a specific resource.

Figure 14 Average time invested in collecting each resource by collectors from El Rincón and San Mateo.



The resource that requires the most time for collection is firewood, however, other perhaps less important resources, such as mushrooms, also require a significant amount of time for their collection. There may be many reasons why people invest more time in collecting these resources. Firewood is a very important resource for rural livelihoods, since it is people´s primary source of fuel for cooking. Mushrooms, on the other hand, are an important source of food during three months of the year, while for some people, they also represent a source of income. The same for blackberries, which are an important ingredient in the local diet during the blackberry season, and for some people, a source of income. Another reason why more time is spent in collecting specific resources, has to do with higher market prices for these resources (see Table 8 below).

An interesting difference observed between La Viguita and El Rincón was that in La Viguita, resources are collected in the gullies close by people's homes, while in El Rincón resources are collected in the forest. Thus one conclusion is that people collect NTFPs in areas close to their communities, even if those areas have reduced availability and reduced species diversity because of reduced forest cover. Few people go to areas where NTFP availability is higher if these are further away. Nevertheless, according to informants, many people from other communities visit the forests of El Rincón, because it is thought that there is greater availability of NTFPs there than in the woods near their own communities. There may be some truth in this perception, because the presence of the NPA may enhance forest conservation and thus, increase the NTFP availability in these areas.

Collection in areas such as *milpas* or *acahuales* is unusual, except for blackberries and some medicinal plants, which ar found on the roadsides and paths. There seems to be a strong preference for collecting resources that grow in the forest. This may be because there are differences in the taste and quality of the products. People prefer, for example, to consume *tabaquillo* that grows in the forest, even though they may grow *tabaquillo* in their own backyards, because according to local residents, it has better taste and scent. Studies on these differences would provide a more complete understanding of preferences for resources that grow in the forest versus those that grow in *milpas*, roads or backyards. The preferences may also be associated with use of allopathic medicines provided by the local health centers, which has contributed to a reduction in the number and quantity of medicinal plants that are collected, many from secondary forests (*acahuales* or *milpas*). These changes may be affecting plant use and transmission of knowledge about plant uses from one generation to another, reducing in some way the importance that these secondary forests had for local residents in the past.

Management activities

Management activities are difficult to categorize, because they depend on the type of resource, but also on the type of user. It is important to observe the associations between the type of resources collected and the groups of users. The following sections describe management activities based on the most used resources, and management activities based on characteristics of the users.

Management by type of resource

Most resources collected are common pool resources, that is, resources that can be accessed by anyone in the community or even people from other communities. No special care is taken of these resources; but there were comments in the interviews and questionnaires about the negative impact of illegal logging on NTFPs. Therefore, any prevention of illegal logging would impact positively the availability of NTFPs and wood. In recent years, some communities in the area are achieving better organization for surveillance patrols around community forests. In some communities, such as San Juan Zitácuaro and Carpinteros (both in Zitácuaro Municipality) this new organization has prevented illegal loggers from entering community forests. The medium term effects of this surveillance are felt in the communities, whose members comment on the improvement in the general state of the forest due to this activity.

In Crescencio Morales there has been an effort to organize surveillance groups; however, this is a difficult task, because these groups do not always receive payment for this activity. They are paid using NPA resources from programs such as the PES, where the principal activity is guarding the forests located within the NPA, particularly the nucleus zone, where no productive activities are allowed. Thus, the PES serves as a source of compensation for the foregone benefits of production activities. The *comisariado* of Crescencio Morales and his board have organized surveillance groups and are changing the financing strategy so that more people can participate in thse groups and for longer periods of time, even if the payment is symbolic (that is, a very small amount). The current *comisariado* mentioned that vigilance had been extended from 2 months during the past *comisariado´*s administration, to longer periods (5 months at the time of the interview) under the present

comisariado. This Ph.D. researcher was able to confirm that surveillance is in fact performed, aftr making a visit to a guardhouse in the nucleus zone. The horse trip to arrive at the guardhouse took about two hours. The guardhouse is located at the boundary of Crescencio Morales with the community of El Rosario, a community that was mentioned several times as being responsible for illegal logging. During this trip, the researchers found a group of vigilantes who had found illegal loggers and had just apprehended them to turn them over to the local municipal authorities. Not recently, but during the surveillance efforts in Crescencio Morales a number of years ago, an individual was shot to death for illegally cutting trees and refusing to turn in his gun. Some of the violent encounters between communities may also be fed by conflicts having to do with undefined community limits (borders). It is in the interest of most communities to work on conflict resolution, but they also consider it to be of high importance to stop illegal loggers in the whole area.

Blackberries: Resources such as blackberries (*Rubus sp.*), which can be found on roadsides and gullies, do not receive any special management. However, there is a tacit understanding among the people who collect these fruits, about the importance of caring for blackberry bushes. They take special care in collecting so as not to break branches or step on the bushes. It is interesting that blackberry bushes have been planted along the roadsides by some owners of roadside plots. Anyone from the community can collect from these cultivated plants. There is still an acceptance of sharing resources such as blackberries, and an understanding that these resousrces are usually collected by particular individuals who, in most instances, sell these fruits within the community. There is also a perception that people who collect NTFPs are in more precarious economic situations, that is, they lack land or access to productive resources and therefore have to make a living out of collecting and marketing NTFPs. Thus, this implies consent on the part of the community to the collection of common pool resources by certain individuals, even if the resources have a known individual owner.

Firewood: Firewood is collected by most households in these two communities. This is most people's most important forest collection activity, and is performed either daily, or every other day, once a week, once every two weeks, or once a month. Collectors can be children, middle-aged women, or older men. The frequency of collection depends on who collects, how close the collectors live from the forest, and what means they have for transporting what they collect. People who own horses or donkeys can collect and transport larger quantities of firewood, and therefore invest less time in collecting these resources; they may collect only once a week, or every two weeks. Those who do not have these transport options collect whatever they can carry in their arms (*brazada*). People collect dead wood that they can find on the ground, and they generally recognize the government's prohibition on cutting branches from live trees, or cutting down trees for firewood. Most firewood is collected from the nearby forests, during which times many other resources are also collected, such as *tabaquillo* and mushrooms.

Wood for construction: Timber is cut by middle-aged men, and as an *ejido* regulation, it is to be used for personal construction purposes only. Every *comunero* or *ejidatario* can cut down a tree for construction purposes, if they can justify the need. This wood is cut every three years per household, approximately. Only one tree is cut each time. There are people, however, who cut trees illegally to sell them inside or outside the forest.

Mushrooms: these products are collected by both men and women of all ages. Young women (25-45 years old, approximately) are accompanied by their young children (8-15) and sometimes, by their husbands. Older people collect mushrooms at the same time that they collect firewood. People who collect mushrooms for marketing purposes are usually young women (25-45), who later sell these resources within the community, or in the Zitácuaro market. There is no particular care taken in the collection of mushrooms. Gatherers pull the entire mushroom taking no care to protect the volva or other parts of the mushroom. People who plan to market mushrooms usually arrive in the mushroom zones very early in the morning. They usually walk around 1.5 hrs to these zones; this means that to arrive at the collection zones before 6 a.m. they have to begin their walk around 4:30 a.m. Those who arrive the earliest collect all the mushrooms available on that day (mushrooms emerge every day during the season). People invest many hours in collection activities, up to 10 hours per collection trip, as seen in the "maximum time invested" in Figure 16. It is rare to find old mushrooms; usually, people collect them the day they emerge. People who collect mushrooms for their own consumption do not gather all the mushrooms available, but only what they can carry with them as they perform other collection activities (such as firewood collection).

People who collect mushrooms are usually the same people who sell them within the communities or in the market in Zitácuaro (1 hr 30 mins from San Mateo and El Rincón by local transport). When mushrooms are sold within communities, sellers go from house to house or they collect for people who have specifically asked for them. They prefer to *ranchear*, or sell these resources within the community, because this option is more profitable. If they intend to sell at the Zitácuaro market, they have to collect larger quantities so that they can pay the bus fare. Going to Zitácuaro usually requires more time, effort and money, and it also implies that less money will be earned, since there is likely to bmore competition from other people, which forces them to lower thee ir prices.

Other related forest resource management activities: Other activities performed in the forests have to do with conservation programs for PES or the like, that require participants to complete activities such as pruning, digging trenches for water capture, clearing fire lines, etc. These activities are done by men from a broad age range (from 15 to 70 years old).

Collection seasons

NTFPs are collected throughout the year (see Table 7, below). The collection of a resource happens during its growth season. Some resources are available throughout the year, such as firewood or *tabaquillo*, whereas others require more intense collection efforts because they only grow in certain months, meaning that whoever collects these resources may have to forego other important activities, such as agricultural production which overlaps with part of the mushroom season. The most intensive agricultural production activities are in May. Agricultural activities end in October; however, there may be times when there is no need to perform any activities, and others when there is a need of intensive labor over one day or week every month. Thus, NTFP collection is done during the times when agriculture and other important activities are not happening.

Table 7 Collection seasons for NTFPs most used

Collection season for NTFPs most used												
	J	F	M	A	M	J	J	A	S	O	N	D
Leña												
Té de monte												
Ocote												
Madera construcción												
Tierra												
Hongo clavo												
Hongo enchilado												
Hongo patitas												
Hongo oreja de borrego												
Hongo gachupin												
Zarzamora												
Hongo amarillo												
Tejocote												
Hongo borrego												
Capulín												
Hongo tecomate												
Hongo cote												
Hongo tejamanil												
Musgo												

Impact of other productive activities on NTFP management and use

As mentioned before, the main productive activities in the Monarch region are those related to agriculture, forest collection, and work in the secondary and tertiary sectors. None of these activities are important for income generation, a situation that forces migration to nearby towns and cities. NTFP collection is mainly important for subsistence rather than for income generation, except for a few particular cases such as Ana and Doña Lupe (who are refered to later on in this chapter). Productive activities like agriculture and cattle ranching have little impact on NTFP collection, in part because these activities are done during specific times of the year, leaving time for collection during the freer times. Migration, on the contrary, consumes most of the time of those who migrate (mostly young men in their 20-30s), while those who stay (mostly their wives, mothers, or sisters) must cover all the primary activity tasks such as agriculture and cattle ranching. Given the time and physical effort required for these activities, those who stay in the communities may find it difficult to devote time to NTFP collection. Most people however, manage to collect mushrooms at least once in the season, while firewood collection is assigned some of their daily time as there is no alternative for fuel.

Scale of production

Discussion of the scale of production focuses on whether the activities done for NTFP management are for subsistence or for marketing at bigger scales. The primary differentiating element is how the end goal of affects the intensity of extraction, and consequently, resource availability and ecosystems.

Index of intensity of use and local value of resources extracted

Learning about the quantities of the resources that people extract is important in order to assess the relative importance that resources have in comparison with others, or with other sources of income or employment in the area. Comparing the intensity of use for each of the resources may give an idea as to which resources merit more attention in terms of conservation efforts, or which may have more potential for becoming part of a marketing chain.

An intensity of use index was created for this thesis research to learn about the quantities of each resource extracted, and the importance these resources may have for local populations. The index created is inspired by the work of Arellanes et al. (2013) and Blancas et al. (2013). These indices combine information such as the quantity of resources used, the distance to the resources, and the times per year these resources are used. The index created for this thesis included information about the quantity of the resources collected, the number of times a resource is collected per year, and the distance to the source of the resource. The data used were gathered through 70 questionnaires conducted in El Rincón and San Mateo, these constitute 10% of the households in both communities.

The purpose of creating an intensity of use index was to learn how much time and effort is devoted to collecting each of the resources: the time it takes to gather the resources is a direct measure of the time investment; the distance travelled to the sites can be a measure of the effort invested in accessing the sources of the product; and the quantities gathered may be an indicator of the importance of the resources collected. The use intensity index therefore may allow us to understand which resources are more important for which people, regardless of other variables that may affect their decisions, including, for example, the price of the collected resource in a market or the taste of the product. To create a more integrated index, the questionnaires would have had to ask participants about all of these variables. However, the design and selection of variables was based on the information considered the most important at the start of this investigation. Table 8 presents information about the value and prices assigned to the different NTFPs collected.

Information about resource availability is also important; the research decision however was made not to sample the resource availability directly, but instead to estimate it by looking at previous scientific studies made in the study area. The focus was on the importance that these resources have for the livelihoods of the people in these case studies, and examining the availability of these resources came in second place. The inquiries focused on people´s perceptions, rather than on sampling the vegetation cover.

The measurement units used by local people for various resources were identified and then all quantities converted to kilograms. People were also asked about the number of times each resource had been extracted in a year, and the distance they travelled to the source of the resource. These data were normalized by dividing each datum by the highest possible number (for example, 30 days divided by 365 as the highest number of days). The calculation of quantity took as the highest quantity that which was reported for firewood, because it had the highest numbers, and for distance 12 hours was taken as the longest length of travel time. The three values: (a) number of collection days; (b) quantity

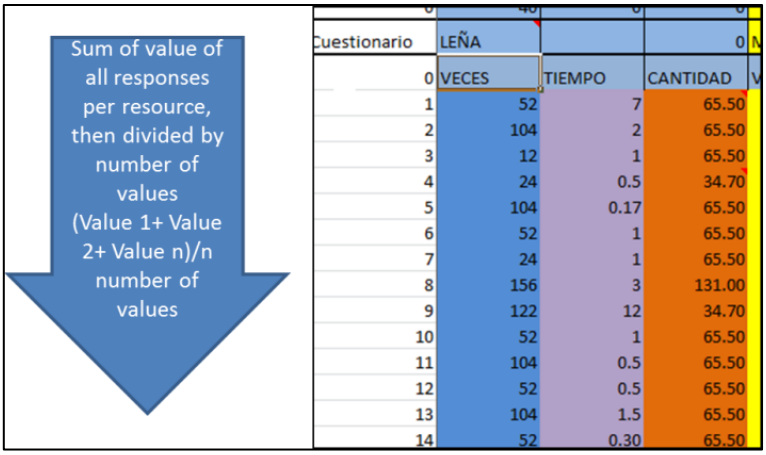
collected; and (c) distance to the sources were summed and divided by three. The highest index value possible is one, and this maximum level would indicate a resource that is highly valued, and for which a lot of time and physical effort has been invested.

Example of calculation:

Resource	Days collected	Quantity (kg)	Time to area of collection (hrs)	Normalized value days collected	Normalized value quantity	Normalized time	Use Intensity Index
Yellow mushroom	36	10	1	.098	0.002	0.083	.061

Days collected = (36/365)*1 = 0.098
Quantity collected = (10/3600) = 0.002
Time to collection area = 1/12 = 0.083
Use Intensity Index = (days collected + quantity collected + time to collection area)/ 3 = (0.098+ 0.002+ 0.083)/ 3 = 0.061

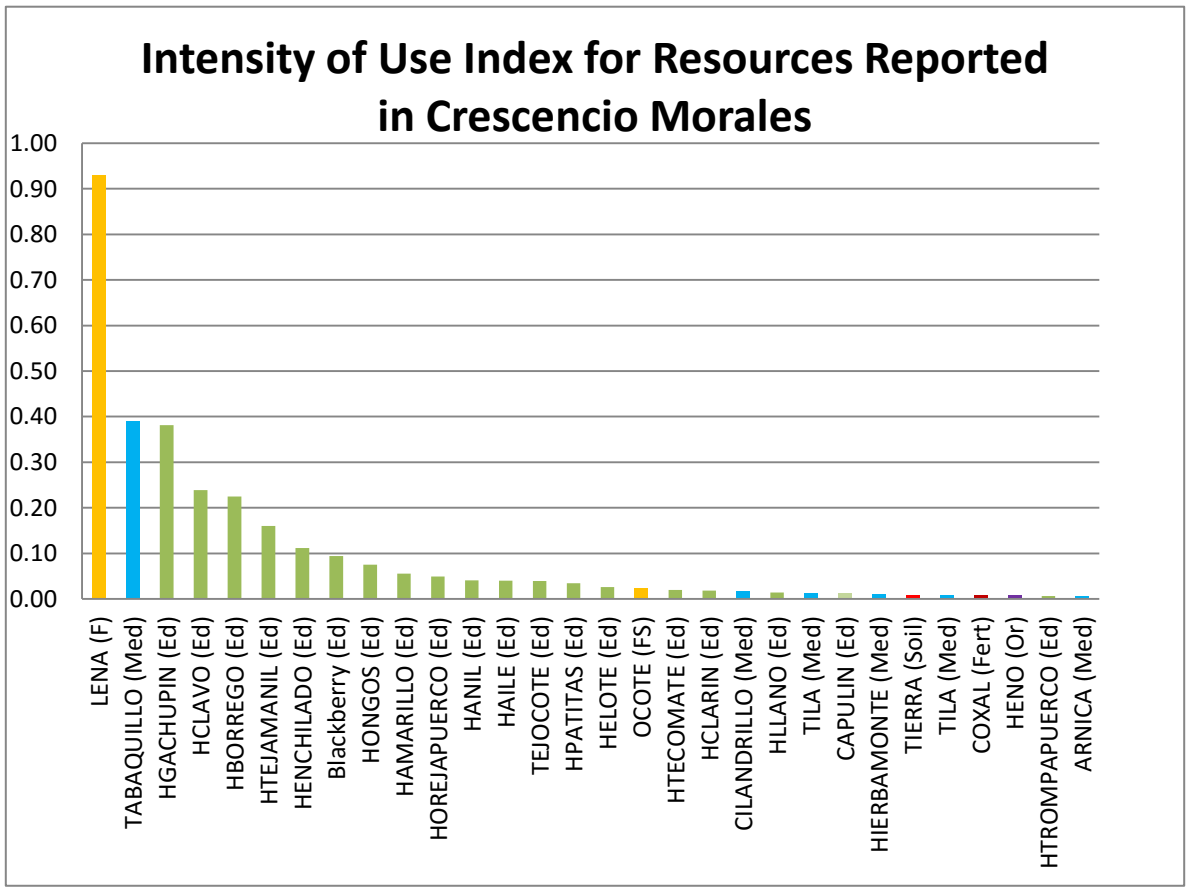
This index was calculated for each resource extracted, by averaging the values obtained for each resource from all the questionnaires.



Cuestionario	LEÑA		0
0	VECES	TIEMPO	CANTIDAD
1	52	7	65.50
2	104	2	65.50
3	12	1	65.50
4	24	0.5	34.70
5	104	0.17	65.50
6	52	1	65.50
7	24	1	65.50
8	156	3	131.00
9	122	12	34.70
10	52	1	65.50
11	104	0.5	65.50
12	52	0.5	65.50
13	104	1.5	65.50
14	52	0.30	65.50

The Use Intensity Index for each of the resources studied is shown in Figure 17, below.

Figure 15 Index of Use Intensity for resources reported in Crescencio Morales. Resources with very small quantities were not reported. Each resource has a marker that corresponds to its use: F= Firewood (Orange), FS= Fire starter (Orange), Med= Medicinal (Blue), Ed= Edible (Green), Fert= Fertilizer (Brown), Soil (Red) and Or= Ornamental (Purple).



It is difficult to compare resources that are very different in their nature. That is, there are some resources that are extracted in very large quantities, partly due to their nature, but also to their economic importance. Take resin as an example: each time a producer collects resin he or she collects quantities that range from 60 to 400 kg, whereas when resources like blackberries or mushrooms are collected, the highest quantities collected are round 60 kg. Perhaps a more useful comparison would be to compare the monetary value of these resources when they are sold. This is however not feasible for most resources, since they are collected for subsistence purposes.

The purpose of the Intensity of Use Index is to combine different measures of use and value, the quantity collected, and distance to collection zone, as indicators of how much people appreciate these resources (by investing the time needed to reach a collection zone, for example), while the quantity extracted and the number of days spent on extraction give an idea of the importance of these resources for subsistence. Another way of finding out how appreciated these resources are would be to ask a question such as “how much is this resource valued for local consumption”, with the answer options being “highly valued” to

"not valued" among others. This question was not included in the questionnaires, but it can be inferred that those resources most valued are also those which are most extracted, whether for subsistence or market purposes.

Therefore, in the case studies in the Crescencio Morales Indigenous Community the forst resources most used are: firewood from many tree species (pine, oak, cedar, etc.); *tabaquillo* or *té de monte*; mushrooms such as *gachupin (Helvella elastica Bull.), clavo (Lyophyllum decastes), borrego (Sparassis sp.), tejamanil (Clitocybe sp.), enchilado (Lactarius deliciosus (L.)), Amarillo (Cantharellus cibarius Fr.) and trompa de Puerco (Gomphus sp.)*; *blackberries (Rubus spp.); tejocote (Crataegus pubescens (Kunth) Steudel); capulin (Prunus serotina Ehrenb subsp. Capuli (Cav.) McVaugh); linden flower (Ternstroemia pringlei); and forest soil,* among others which are extracted in very small quantities.

As can be seen from Figure 17, those resources that have the highest Intensity of Use Index are firewood and *tabaquillo,* and mushroom species such as *gachupin, clavo and borrego*. Other mushroom species, although important, hold lower values, and the same is true for the medicinal plants. In Table 8, below, the mushrooms with the highest Intensity of Use Index values are those that also generate the greatest income (the *clavo* mushroom can generate up to $8,400 pesos per season, and *gachupin* $4,800 per season, according to key informant interviews). *Tabaquillo* also appears to be a very important resource, with the second highest Intensity of Use Index value, but it does not generate as large an income ($1,400 per season) as the mushrooms. However, the high index value points to its importance for subsistence and its cultural importance in the local diet and healing traditions. Blackberries hold lower index values, even though the income they generate is similar to *tabaquillo,* and they are also important for subsistence, being used in local diets. The reason why blackberries do not generate as high an income as other resources, even though commonly consumed, may be because they are readily available close to settlements. Thus, people do not need to invest much time in accessing the blackberry sources. This may also increase competition for blackberry sales within the communities, because there can be more people collecting and selling them.

What can be inferred from the Intensity of Use Index is that firewood is the resource that receives most investment in time and physical effort. To understand why other resources that seem to be important do not entail more effort in their collection, it is necessary to look at other issues associated with the resources, such as marketing factors and consumer preferences. The next section integrates a more in-depth discussion of these other themes.

Marketing and certification

Marketing

Marketing has an important influence on the management of NTFPs and their availability. In the two communities in Crescencio Morales that were studied here, support from government or NGOs in marketing NTFPs was insufficient. Most efforts to market these resources came from the gatherers themselves, since little support is given through government programs, although the Sub-Director of the MBBR mentioned a few marketing projects such as the collection, production and marketing of honey and derived products

such as soap, shampoo, etc. Promoting a brand from the MBBR would support products produced in and around the reserve, and with the assistance of NPA and NGO personnel, could incorporate sustainable practices towards conservation and livelihood goals. This is still an important challenge for organizations working in the area.

Marketing strategies were similar for almost all of the resources sold in the MBBR. Below is a concise description of marketing strategies for each of the most marketed resources in El Rincón and San Mateo.

Mushrooms: There are two ways in which mushrooms are marketed. One way is that some people collect and sell them within the community, a practice called *ranchear*. Many people do this when they have time to collect enough mushrooms. Sometimes people collect for their own consumption, but if they can collect more than they can consume, they sell the rest within the community.

The other way is when the more serious NTFP collectors, those who depend on these resources for income, invest enough time to collect larger quantities, which they then sell at the market in Zitácuaro (an hour and a half away from these two communities). When they cannot collect enough to make it worth traveling to Zitácuaro, they also may resort to *ranchear* in the community.

Blackberries: There is a stronger practice of collecting mushrooms than there is of collecting blackberries. However, people do buy blackberries from people who specialize in marketing them. It is usually women collectors who, through *ranchear*, sell these within the community. But when the blackberry season overlaps with the mushroom season, or when these collectors also find other resources such as *tabaquillo*, they can then afford to travel to the market in Zitácuaro. Sometimes, what makes marketing these resources difficult is that people in the communities cannot buy very large quantities, thus the preference for selling in the Zitácuaro market because traders there can sell larger quantities at one time and do not have to spend much time looking for buyers. Whereas, in the communities, they have to walk sometimes long distances to find buyers. Selling at the Zitácuaro market however usually implies that prices will be low, because there is more competition in the bigger markets than in the small villages. Many traders thus prefer to *ranchear*, even though it implies more physical effort in walking to people´s houses, because the gains are higher.

Té de monte or *tabaquillo*: Usually, this product is sold by specialized NTFP collectors outside the community in the Zitácuaro market. Within the community, people can collect this product themselves, and many people grow it in their gardens, so there is less need for buying it from collectors. Locals however prefer wild *té de monte*.

Firewood: This product is sold mostly by people who have a means of carrying it, such as by donkey, and it is then sold to older people who live by themselves or who take care of young children and therefore cannot invest time in collecting this product.

Linden flowers (té de tila): Only one collector of all those who were interviewed and surveyed sells this resource (Doña Lupe). However, trading this product is very important for her economy. She collects the flowers throughout the season and saves them until she has a large quantity of them. Once she has enough to make it profitable to travel, she takes these products to the Sonora market, a big market in Mexico City which specializes in medicinal plants and other products used by *curanderos* (shamans).

Moss and fern: Although these resources are easily available, moss is particularly difficult to market because it is heavy and very fragile, and the supply is so high during the Christmas season that it must be sold at low prices. Doña Lupe (whose story is presented in Box 1) prefers to buy moss in the markets in Mexico City, where she sells the other products she has collected, and she then re-sells moss in other places in the city. She could collect moss in Crescencio Morales´ forests, but the costs of transportation and packaging such a fragile product, are not compensated by the profits from selling it. Fern is different; it is a more durable product, and is not fragile at all. It can be packaged very tightly in bulk and is not heavy, so it can easily be carried in large quantities.

Problems related to marketing NTFPs identified by collectors in the case studies in Crescencio Morales: As mentioned, only a few people commercialize the products available in the area. This is mostly due to the low monetary gains that are to be made from selling these products, and the high costs of collecting and marketing them. As Doña Lupe suggested, there are NTFP resources that, although available in the area, are not profitable when making a cost-benefit analysis, because the marketing costs are very high.

Another barrier to marketing is the frequency and ease with which the resources are found in the area´s forests. In some cases, the resources can be found in higher frequencies in secondary vegetation; however, much investment is still needed in time and physical effort to collect resources like blackberries and mushrooms. The costs of collecting are not

Box 1. Doña Lupe

Doña Lupe is a woman from San Mateo, the largest community in Crescencio Morales Indigenous Community.community. She is known for being the shaman of the area and also for being one of the specialized NTFP collectors. She collects medicinal plants like linden flowers (tila), hierba de sapo (Eryngium carlinae Delaroche), gordolobo (Gnaphalium spp.), and edible products like blackberries (Rubus spp) and many types of mushrooms. Doña Lupe not only sells NTFPs, she also knits woollen blankets and gabanes (ponchos) She also performs other common productive activities of rural life, like growing maize and oats for her lamb and cows.

Although she sells what she collects;, when in Mexico City she also buys at the biggestbig plant market such products as moss and fern for Christmas decoration, and sells them in other neighbourhoods in Mexico City. Although she could collect moss herself, moss is heavy and she would have to pay more to transport it, in addition to the effort of carrying it and the risk of damaging it.

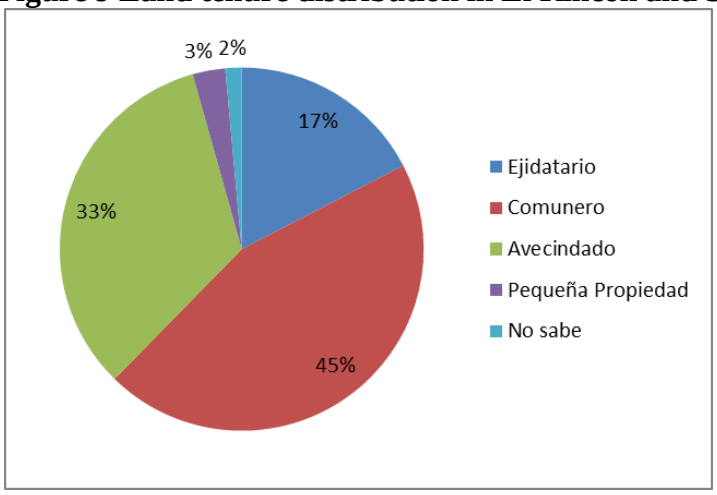
equalled by the small monetary benefits obtained from selling. Marketing of these resources must be understood as part of a larger strategy in which other products are also sold, and/or bought to be traded. This is true in the cases of Doña Lupe and Ana, who usually collect more than one resource, and then combine marketing them with marketing other products which they have bought from the community or from the markets where they are selling their main products.

Ownership of the resource and benefit distribution

Land tenure and its impact on benefit distribution

The inhabitants of the communities studied have on average 1.2 hectares of land (a range of 0.5 to 2 hectares, according to CONANP, 2001), with the mode being 1 and the largest outlier being 5 hectares. Of the study participants, 45% are *comuneros*, 33% *avecindados*, 17% *ejidatarios*, 3% *pequeño propietario* and 2% did not know their land tenure status (see Figure 9).

Figure 9 Land tenure distribution in El Rincón and San Mateo



Differences in land tenure status affect not only the type of productive activities people can carry out on the land, but also the distribution of benefits coming from government programs such as PES. Regarding the norms and rules for the use of these resources, Martin (2002) observes four basic characteristics of forest management in the area: within communities the norms vary, and depend on the degree of exclusivity according to the type of resource. Only those with formal tenure (that is, either *ejidatarios* or *comuneros*) within the *ejido* take part in the distribution of profits made from selling firewood. This benefit distribution also applies to other beneficiary programs of state agencies and NGOs, such as PES, where it is mostly those with formal tenure who can profit from available monetary resources.

This situation generates great stress because it automatically excludes an important sector of the population, mainly the *avecindados* or people with no formal tenure (personal observation). In some instances, communities decide to distribute the resources more equitably by applying them to community needs such as schools, churches or clinics (personal observation from interviews). Nevertheless, the sectors of the population that

most benefit from support of these programs are the *ejidatarios* or *comuneros*. This is because the decisions of how benefits are distributed take place within the *asamblea*, which is constituted of *ejidatarios* or *comuneros*, while *avecindados* are usually left out of this institution. Consequently, *avecindados* may be invited to participate in program activities, but most participants tend to be either *ejidatarios* or *comuneros* or their close relatives. Thus, benefits usually stay within a close group of inhabitants. In many communities however, activities related to the wellbeing of the community and its surroundings involve all inhabitants, regardless of their tenure status.

Ownership and distribution of benefits and impacts of NTFP extraction

The distribution of benefits obtained from NTFPs depends largely on the type of resource. However, most NTFPs come from a common pool source. Common pool resources in Crescencio Morales´ selected communities are under some degree of regulation or tacit agreement regarding their management. Anyone from the community is free to access resources and extract small quantities. As mentioned above, very few people actually collect these resources for marketing purposes. It also seems that there are profiles of users who have extended collection rights because they are seen as the people who really depend on the marketing of these resources. These people usually sell resources collected within the communities, so that local inhabitants also benefit from this collection as buyers.

Specific support for NTFP collection, production and marketing is not offered through forest-related agencies. NGOs like Alternare organize workshops about medicinal plants from the area that can be grown in home gardens. The MBBR is able to offer support to the collction of NTFPs in the buffer zone, however, there is no program currently active. The former director of the MBBR observed that there are some income-generation alternatives based on NTFP management, such as the collection of seeds from *Abies religiosa*, which could be sold to greenhouses to help reforestation efforts. This idea did not come through in our interviews and surveys, however, nor did other ideas about collecting moss and pine needles for craftsmaking.

Regarding moss and pine needles, there are restrictions for collecting these NTFPs in the nucleus zone, similarly to mushrooms. The former director of the MBBR mentioned that there were efforts during his administration to support the creation of a collective brand for mushrooms from the MBBR. He mentioned however, that one of the obstacles to collecting these resources is the requirement of a costly environmental impact evaluation; and therefore, only the wealthiest inhabitants could afford to pay for this study.

Ecological impact of extraction of NTFPs

Perceptions of impact of NTFP extraction on the forest

In Crescencio Morales there is a generalized perception that the extraction of NTFPs causes less harm than timber extraction. This perception may be the result of the influence of the NPA in the region, and of the work of NGOs that carry out environmental education activities in the communities around the NPA. These organizations promote the use of NTFPs as a strategy to conserve the forests, or as resources whose extraction is less harmful than other productive activities (timber logging and cattle ranching, for example). This discourse is well accepted by communities around the NPA, because most people still

extract and use these resources. People who collect NTFPs to sell do not have a perception of their extraction being harmful; however when harm is done to a resource or to an area where a resource used to grow, locals tend to blame outsiders. The perception of the impact of NTFP extraction thus depends on who is extracting the resource and also the objective for collecting the resource (whether it is for self-consumption or to sell outside the community). The extraction of NTFPs or other resources by outsiders is perceived as more harmful than if it is done by people from within the community.

> *"uno de la parte de la mesa del comisariado [comenta] … que la comunidad de Los Lobos del estado de México sube, no nadamás traer madera sino también se lleva el liquen, se lleva el musgo"* (someone from the commissary´s board comments that people from the community of Los Lobos in the state of México go to the forest not only to extract timber, but they also take moss and lichen).

In general, there is an idea that the forests are not in a good condition: 41% of questionnaire participants thought that the forests are in a "regular" state, 45% in a bad state, and only 14% thought forests are in a good state. This is attributed mostly to illegal logging, the factor cited in 33% of responses, but respondents also refer to factors such as climate change, unemployment, the lack of surveillance, the lack of social organization, and limited reforestation efforts.

Regarding the impact of NTFP extraction on environmental services, the research found that the concept of environmental services is ambiguous, yet people can relate deforestation to a decrease in water availability, or the presence of a healthy forest with having clean air, but there is less response regarding soil retention or biodiversity conservation. There is an understanding of the importance of conserving forests, and some services are clearly seen as depending on the well-being of the forest. Water, for example, is considered, in a local´s own voice, as a "product" of the forest. Of the 70 people surveyed, only 3 had heard of ecosystem services and described them as: "*si se acaba el verde ya no hay agua*" (if there is no more green, there is no more water), or they refer to "*la generación de agua*" (water production), and also to services as being necessary for the existence of other resources: "*necesarios para que haya agua, árboles, etc*." (necessary for there to be water, trees, etc).

Forests suffer indirectly from changes that are attributed to phenomena such as climate change or migration. For example, 37% of survey participants thought that climate change has an impact on agricultural production (by causing increases in pests and diseases, changes in precipitation, changes in local climate that reduce yield, etc.), which indirectly also affects migration dynamics. More people migrate because they cannot depend wholly on agriculture or other subsistence activities. When agricultural production suffers, one of the consequences may be that people fall back on the forests, to extract timber or other resources such as NTFPs. Although the relationship between the increase in the number of NTFP collectors and negative changes in agricultural production (including marketing of agricultural products) is not clear cut, it could be hypothesized that more people than before are in fact turning to the forest to collect resources for both subsistence and marketing. This last observation may point to a resurgence in marketing of NTFPs in the area in the near future.

Climate change may also contribute to decreasing pressure on forests, by allowing other productive systems, such as avocado orchards, to be more successful because of the warmer temperatures (this is an observation of an avocado producer in the area).

Impact of conservation activities on availability of the resource

Impact of conservation programs, laws and the work of NGOs on NTFP management

The main program operating in the area, besides the Biosphere Reserve, is the Cutzamala System. This system focuses primarily on restoration actions, mainly soil restoration, due to its location in one of the "priority zones" of the "Forests and Climate Change" program (which is part of CONAFOR´s Priority Watersheds Program) (CONAFOR 2012a). Among the actions done by inhabitants who beneficiaries of this program are: reforestation, clearing the forest floor of debris and dry herbs and grass (*chaponeo*), digging ditches for water infiltration (*tinas ciegas*), fencing to prevent livestock from trespassing into reforested plots, pest control and fighting forest fires, surveillance brigades, among others.

The weakness of these programs is that they usually involve the land-holding members of *ejidos* and *comunidades indígenas*, and exclude those who do not have land tenure. This creates great inequality among local people and a feeling that the distribution of government resources is unfair. The social impacts of these programs are perceived through a polarized view of those who have benefited from the programs and those who are excluded. In the future it will be important that organizations that implement these programs generate mechanisms to ensure better distribution of benefits among the local population. There are such initiatives under way through organizations such as the Monarch Butterfly Fund (personal communication); however, these improvements won't be seen until later.

These programs have positive impacts, such as generating a new attitude towards care of the forest, which includes organizing surveillance brigades to prevent illegal logging. However, conservation programs such as the MBBR have had a profound impact on the livelihoods of people living within the community, changing their traditional productive systems, of which the extraction and sale of timber was a big part, as described in the section on Community Organization around NTFP use.

In terms of the ecological impact of these programs and strategies, there is insufficient knowledge about their impact on the structure of vegetation and soil. This is very important because these actions may generate negative impacts, as the villagers themselves observe; for example, in the case of digging infiltration ditches or clearing forest floors of debris. Local collectors suggest that when the forest floor is cleared, the substrate where resources such as mushrooms grow is also cleared, affecting mushroom growth. In other cases, bushes such as those of blackberries and *tila* (linden flower) are cut in the effort to keep a "clean" forest floor that is clear of decaying wooden material. Also, the digging of infiltration ditches causes soil loss, while the benefit of this conservation strategy are not certain. Much research still needs to be done on the impact of human activities on NTFP availability, because, as has been mentioned, different types of management can provoke

different types of environments in which NTFPs can grow. Sometimes human interaction is necessary so that NTFPs, such as some types of mushrooms, can grow (Lowenhaupt 2016).

Rural livelihoods and safety nets

NTFPs are a very important element of rural livelihoods. Rural livelihoods are, however, very diverse and depend on different productive and ecological systems (for example, agriculture, forestry, NTFP extraction; and primary forests, secondary forests, gullies, rivers, lakes). Therefore, exploring the importance of NTFPs for rural livelihoods must necessarily integrate an analysis of the place that these resources occupy in a broader spectrum of economic activities and alternatives.

Economic contribution of NTFPs to Rural Production Units

The economic contribution of NTFPs varies depending on the resource and also the type of user. Very few people actually obtain monetary gains from marketing these resources. Most people obtain the direct benefits of consuming what they gather. Even those people who market these resources receive only a small contribution to their income. However, there are some people do depend strongly on the marketing of these resources during at least five to six months per year (see Box 2). People who market NTFPs generally have a preference for certain resources, nevertheless they collect as many resources as possible during a single trip, when the seasons of these resources coincide.

Some resources are preferable to others, such as the *clavo*, *tejamanil* and *gachupin* mushrooms which are preferred over the rest of mushrooms. Those mushrooms which have higher prices in relation to volume may be preferred to others which need to be sold in greater volumes and at lower prices. Figure 18, below, shows the price differences in mushrooms, which are very large in the case of *orejas de ratón*, *tejamanil* and *clavo* in comparison to *cornetas*, for which a similar quantity may have a much lower price. Therefore, collectors prefer to gather those resources that generate greater income. Other reasons why certain mushrooms are preferred to others may be that carrying large volumes of some species may be difficult because these products are very fragile, cannot be stacked and must be transported with care. Therefore, traders may prefer to carry lesser quantities because there is less risk of damage.

The case of Ana exposed in Box 2 demonstrates that for some people, NTFPs represent a significant source of income. NTFP availability depends on the season. Therefore, NTFP collection is not carried out throughout the year, and people who depend on these resources usually perform other activities that help them generate income, such as sewing, embroidering, working for other people in agricultural activities, including working in their own family plots.

Rural livelihoods in Mexico integrate a diversity of productive systems that overlap over time and space. For NTFP traders, this activity is an important element of their yearly productive organization, and it is present almost throughout the year.

Generating income from these resources is, however, not simple, due to many obstacles, such as the difficulty of gathering enough volumes for marketing or for covering transportation costs and needs, as well as the high competition in local markets, the decreasing availability of NTFPs or the increasing demand from other local collectors.

Box 1. Ana´s case

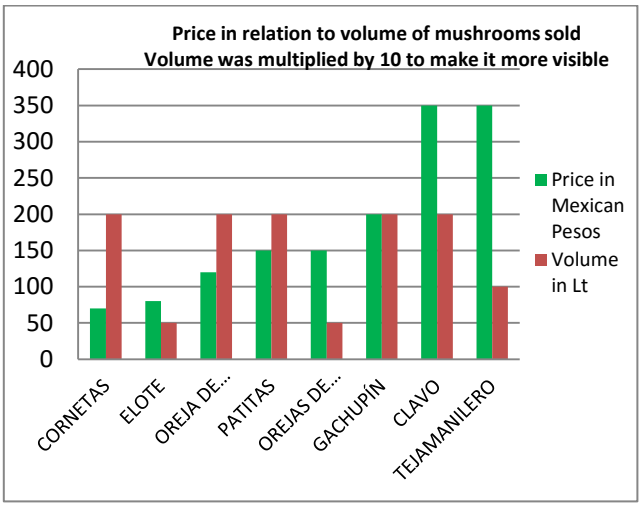
Ana is a woman in her 30´s from one of the largest towns of Crescencio Morales indigenous community. We found her by chance, eating at the house of the Secretary*secretary* of Crescencio Morales. Ana was babysitting for the daughter of the Secretary, b*Secretario*.ut she also turned out to be an important NTFP collector. She collects blackberries, mushrooms, *té de monte, té de tila* and medicinal plants, among other products. The most important products she collects, because of their marketing potential, are mushrooms, blackberries and *té de monte*.

Ana sells what she collects either in the towns nearby (what people call *ranchear*, that is, to go from house to house), or takes the products to the market in Zitácuaro, the largest city nearby (about 30-45 minutes from the area where she collects).

NTFP collection is a very important activity for Ana. During half of the year she is able to generate a significant part of her income from collecting and selling NTFPs (approximately $25,000 during 4 to 6 months). During the rest of the year she works in agricultural activities (paid or for her own family), babysitting, doing embroidery, among other activities.

NTFPs for Ana are very important

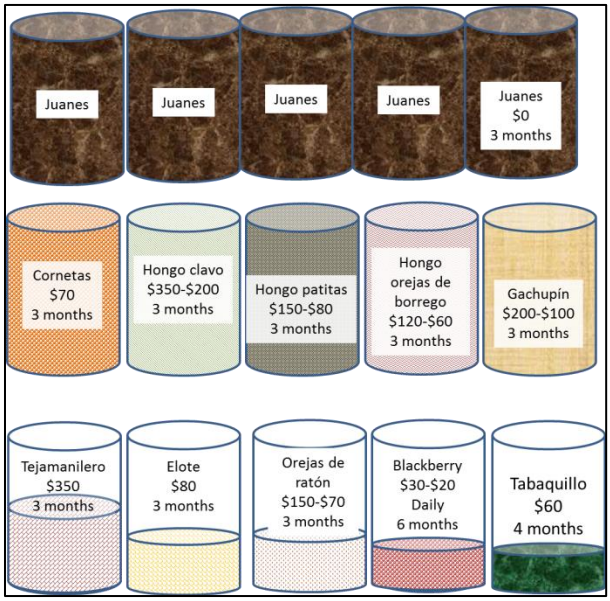
Figure 16 A comparison of the price of mushrooms in relation to the volume sold



As can be seen in Figure 19, below, some resources are available in small quantities, such as *elote* mushrooms, while others, such as *juanes* mushrooms, are available in higher quantities. One would think then that *juanes* could be an important source of income; however, these mushrooms are not in high demand in the market, so their potential to generate income is low and their value is rather linked to subsistence. On the other hand, mushrooms such as *elote* have a high demand in the market; but, as they only appear in small quantities in the forest, their potential to generate income is also low.

Local NTFP collectors prefer to sell the products they collect within their own village (*ranchear*), because they perceive greater benefits. When they take their products to the markets in the largest city nearby (Zitácuaro), there is more competition in the market from other sellers, and this forces prices down. Moreover, transportation is a problem, not only because it is costly, but also because transportation is a problem when it involves moving fragile and perishable resources like mushrooms and blackberries. This limits the quantities of these products that can be transported due to the difficulty of packaging them in a way that protects them from damage (on top of that, calculation of volume or weight is difficult, collectors do not own scales, so they measure the product using containers and calculare "volumes" or product sold).

Figure 17 Illustration of resources collected by volume.
Each container represents 20 liters. Not all containers are shown as full, that is because not all resources are available in the same quantities, some are more abundant than others, such as *juanes* mushrooms. This figure only shows the volumes usually collected, so as to compare volume against possible income generated. The figure also shows the duration in months of the season for each resource. Blackberries, for example, are available six months of the year, versus most mushrooms, which are available only three months of the year.



Increasing harvesting pressure, due to an increase in collectors, is also a problem that affects those collectors that have depended on this activity for many years. A main collector commented that in recent years more people are resorting to NTFPs to complement their economies. This may be due to decreasing employment options, rising costs of food and decreasing agricultural yields, which push people to search for other sources of food and resources to fulfill their subsistence needs and also generate income.

Table 8, below, exemplifies the differences in collection efforts and the revenue obtained from each resource. It is interesting to see that mushrooms like *juanes* are collected every day; however, they are specifically collected for subsistence purposes, no income is generated from their collection. *Juanes* may be more available than *gachupin*, which, in people´s perceptions, are present only in very specific environments and times of the year. *Juanes* may be more resilient to ecosystem degradation, while *gachupin* and other less available mushrooms may need more conserved environments. Thius highlights the need to study the differences in the environments where these resources appear, and also the possibility of using certain mushrooms as indicators of ecosystem wellbeing.

The data presented below presents the average quantities collected and the average revenue generated for each resource.

Table 8 Times collected and income (in pesos) generated per season per product.

Resource	Duration of season	Times collected per season	Price	Total generated per season
Juanes	3 months	Daily	$0 (subsistence)	
Cornetas	3 months	24	70	1680
Hongo Clavo	3 months	24	350	8400
Hongo patitas	3 months	24	150	3600
Hongo orejas borrego	3 months	24	120	2880
Hongo gachupín	3 months	24	200	4800
Hongo tejamanil	3 months	24	350	8400
Hongo elote	3 months	24	80	1920
Hongo orejas ratón	3 months	24	150	3600
Blackberries	6 months	48	30	1440
Tabaquillo	4 months	24	60	1440
			Total estimated	**38160**
			Discount by end of season 30%[34]	**12720**
			Total discount	**25440**

Some annotations about this table: mushrooms such as *clavo* are always in high demand compared to others such as *cornetas, elote*, or even *juanes*, which has no buyers at all. Regardless of the type of mushroom sold, there exist throughout the season different prices that depend on the availability of the resource. So *clavo*, por example, starts with a price per bucket of $350. By the end of the season, the price goes down 30%, because the availability increases, more people are selling the product, and therefore there is more competition. So, even though marketing NTFPs is a good option for some collectors, other dynamics interact to hinder the potential of marketing NTFPs as a viable income generation alternative.

Impact of Migration on Forest Resource Use

In the current economic scenario, NTFPs are an important complement to other subsistence and income generation activities. Money is hard to come by in rural areas, but greatly needed. Therefore, an obvious option is to migrate to find employment. Migration is one of those dynamics that interact with other productive systems, generating particular effects on NTFPs and forest resources in general.

[34] Most products go through changes in their prices as the season progresses; usually, prices go down as the end of the season approaches, due to an increase in availability of the product.

A large proportion of the men migrate temporarily to Mexico City. The usual dynamic for these men consists of working during the week in the city of Mexico and returning to Crescencio Morales during the weekends. Others migrate for periods of several months and return to their community for activities related to agricultural production (April to September). 46% of interviewees reported having migrated in the past, while 50% said they had never migrated. The average period of years that people have migrated for is 9 years, while there are people who have migrated up to 20 years: some to Mexico City and some to the United States. 54% thought that migration had increased in the last 15-20 years, 7% think it has decreased, and 31% think it has stayed the same. The reality is that a large percentage of the male population of working age migrate temporarily or permanently to Mexico City, Toluca or the US; meanwhile, the male population that stays are children, very young teenagers or older men. Migration contributes a share of the income that is generated in a household. Many of the men or women who migrate send remittances to their families, yet others find it very difficult to generate enough income for their own survival in the places where they migrate, and therefore do not have the possibility of contributing to their family´s economy.

Interviewees from NGOs and government institutions have mentioned the importance of women as upholders of the social fabric. This is not just metaphorically, since knitting, weaving, collecting NTFPs and other forest products, and producing agricultural products are some of the many activities that women undertake in order to support their sometimes menless families. Migration also affects internal community organization, since even *ejidatarios* or *comuneros* migrate, leaving their responsibility as members of the Board to those members who stay, and in many instances, to their wives, who are not equally considered in the decision-making process of the Board. NTFPs, as little as they may contribute to income generation, are an important source of subsistence products, and in some instances, represent a possibility to generate income, particularly for women. The current context of rural populations is one in which women have an increasing role in productive and income-generation activities. Women also carry out many activities related to the wellbeing of the family and household. However, cultural dynamics related to decision-making in the community have not evolved to integrate women. NTFPs are important in this context, because they offer an opportunity for women to contribute in a small way to the income of their families, which in turn, hopefully, may open up spaces for them to become decision-makers and gain a greater say in household decisions.

Community organization around NTFP use and the impact of policy, regulations and sanctions

The basic organizational scheme in the communities studied corresponds to what has already been described before in this work. Both *ejidos* and *comunidades indígenas* throughout Mexico have an *Asamblea* that is selected through votation by *ejidatarios* or *comuneros*, respectively. This board is constituted of a commissary, a secretary and a treasurer. The board is responsible for organizing the *comuneros* when it comes to activities in the forest related to government programs. Usually, when government representatives come into a community to implement a program, they contact the *comisariado,* who in turn

contacts other *comuneros* or *ejidatarios*, to invite them to participate in a program (that is, to receive some sort of economic or material support for their participation).

Most people who participate in a government program or, in the case of the MBBR, in programs from the Monarch Butterfly Fund, are primarily interested in receiving some sort of economic or material support, be it payments for their work, or fences, tools, seedlings for reforestation, or even the use of mechanical plows to dig ditches or level terrain. People also participate in activities organized by the board for the benefit of the community, such as building school classrooms or improving the church or the board house (*casa communal*). These activities are done as voluntary work (*faena*) by all community members.

San Mateo has benefitted from payments for environmental services from the Monarch Butterfly Fund, from the Sistema Cutzamala, and from CONAFOR´s *Fondos Concurrentes* program, and NGO support. In order to invite community members to participate, the *comisariado* contacts first his closest acquaintances, friends and relatives. In most rural communities in Mexico this process lacks transparency, because invitations to programs usually work in this way. Therefore, every time there is a new commissary, the group of people who participate in the programs changes, unless they happen to be from the same group of close friends, relatives and acquaintances as the past commissary. There is always the perception from those who do not receive support that the commissary and the rest of his board are stealing or withholding resources from the people who are not their friends.

Regardless of the usual conflicts, people in San Mateo and El Rincón do agree sometimes to invest whatever they are paid by the PES programs in improving their community. These decisions do not always depend on the commissary: sometimes they depend on the group of people who decide to participate in programs or opportunities. Some of this support also comes from NGOs who work through other social channels, such as through women´s groups or schools. This allows these organizations to distribute benefits to sectors of the population that are usually excluded, not only due to their land tenure status, but also to their gender, age or even ethnicity. For example, the work reported by Jaramillo-López et al. (2015) was organized independently through NGOs working in the area, and allowed for different types of people to participate in the activities.

One of the most important activities to conserve forests are surveillance brigades. These brigades were initially organized in other *comunidades* nearby, such as Donaciano Ojeda. Currently, more communities are getting organized to have these brigades. This work is made easy when communities receive support from PES programs. The Cutzamala System PES program, for example, has as one of the activities that receive the most community support the surveillance of forests to prevent illegal logging. Crescencio Morales has received support from this program and also from the Monarch Butterfly Fund together with CONAFOR´s Fondos Concurrentes. Those that participate receive about 300-500 pesos per hectare. Incentives are given to participants individually, but these are mostly symbolic. The entire *comunidad indígena* receives a large quantity of money to perform activities related to forest conservation ($543,000.00 in 2013, according to the *comisariado*). When this money is distributed among all the *localidades* (communities), a

very small amount of money is left over to do any social work that is needed; this is decided by the community:

> "*las autoridades no intervenimos pero estamos presentes, y llevan a cabo la reunión para decir dónde ponen un tejado, por ejemplo, en otro lado para invertírselo para impermeabilizar para las escuelas, pero siempre es algo para todos, en otros que hacerle una cúpula a la capilla, otras que un puente, pues los 10 mil o 15 mil ahí se van , y pues tenemos que meterle de otros lados; pero eso nos ayuda porque hace que iniciemos una obra*" (we authorities do not intervene but are present, and they, the community, carry out the meeting to decide where to put a roof, for example, in another place to invest it to proof schools, but it is always something for everyone, in others to build a dome for a church, in another a bridge, and so the 10 or 15 thousand go there and we have to get the money from somewhere else, but that helps us to get work started).

The surveillance brigades are organized in different ways, as mentioned by the Commissary:

> *"las vigilancias armamos grupos por semana, este año que pasó hicimos 5 grupos de 5 que son 25, el programa anterior que dejó el comisariado y le aprobó la asamblea era vigilar dos meses, nosotros llevamos 5 meses vigilando porque montamos otra estrategia, y beneficiará a más gente se les da una cosa simbólica*" (for the surveillance we organize weekly groups, this past year we did 5 groups of 5, 25 people, in the past commissary´s program, which was approved by the General Assembly, the goal was to carry out surveillance during two months, we already have been doing surveillance for five months, because we have another strategy, and this will benefit more people, even if it´s a symbolic incentive).

Internal organization in Crescencio Morales depends not only on the board, but also on the general population that participates through the general assembly or other types of informal meetings that are carried out at each one of the communities that belong to the *Comunidad indígena*. This assures that some of the important decisions related to the community as a whole, some of which are independent of the forests, are made with the participation of a larger group of people, not only *comuneros*.

The rules regarding forest use are closely related to land tenure and also to the NPA decree. People from the Crescencio Morales communities are allowed to cut down a tree with permission from the *comisariado*, but only if the wood is to be used for their own consumption, which is usually for construction. No trees can be cut for marketing purposes. In terms of NTFPs, the rules are more flexible, but they also have to do with recognition of who in the community is most in need of collecting and marketing these products. Everyone is allowed to collect NTFPs for their own consumption, but people who collect them for marketing purposes are seen as having a particular need and therefore are given even more tolerance in terms of the amounts they collect.

People from El Rincón and San Mateo talk about illegal logging as an activity that "other" people from the State of Mexico do. However, fewer people mentioned that it is also people

from these two communities who cut trees without permission, to sell them to outsiders. There was no mention about sanctions for those who cut trees illegally. When people from other *comunidades* are caught cutting a tree, not only is the tree confiscated, but also their tools and their animals. The illegal loggers themselves are kept under guard for an entire day as a punishment, but it is people from the community themselves who make sure that illegal loggers are guarded. No notice is given to PROFEPA, possibly because it implies lots of paper work and having to travel to where the offices are found. No other sanctions, like fines, are given. People do talk about these incidents, and this in a way helps create a sphere in which illegal loggers are seen as wrong-doers and in some way marked by the rest of the community.

The presence of the MBBR has a profound impact on how activities are organized. Since the decree of the Reserve in 2000 (when it was expanded to its current extension), subsistence and income-generation activities have been strongly modified. Before the decree, the forests were a very important source of income for the local population. Through traditional decision-making structures (the directors of the board), people from Crescencio Morales communities would decide which areas to exploit, and the quantity of resources that could be extracted, taking into account the ability of the forests to regenerate. People comment that community members could more easily distribute the benefits of the forests in an equitable manner, and that this production system was a good source of income. However, after the MBBR decree, timber extraction was forbidden, causing initially a reaction from locals to cut down the trees in their plots, with the argument that these trees were theirs to use, because they had taken care of them. Thus, in the first years after the decree, deforestation increased in the area, particularly in Crescencio Morales (both *comunidad* and *ejido*), because it is one of the *comunidades* with the largest area of forests located within the nucleus zone of the reserve (more than 1,000 ha), and thus this meant that what could be potentially exploited in the past would no longer be available.

> *"Si, antes de, si daban permiso para aprovechar, a mi tocó en el 90 que si se trabajaba bien, después de lo de la mariposa ya no se dio el permiso, y qué dijo la gente, pues ahora le entramos y fueron todos los vecinos, el estado de México también le entraron a la tala en sus bosques, y si tiene algo que ver la prohibición*" (Before we could get permits to extract [timber], I saw it in the 90´s that it worked well, after the butterfly we could not get permits anymore, and so people said well now we will cut it down, and all the neighbours went, in the state of Mexico they did the same, and they logged their forests, so yes, prohibition did have an impact).

Before the MBBR, people would be able to cut down a tree either for their own consumption or to trade it, and they would take turns to extract timber giving more people the opportunity to benefit directly from the forest. After the decree, logging was prohibited (although *comuneros* and *ejidatarios* can still cut down a tree for their personal family consumption), so other activities acquired more importance. As the *comisariado* mentions, presently they don´t depend so much on the forests for income generation, and other production systems have gained more importance, such as the avocado orchards, or support from programs such as PES.

The avocado orchards in other *comunidades* represent a new organizational challenge,

because this new production system requires large quantities of water. Crescencio Morales is a community that has several water bodies, because they are closer to the forest. For this reason, they have been asked by other *ejidos* to supply them water for a fee. This gives Crescencio Morales´ communities an opportunity to generate income from the services they obtain from the forest, and also serves as an incentive for caring for the forest.

The presence of the NPA, particularly the work of the Monarch Butterfly Fund together with some CONAFOR programs (*Fondos Concurrentes* and the Cutzamala System), have served as an incentive for locals to work on their internal organization to better profit from these opportunities. Because of these programs, more people are interested in participating in conservation activities, not only because of the potential improvements they see in the forest, but also because they usually obtain some sort of economic incentive, either for themselves or for the community.

Gender, ethnicity and age, and their impact on NTFP use

Women´s participation

Another issue that is important for understanding the complexity of how land is used and how resources are distributed is women´s participation in the activities called for by different government programs. In many instances, women represent husbands or other male relatives who have migrated temporally or permanently; therefore, these women become important participants in program activities such as reforestation as well as decision-making processes within the *Asamblea*. In the Crescencio Morales area, it is women who are mostly responsible for projects such as greenhouses for producing pine seedlings for reforestation, or for organizing resources to build latrines, "ecological" stoves, or other services partly provided by the government through NGOs such as Alternare.

Regardless of their importance as active members, women have not yet gained the power to participate in decision-making processes. While they can be present in the *Asamblea*, they may not vote unless they are *ejidatarios* or *comuneros* themselves. As mentioned above, the rights to the land are usually inherited by sons and only in a few instances by wives; therefore, the number of women who participate in *Asambleas* is usually small or non-existent. Moreover, decisions regarding forest uses are mostly made by men; thus, topics such as the need to incorporate support programs that promote NTFPs, which are primarily used by women, are hardly considered.

Management by type of user

When studying management based on the type of user, several groups of users and differentiated management activities can be distinguished: groups differentiated by age and gender, and the overlap of age and gender groups.

<u>Differentiation by age and gender</u>

Particular attention must be paid to the fact that age differences interact with other factors such as gender and land tenure, to create sectors of the population that are marginalized from forest management activities. Young people are particularly excluded from forest conservation and production activities, due to their lack of tenure and therefore non-membership in the communal or ejidal assembly (Merino & Hernández 2004). This

influences migration dynamics, since the ability of youth to participate in productive activities within their communities is limited, pushing them to search for employment opportunities outside the community.

Children aged 7-10 (both sexes): Young children usually accompany their parents, but mostly their mothers, in collection activities, focusing on firewood. The researchers did find a group of young children who had been sent to the forest to collect flowers for the Day of the Dead. Children of this age or older are also sent to collect firewood by themselves in the nearby areas (ie. a 30 minute radius walk from their house), and sometimes to collect mushrooms. This last activity may be a risk for the children, who may not be well acquainted with which mushrooms can be eaten, and may end up collecting or eating poisonous mushrooms.

Young men (aged 15-30): This group is usually absent from collection activities because most of the time they are away living and working in Mexico or Toluca cities or have migrated to the United States. They may also migrate daily to the nearby towns to work in the construction sector. However, this is also a cultural matter, for NTFP collection is an activity associated mostly with women.

Young and middle-aged women (15-55): This group of people collect mushrooms and other products such as blackberry and *té de monte*. Most women in this segment of the population collect these resources for subsistence purposes. Women who market NTFPs invest more time in collection activities, have more precise knowledge of the areas where NTFPs can be found, and also have a better developed marketing network, be it within the community or in other towns.

Middle-aged men (55-75): Men who are *comuneros* attend the community meetings or *asambleas*. It is in those meetings that decisions around conservation programs, PES and other government funds are taken. Younger men do not participate in these meetings because they are not yet *comuneros*, but are only sons of *comuneros.* Women also do not participate in these meetings, even though the legal option exists for them to participate. Usually it is men who perform the major conservation activities for which participants receive financial resources (from CONAFOR programs, such as the Cutzamala System or local or municipal governments). Patrolling is an activity done by men of a wide range of ages (15-70). Given their involvement in this activity, men also tend to do a greater part of firewood collection and even NTFP collection when these resources appear on the way to the patrolling stations. The frequency of contact of men with forests allows for their deeper knowledge of the forest. The experience of the two group interviews conducted in the localities La Viguita and El Rincon demonstrate knowledge differences resulting from a division of labor by gender.

Knowledge of forest resources differs in these communities. The mapping exercises showed differences in the ease with which different genders interpreted and commented on aerial photographs. The group consisting of only women from La Viguita found it very hard to interpret these images, while the group in El Rincon, composed only of men, interpreted images more easily, although it took a long start-up time. The group of men was able to identify several areas of the forest where specific resources could be found (for

example, firewood collection areas, and different areas zoned by type of mushrooms). The group from La Viguita produced a map in which they identified the gullies as important NTFP collection zones. In that community, the gullies are the closest "forest" because the forest areas of the *ejido* and *comunidad* are far removed from these settlements. Women´s knowledge of forest resources and their degree of conservation is more limited. This may also be due to their distance from forests. However, in a group interview conducted with this same group of women, the husband of one of the women spoke of forest resources that the women did not know about. He had recently been part of a group that had been patrolling Crescencio Morales´ forests.

Elders, both sexes (75+): Older people have more free time during the periods between production activities (such as agriculture, forestry, etc.). These people collect as they perform other activities (for example, as they are gathering firewood), or sometimes go specifically to collect mushrooms in order to sell them in the communities (*ranchear*). Older people, however, sometimes stop collecting resources like firewood because it implies too much physical effort. Many older people who live alone or who take care of grandchildren prefer to buy firewood from other people who market this resource.

Importance of traditional/local knowledge

Influence of indigenous populations

As mentioned before, the Monarch Butterfly region has a significant indigenous population, a characteristic that makes it a very interesting area, culturally. In Crescencio Morales *comunidad indigena* this influence can be seen from the way people dress, to their religious festivities and the customary decision-making protocols that they follow. It is also evident in the language, since many inhabitants still speak Mazahua, especially the older generation. Traditional knowledge is also a cultural asset that is important for natural resource use, and even more important when it comes to the use of NTFPs. There is ample knowledge of medicinal uses for various plants, however, few of these plants are actually used. Older people acknowledge that their elders used to know much more about the use of medicinal plants, and that in the past, all ailments were cured using plants and other resources (sometimes also animals). In my interviews I heard many indigenous terms for various plants (all in *ñhañhu*) whose uses are known. But when asked about what are plants are still used, only very few were mentioned. There is a cultural transition happening, as in other parts of the world, where factors such as migration, generational change, the influence of other cultural systems, the entrance of public health care or the availability of cheaper medications, all influence people´s perceptions about the effectiveness of traditional cures, while offering new options for treating illnesses. This change has a direct impact on peoples' knowledge of forest resources, their uses, their availability, and where they may be found. This change also affects forest management by promoting a perspective that other resources or services (PES) are more important than NTFPs.

Importance of NTFPs for subsistence, culture and traditional/local knowledge

The importance of NTFPs in the communities of Crescencio Morales is significant. Most households use on average 7 resources throughout the year, while there are some that use up to 14 resources (ie. those who sell NTFPs). The importance of these resources lies not only in their subsistence value, that is, their importance as a complement for people´s diets,

but also in their intrinsic value as an element of the local identity. NTFP collection, particularly of mushrooms and *té de monte*, represents an activity that is grounded in people´s organization of their daily activities during specific seasons. People incorporate NTFP collection into other important activities, such as firewood collection, while some people make a special space in their day to collect these resources. Collection trips are unique opportunities for getting family members together. They are particularly special for the relationship between women and their children, and it is also a way in which children may learn about the resources available in forests, and the way these resources are collected and managed.

In visits to the nearby forest, in advance of the Day of the Dead, a group of children were found bringing back flowers to use for the altars for the dead (this takes place in the beginning of November). In other seasons, entire families were seen going up the forest to collect mushrooms. But at other times, collection of multiple resources was observed, such as firewood, forest soil and *té de monte*, so collection may be incorporated as an important part of people´s subsistence activities; whenever they go to the forest to collect important resources, they make sure to look for whatever NTFPs are also available during that season.

Local knowledge about NTFPs is reproduced and transmitted through these family visits to the forests. Also, because people have the tradition of collecting these resources throughout the years, they can observe the particular sites and conditions in which these resources grow. One observation, for example, has to do with the presence of mushrooms in places where there has been a fire. Another has to do with the places in the forest where there is more humidity and therefore a greater presence of mushrooms. Other observations have to do with the negative impact of logging on the availability of mushrooms, blackberries and linden flowers in places where these resources used to grow.

In terms of the cultural value that people attach to forest activities, an interesting observation is that cutting down trees to produce wood for construction is given a negative connotation, which is not given to collection of NTFPs. Cutting trees is not well accepted socially, and is permitted only in special cases, with special permission from the *comisariado*. There is a widespread idea that trees are the most important resources for the wellbeing of the forest and for services like water. This perception may have been influenced by the presence of the NPA, and the information that comes from this institution regarding protection of the forest and what activities are not allowed within the NPA. Local inhabitants know that felling trees is not allowed within the nucleus nor buffer zones; however, NTFP collection can be done by local inhabitants within the buffer zone as long as it is for local consumption and not for sale.

These legal restrictions may have modified in some way the general perception regarding what are good and bad forest extraction practices. These perceptions also affect the information flow (in terms of the research) about NTFPs, because many of them may be collected for commercial purposes, and therefore, this activity may be regarded as illegal if not allowed by the community, so collectors who sell these resources are sometimes reluctant to talk about NTFP collection. Sharing cultural values around the forests, or not, may enhance or impede the flow of information between users and forest conservation

agencies or researchers. Therefore, approaching local inhabitants about NTFP management may be hampered by cultural differences in their understanding of the value of the forest.

Identification of changes in NTFP management in the past three decades: Comunidad Indígena and Ejido Crescencio Morales

Changes in local forest conditions may lead to the degradation of the forests, but when it comes to some NTFPs, degraded spaces may be more suitable for their growth. This is the case of *Ternstroemia plinglei* (linden flower) which is found in greater relative abundance in the most perturbed areas of the MBBR (CONANP 2001). This allows collectors of linden flowers to concentrate their collection efforts in these areas, and so degradation of the forests may actually be beneficial for this sector of the population.

Local traditional ecological knowledge is changing in the area. Dynamics such as migration may be affecting the body of knowledge of local inhabitants; however, there is still ample knowledge of potential uses for plants available in the area. What is definitely changing is the actual use of these resources, for, although there is knowledge about their uses, people do not resort to these resources as they used to in the past. This may be partly due to a preference for conventional health systems, or to education campaigns associated with government health programs, or to the implementation of aid systems which subtly change people´s habits and preferences. This change may also be due to the fact that people have less time to collect these resources because they need to invest that time in other more important productive systems. Thus the tradition of entire families going to the forests to collect these resources is being lost as other activities become more important economically, and families reorganize their time to incorporate these activities. The loss of collection traditions is likely to eventually affect the body of knowledge related to NTFP uses in this community.

Perceptions regarding the value of forests and their resources have changed since the implementation of the NPA. After the establishment of the buffer and nucleus zones, people have become more aware of the activities that are allowed in the forests in each of these zones. For example, the restrictions in the buffer zone are more lax, allowing NTFP collection by local inhabitants. There is a perception that trees are the most important resources of the forest, while other resources, such as NTFPs, have lesser value and also cause less harm when collected. Therefore, rules regarding logging are more strict than those regarding NTFP extraction.

The impact of social dynamics on the state of the forest is not clear; however, we suggest that aspects of the local economy which are necessarily linked to national and international dynamics, such as the lack of employment opportunities, motivate people to search for other sources of income, among which are NTFPs. This causes an increase in the number of NTFP collectors, and this in turn has a mostly negative impact on availability of forest resources.

Currently, climate change is generating new opportunities that may have yet unknown consequences on the state of the forest. New production systems such as avocado orchards

are offering important income-generation opportunities, and in some ways, these opportunities take the pressure off the forests. However, if avocado production increases, like in other parts of the state of Michoacán, it may put more pressure on forests in two ways: by promoting deforestation in order to expand the establishment of avocado orchards, and by increasing the demand for water in the area. As mentioned by a *comisariado*, some *ejidos* in the surrounding areas are buying water from Crescencio Morales, creating an opportunity for this *comunidad indígena* to generate revenue from a resource (ecosystem service) that is available to them. On the other side, the increase in water demand can also increase the quantity of water that is extracted from other sources, mainly underground, affecting water availability in general.

Another impact of conservation programs is that related to the activities included in the restoration packages, which include not only reforestation, but also digging infiltration ditches, clearing the forest floor of dry wood and debris, among others. The ecological impact of these activities on NTFPs and forest diversity has not been well studied, but there is a perception that some of these activities affect mushroom availability.

Conservation programs in the area are also creating income-generation opportunities for those who participate in them. However, they are also causing new conflicts among the population, because those who lack land tenure are often excluded from receiving direct support.

CHAPTER 6. NTFPs in rural communities: environmental conditions, social organization, and management in Nieves ejido

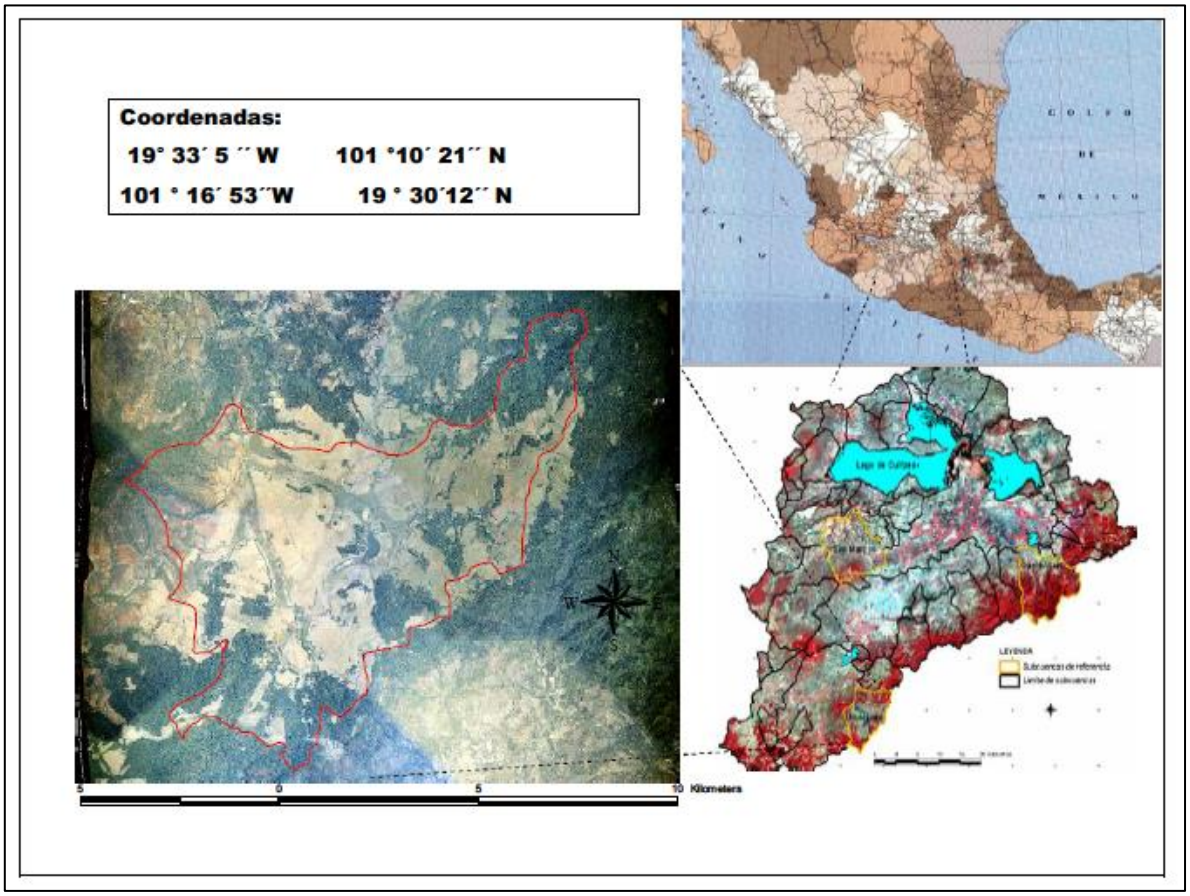
This chapter has as its objectives to 1) todevelop an understanding of NTFPs´ role in rural livelihoods, concentrating on the Rural Production Unit (RPU), through a thorough description of NTFP uses, their economic and cultural importance in Nieves. It also aims to 2) identify changes surrounding NTFP extraction, availability, management systems and impact on RPUs through an analysis of the information gathered through questionnaires and interviews and, with this information, identify the time period during which these processes of change have been more evident. It also 3) examines and explains the possible causes that provoked the changes in NTFP management identified in objective 2 (Markets, climate change, policy, tenure), using the proposed model from objective 1 as a reference to study these factors.

Introduction

The second case study selected for this work was Nieves *ejido***.** Nieves *ejido* is located within the basin of the dam Umécuaro-Loma Caliente, which is part of the Lake Cuitzeo basin, which in turn is located within Lerma-Chapala-Santiago basin region (SAGARPA 2004) (See Figure 20 below). In the past decades this region has suffered from water supply distribution, availability and quality problems (Schoendube et al. 2002). Specifically, the basin of Lake Cuitzeo presents a number of problems related to urbanization associated with the growth of Morelia city, the capital of the state of Michoacan. The Umécuaro-Loma Caliente basin is no exception, due to its proximity to the city. The most notable problems in this microbasin have to do with land use change, from forests to avocado plantations, pollution associated to agricultural production, forest degradation (pests, unsustainable logging practices) and low agricultural yields.

Figure 18 Location of Nieves ejido. From Delgado (2009).

The line in yellow in the southernmost side (lower right map) indicates the limit of the Umécuaro-Loma Caliente Basin. This basin is in the southern limit between the Cuitzeo basin (represented in the lower right image) and the Balsas basin to the east.



The ejido Nieves was enacted in 1937 and entered the PROCEDE program in 2005. It has 65 *ejidatarios* and 19 *avecindados*. The *ejido* has an area of 1,005 ha, of which 613 are dedicated to agricultural and common uses (RAN 2013), and the rest are forested areas. According to INEGI (2010), Nieves had 332 inhabitants in the 2010 census (INEGI 2011). It is distributed among 91 households. 51% of the population is male and 48% female. 31% of the population is represented by ages 0-14, 62% by the ages 15 to 64, and the range from 65 years and above 6% of the population. This is a mestizo population with no indigenous inhabitants. The average educational degree is 5.8 years (elementary school). 89 people report being economically active, of which 83 are male and 6 female. 25% were employed at the time of the census. The percentage of the population from 12 to 30 years that was unemployed during the census was 2% of the total population. Of a total of 91 households, 16% have a female head of household. The average number of inhabitants per household is 3.6. The number of houses with electricity, water and sewage is 6% of the total. The results of the survey carried out in this thesis research are that 63% of respondents are *ejidatarios*, while 37% *avecindados*, indicating that still a large proportion of households have formal land tenure. The average area owned by *ejidatarios* is 3.2 hectares.

Environmental context of Nieves community

Physiography, Hydrology and Geology
The most important water body in the Umécuaro- Loma Caliente basin is the dam of the same name, which is the second largest dam near Morelia. It has an area of 120 ha (Prat et al. 2007), with a depth of 6.16 m and a volume of 2,025,121.23 m^3 (López et al. 2007). The dam is the initial part of the course of the Rio Grande de Morelia , one of the two most important rivers in the state capital (SAGARPA 2004). Nieves *Ejido* has an important spring, a main stream and a small dam that was built in 2007. In recent months the community has maintained a dispute with one of the new *ejidatarios* (someone who recently acquired *ejido* land), due to the use of the spring. This person has attempted to encircle the source, which is just outside his property. The community became organized to prevent this attempt to privatize the spring.

Geomorphology and soils
The basin presents all types of slopes, the steep slopes represent 33,3% of the area, the moderate slopes 6 to 13%, and slight slopes 18,6% of the area (SAGARPA 2004). The dominant soil types are Acrisols, Luvisols and Andosols, (INEGI, 2006 based on FAO 1968).

Climate and vegetation
Nieves *ejido* is located in what is called the Neovolcanic climatic zone. The climate corresponds to the C(w2)(w) classification, which refers to temperate-sub-humid climate with summer rains, with a P/T coefficient greater than 55.3. Temperature varies from 12°C to 14° C up to 16°C to 18° C. Annual precipitation in the greater part of the basin is from 1000mm to 1200 mm. The basin also presents from one to eight *heladas* (frost) days in November, February and March, and more than nine days with *heladas* in December and January (SAGARPA 2004), although this information is changing. The range of time in which frost days appear seems to be increasing, as well as the quantity of frost days, according to local opinion. Before, frost used to appear in November, however in recent years there has been frost as early as the month of May.

The Neovolcanic zone (Madrigal Sánchez 1997) has vegetation associated with subtropical scrub, oak forest, pine-oak, pine, cedar forest, *tázcate* forest, fir forest, cloud forest, *palmar*, *tular* and *carrizal* and gallery groves. One of the main driving forces of change in land use in these areas is the establishment of avocado orchards (Carlón Allende 2006). In the last three decades, pine and oak forests in this region have been subject to an annual deforestation rate of 1.8%, while 20% of the area has suffered some type of degradation (Bocco et al. 2001). Bocco et al (2000) argue that at the state level, changes in land use cover are not linked to demographic pressures nor subsistence needs, but are rather a reflection of uncontrolled forest exploitation. In our field visits to the Umécuaro-Loma Caliente basin, we observed the establishment of new avocado orchards, especially on fallow land, but this phenomenon has also occurred in areas that were covered by forest.

Fauna
According to SAGARPA (SAGARPA 2004) the basin registers a great diversity of fauna. Among the mammals that have been observed in the area are: the arboreal squirrel (*Sciurus*

aureogaser), deer (Family *Cervidiae*), gopher (*Pappogeomys tylorhinus*), opossum, armadillo, rabbit, coyote, skunk, fox and mouse. The reptiles observed are rattlesnake, the *culebra de campo*, *hocico de puerco*, and *Alicante*. Among the amphibians we can find frogs and salamanders. The researcher personally found alive in a stream an *ajolote* (*Ambystoma* sp.) (Figure xxx, taken from Delgado, 2009), which is a species present in central Mexico, and is associated with highly conserved environments, which makes it a good environmental indicator (Huacúz Elías 2001).

Figure 19 A sample of *Ambystoma sp. found in Nieves*

SAGARPA´s (2004) participatory diagnostic found that when original cover is perturbed, some species abundance is also modified, and they acquire a plague status. Such is the case with "tuza" (*Pappogeomys tylorhinus*), mouse (*Apodemus* sp.), and, in the forests, the pine bark beetle, specially present after fires. In agricultre there is the black cutworm (*Agrotis ipsilon*), the larva of the May beetle (*Phyllophaga* sp.), the corn worm (*Helicoverpa zea*), and grasshopper (*Melanoplus differentialis*).

Productive activities (agriculture, animal husbandry, forestry)
The main productive activities are agriculture, animal husbandry and pine resin production. Through surveys performed in 2007 (Delgado 2009), we learned about some characteristics of production systems and the population dedicated to them. On average, producers have 3.32 hectares per household for agricultural production, where the main crops are corn, squash and beans (the latter is not always planted due to climate characteristics, it is greatly harmed by early frosts). In some areas also oat and wheat is sown. 50% of respondents mentioned that the agricultural area cultivated has declined for reasons that have to do with low productivity, the "thinning" of the land (unfavorable change in soil structure) and migration. The analysis of change in land use found that agricultural land has increased although only marginally in the last 15 years (Delgado, 2009). About half of producers use chemical fertilizer, while the other half continues to use organic fertilizer, pig manure, which they buy in the state of Guanajuato. Most of the products are for personal consumption, but some producers sell corn in the regional market. As for pests, producers report that the plague of *Melanoplus sp*, is recent and affects some areas of the watershed more than others.

The area dedicated to cattle constitutes 59% of the basin. Each producer designates an average area of 3.62 ha for grazing on fallow land. Grazing intensity follows the system of *año y vez*, that is, land is sown one year and the next year is left fallow. Producers add that the land in that area gives very "weak" grasses that do not meet the nutritional requirements of livestock, so they need to buy balanced cattle feed. Livestock production represents

savings for emerging situations, such as sickness but also important family fests, such as baptisms and weddings. Cattle is rarely sold at the regional market.

The forest areas are common use areas; although these areas have in practice been divided among *ejidatarios*, so that each owner can manage his/her property as he wishes. On average producers have 5 ha of forest, few producers have up to 20 ha, the rest, mainly small landholders and *avecindados*, do not have forest land. The main forest product is pine resin, which is extracted by a slit on the sides of trees. Resin extraction has been carried out since the forties and continues to be profitable, perhaps the most profitable income-generation activity for these forest-dependent families. The collected resin is sold to the industry "El Pino", in Morelia. A producer can earn on average 1.166 MX$ per hectare every two months. This amount does not represent the income of all *resineros*, as some acquire agreements to extract resin and divide it by half with the owner of the forest, earning about 1086.33 MX$ pesos per ha every two months, while those who extract large surfaces, or who dedicate most of their time to this activity, can get from 12,000.00 MX$ to 21,120.00 M$ every two months. It is noteworthy that the resin activity is subject to heavy duties imposed by the organized crime in the area, mainly in the retail part of the process (people who collect resin from each one of the extractors and gather it all together to sell it to the processing factories in the area (El Pino, Pinosa, etc.).

Intensive avocado production in orchards is an activity that is becoming increasingly important in the region, and is generating strong environmental changes locally and regionally. The orchards have been established mostly in areas where there was fallow land, with a few exceptions. People in general are concerned about the presence of these orchards, because they associate them with declining water quality and quantity, future water and soil pollution (due to the use of agrochemicals), and because they are not contributing significantly to generating employment in the area.

Important Socio-Political Actors in the area
Nieves is a rural community like most in Mexico. The institutions with which people interact or which have importance for natural resource management are: SAGARPA, CONAFOR, COFOM, and SEDESOL. They interact with these institutions through either technical assistants or through program representatives who visit the community directly to implement/monitor programs. Other political actors in the area may be the large avocado orchard owners, who due to their economic status, may have strong links to important government actors from the institutions mentioned. The *ejido* also has its *ejido Asamblea.*

Women´s participation
Women participate mostly in household activities; they also participate in government program activities, such as those offered by PROSPERA (before Oportunidades). They also participate actively in school activities, such as helping in the community cafeteria (which is part of SEDESOL programs for community cafeterias or dining halls). Women who help in the cafeteria have a rotating schedule to take turns to cook food for all the children in Nieves (from kindergarten to secondary school). Younger women who have gone through higher levels of schooling seem to have more esteem to participate in decision-making processes even when they´re interacting with men.

Analysis of the most importan issues in the NTFP literature

In the following section the different issues outlined in the introductory chapter will be discussed as they pertain to the case of Nieves *ejido.* This thesis work attempted to gather data and information regarding the issues outlined, however, many of these issues were not sufficiently explored, sometimes due to lack of time or to inadecquate questionnaire preparation (for example, missing questions regarding topics that came up in the interviews and discussions, posterior to the creation of the original questionnaires).

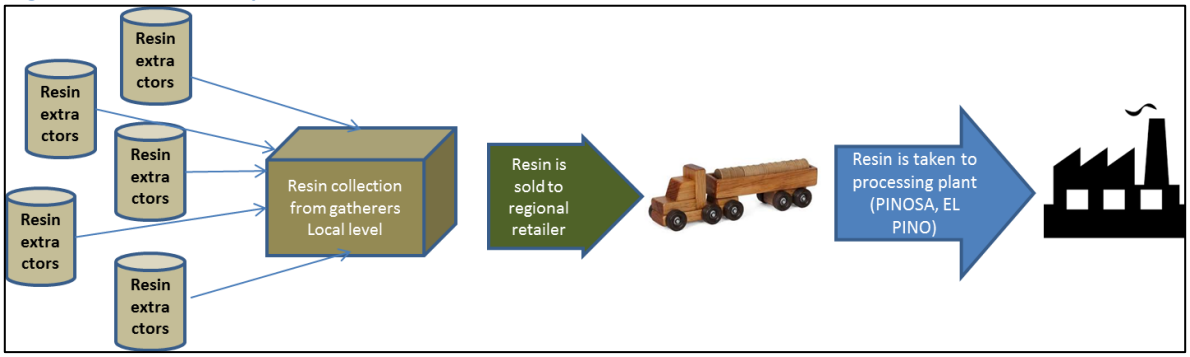
The source of the product, nature and production of product and scale of production

Resources used, common uses and management activities

The four most important resources extracted are resin, firewood, blackberries and mushrooms.

Resin: is a resource extracted from many species of pine. The collectors are mainly forest owners, and sometimes people they hire to extract and take care of their plots. Resin is extracted by making cuts on the trunks of pines, from which resin trickles down to small containers. When these containers fill up, collectors put all the resin in larger containers which they then take to a larger collector in the town, who in turn takes a truckful of barrels to a larger collector in the region, who takes it to the processing industries in Morelia. Resin is therefore not consumed locally, it is always sold at a regional level (See figure below)

.Figure 20 Resin chain of production



Firewood: most households use firewood for cooking. Firewood collection depends on the type of household. Poorer households will depend on firewood collection that they perform themselves, and they will use horses or donkeys for carrying firewood. Better-off households will collect firewood using trucks, and therefore the quantity of times necessary for them to supply their annual firewood needs may be less than those who do not own trucks. Some people will prefer to buy firewood from other people in the community. There are people in the community who sell firewood. It is sold at different prices depending on the season and quantity. People measure it by the size of the truck. One small truckfull of firewood is sold at $500.00 pesos. Larger amounts are more difficult to sell because people do not usually have that amount of money. Doña Rosalinda says:

"Nos dejan el viaje a 500 pesos y hay veces que andan las muchachas cooperando entre todas para comprar". (They sell the truckfull for $500 pesos, and there you have all the girls putting together their money to buy it").

Blackberries: these resources are collected by most people while they conduct other activities in the forests, such as collecting firewood. However, there are people who collect these resources specifically to sell them in the community or to take them to the towns around the community or to Morelia. These collectors invest more time and have greater knowledge about the areas where these resources are found, and also knowledge about the places where these can be sold.

Mushrooms: Most households in Nieves collect mushrooms during the season. In this community mushrooms are collected in the nearby forest, mainly for subsistence purposes. There are a variety of mushrooms, such as *llano*, *oreja de puerco*, *trompa de puerco*, *potorico*, among others (see annex I for more information on possible species collected). People consume mushrooms as part of their diet during the season, and rely on them to save up money which would be spent buying other foods. Some people say that eating mushrooms is like eating meat, and they do consider them an important part of their diet. In Nieves we did not meet mushroom traders. In the past some of the women who collect blackberries also collected mushrooms to sell in Morelia´s markets. But there are complications with this, because the blackberry and mushroom seasons do not always coincide, therefore, it is not easy to collect mushrooms and blackberries at the same time. Moreover, mushrooms are very perishable resources, and this may imply collection and transportation costs which are not compensated through marketing.

Although there are no rules for extracting blackberries and mushrooms, people from the community, especially those who have used these resources for many years or generations, know that special care must be given to bushes or plants so that they can grow again in the next season. Doña Rosalinda comments that more people now are collecting blackberries than in previous years:

> "Sí, mucha gente la vende también, ya no sólo nosotros, gente de por allá de otros lados o a veces vienen de Zimpanio los inditos, esos duran días se quedan en el cerro y juntan por cajas maltratan los árboles bien feo, los tumban, los hacen muy feos." (yes, a lot of people also sell, not only us, people from other places, sometimes they come from Zimpanio, the indians, they stay many days in the Woods and collect by the boxes, they harm the trees badly, they throw them down, they damage them).

There is a clear vision that in order to have resources like blackberries and mushrooms the trees need to be in a good state, therefore, one of the activities that people consider important for maintaining NTFP availability is to prevent logging (illegal or not).

Regardless of the importance of blackberries for subsistence and small-scale marketing purposes, blackberry collection is diminishing, due to the reduction of collection areas. The map (Figure 25) in a section below shows the areas where NTFPs are collected. These areas are undergoing land use changes, some of them are being covered by avocado orchards and

encircled by their fences, some others are undergoing ecosystem changes, such as the reduction of humidity due to the drying up of springs. Many areas are becoming unaccessible to local collectors, and in some others availability of resources is diminishing. In the rest of the areas collection is open and permitted. However, in many instances, arriving at these areas involves walking around the large extensions of avocado orchards, which plays a major role in the decision to arrive or not at these far-away zones.

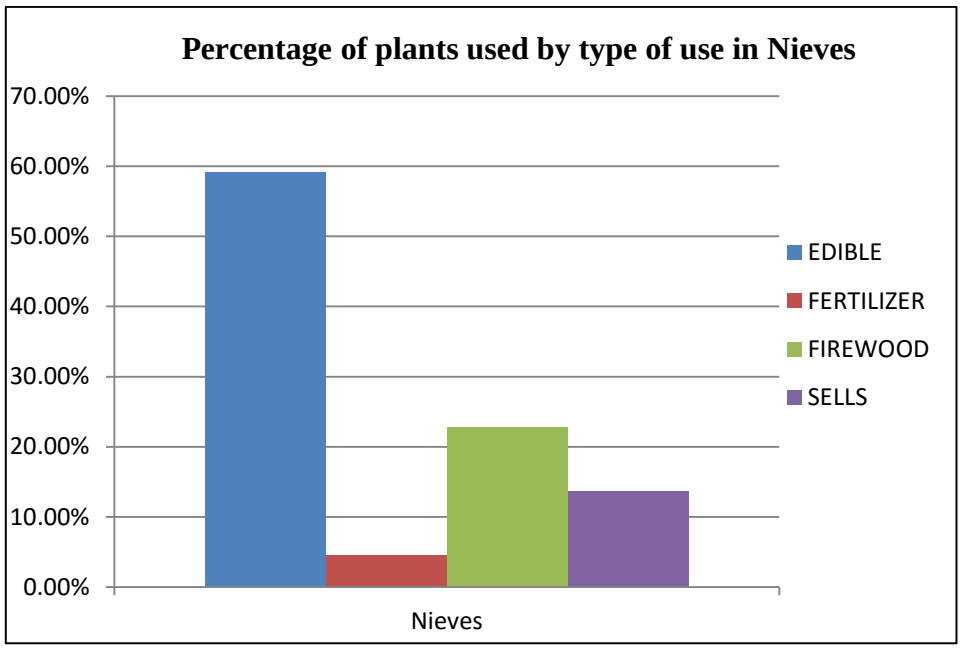
Wood for construction:
Wood is another resource extracted from the forest. Although it is a resource that is under stricter extraction rules, it is extracted by locals with permission of the state forest commission (COFOM), and in many other instances, it is extracted without permission from people´s own forest parcels. In order to cut a tree with COFOM´s permission, the interested party needs to go to COFOM´s offices in Morelia and then wait for COFOM to send a technician to Nieves in order to "mark" the trees to be cut. This process may take some weeks, sometimes making it simpler for people to just go ahead and cut the trees without permission. Although the permit itself has no cost, getting a permit involves transportation costs to Morelia and back.

Medicinal plants: it is not common to find people who collect medicinal plants from the forest or secondary vegetation. It is older women who still collect herbs to use them as remedies for simple illnesses. Doña Rosalinda, for example, collects:

"De medicinas pus plantas de las que hay en el campo como la cincogalla, la conolor, la Santa María, la salvia, pero hay muchas plantitas que uno a veces las usa como pa un golpe, la pata de león, tecata de encino es lo que usa pa remedio pues" (As medicine, well, plants that can be found in the fields such as cincogalla, conolor, Santa María, sage, lion´s paw, oak bark is what is used as a remedy).

She collects them during the season and dries them up to save them, or puts them in alcohol to be used when needed. She also buys locally chamomile, garden cinnamon (canela de huerto) to dry them for later use.

Figure 21 Percentage of plants by type of uses in Nieves. The bars represent a percentage of all uses reported.

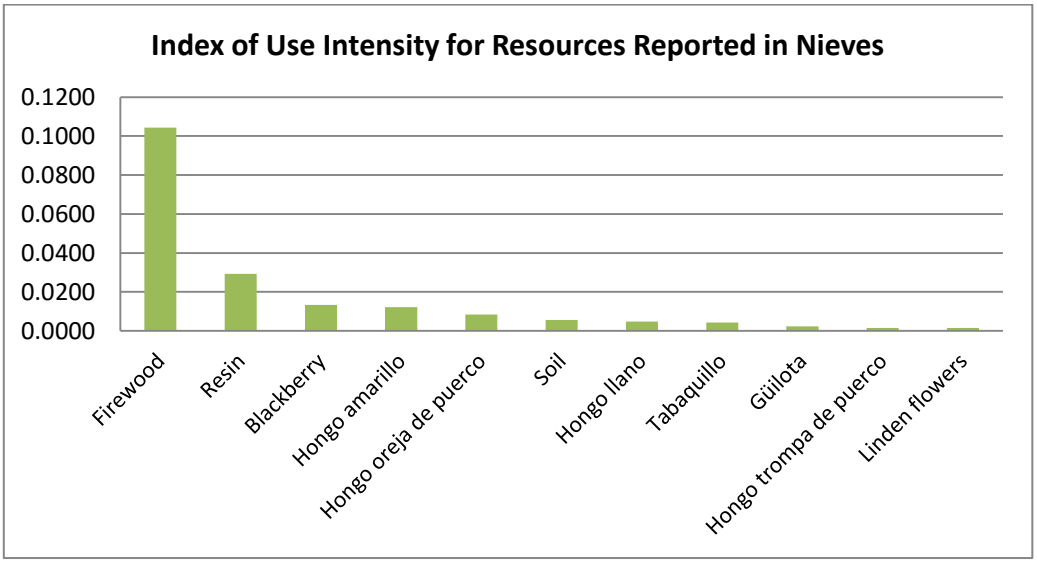


As can be observed in the graph above, 60 percent of all plants used and named by people are collected for eating purposes in a subsistence scheme. The second most common use of resources collected is fuel (firewood), indicating the importance that forests still have for household economies and livelihoods. The third most important use is collection of specific resources, such as resin, for marketing purposes.

Index of intensity of use and local value of resources extracted

As mentioned in the methodology and in the Index of Intensity of Use section in chapter 5 (en la página 140), from the information gathered through our questionnaires, we developed an "index of intensity of use", which incorporates the variables of quantity of the resources collected, times during the year in which these resources are collected, and the time that it takes to get to the resource as a measure of distance. Our results are presented in the figure below.

Figure 22 Index of intensity of use for the most used resources for *ejido* Nieves.



As can be seen in the graph, the resources with the highest intensity of use values are: firewood, pine resin, blackberries, yellow mushroom, pig-mouth mushroom (trompa de puerco), forest soil, plain mushroom (*llano*), *tabaquillo, güilota* (a type of bird), and linden flowers. Most of these resources are collected for subsistence purposes. The resources that are marketed successfully are pine resin and blackberries. Some people collect mushrooms and blackberries and sell them within the community, but other resources are sold to traders in Morelia´s markets.

The importance of firewood in the livelihoods of this community is evident in the graph above. Most people in communities such as this one still depend principally on firewood for cooking (92% of people surveyed by Delgado, 2009) , although they may also buy natural gas to cook in stoves, but gas is more expensive than taking a few trips to the woods twice or thrice a year, -because in rural environments money may be hard to come by-. Some people collect wood and sell it to other people in the community, but in general, each household collects the firewood it needs and organizes its members around firewood collection. Firewood is collected in the nearby forest, however, due to demand and forest degradation, firewood is hard to come by in the nearby forests, therefore, collecting firewood is becoming an activity that requires more time and effort investment. This is a reason why many people are deciding to buy firewood, and others are assigning more time and effort to collecting large quantities of firewood so they can sell it to other community members. Firewood is mostly fallen branches of trees, but people sometimes recur to cutting down branches of trees (cutting down entire trees to obtain firewood is not accepted in the community- although it may be done).

The second most important resource in terms of use is resin. Resin is of high economic importance for those households that extract it, because it is well valued in markets, they have regular buyers, and it requires less effort than other productive activities.

The third most used resource is blackberry. Blackberries are also very marketable resources. Of all the resources extracted, the ones with the highest index of intensity of use are also those that are more marketable. This may be coincidence, however, it's a topic that must be analysed when looking at marketing and intensity of extraction.

Availability of resources

The perception of availability of a resource depends greatly on the type of user of that specific resource. People who extract a resource for subsistence purposes may have a different view from a person who extracts that same resource for marketing purposes. When people extract berries for their own consumption, for example, they expect to extract whatever they find, but in small quantities. However, people who extract for marketing purposes expect to find greater quantities and thus are more aware of changes in availability, because they can make comparisons through time. One of the women interviewed, doña Felicia, observes that currently it is more difficult to find blackberries, they can only be found in gullies and each time it is necessary to walk greater distances to find them, also due to the establishment of avocado orchards. The presence of these orchards force blackberry collectors to have to walk around the fenced orchards, increasing the distance and time that people have to spend to go around orchards in order to arrive at the zones where blackberries can be found. So it is not only a matter of availability, but also of how to arrive at the zone where blackberries *are* available.

Avocado orchards have had an important effect on blackberry and mushroom availability. In many instances, orchards have been established in zones that used to be forests, therefore, eliminating all the resources that used to grow there, and the possibility of regrowth in the long term. The perception of one of the collectors (all women) is that orchards "take away all the soil" which is needed for other resources to grow.

Another blackberry collector, doña Rosalinda (a lifetime collector), mentions that availability has decreased, particularly in the past 5 years, and she associates these changes with an increase in the number of people who collect this resource. She also comments:

> "antes que juntábamos para ayudarnos más había harta y ahorita por los bosques que ya se los están acabando ya no hay, pues es que como limpiaron los montes que los querían reforestar y limpios pues tiraban todo el zarzal y pues muchos montes ya no tienen. Pues como el hongo, que en este año ya no hubo pues falta de eso, pues ya no hay condiciones ni nada que se da, no hay bosque con que se cría" (before, when we collected for ourselves there used to be a lot (of blackberry) and now, because the woods are being destroyed, there are no more blackberries, because they cleaned the woods because they wanted to reforest them, they cut all the blackberries and so many woods do not have blackberries any more. The same for mushrooms, this year mushrooms did not grow because the wood lacked the debris that had been cleaned... there are no conditions for mushrooms to grow. (Interview with Rosalinda Villaseñor, 28 November 2013).

Doña Rosalinda reports that many years ago, when her children were young, she used to collect up to 9 buckets of blackberry, and she would take the bus to the *Independencia* market or other markets in Morelia to sell them. Five years ago she would collect from 4 to

5 buckets and it would take her three days to fill this amount of buckets. Now-a-days it takes her a whole week to gather enough to fill a bucket, and she hardly collects 2 buckets in a week. Carolina and Enriqueta, another two collectors, say that before it used to take them about an hour to fill a 20 lt bucket, now it takes them about 3 hours.

So another theme that comes up when talking about availability is the impact of forest conservation activities on NTFP availability. In the section below "management activities" we refer in greater length to the impact of conservation activities on these resources. Management activities that are part of reforestation programs affect availability because the purpose is to "clean" off all wood debris from woods. The impact of this clearing is that it removes decaying material on which mushrooms grow; but it also directly eradicates blackberry bushes in an effort to clear the ground to make room to plant pines and to eliminate competition for pine seedlings.

Availability is also calculated through perceptions on the time and season in which these resources grow. Doña Rosalinda comments that blackberries used to grow from the month of March on, until the end of the spring (june):

> "pus ya casi no come uno pronto porque pus ya empieza a haber tarde y más antes no, empezando ya pal 19 de marzo ya andábamos vendiendo pal día de los Josés ya vendíamos mucho en los ranchos pa el atole, porque mucha gente lo usaba para las fiestas y ya ahorita pus empieza a haber hasta abril" (now we don´t eat early because the blackberries grow later in the season, before they used to grow by March 19, for the José festivity, we would already be selling in the ranches to make *atole,* many people used it for the festivities, but now they grow until April).

The blackberry season has shortened. The mushroom season has also become shorter, it used to last until November, now it ends in September.

The time it takes to collect these resources is also a measure of their availability. Rosalinda comments that before they used to arrive at any woody area and find blackberries right away. Now in these same areas they have to walk around the hill to find very few blackberry trees. Her perception in general is that today there are fewer blackberries available than before. Other collectors also observe that before it would take them about half an hour to get to the places where blackberries grew; now it takes them more than one-and-a-half hours to get to these places, and the availability in these areas has decreased, so they have to spend more time walking around to find blackberries.

Other factors may be affecting availability, such as changes in climate and resource use. Doña Rosalinda observes that in areas where she currently collects blackberries she also would find mushrooms, but lately, mushroom presence in these areas has decreased or in some cases, mushrooms no longer grow there. This may be due to many factors, such as a decrease in water availability (which is manifested with the drying up of many springs in the area), the degradation of vegetation, which impacts on microclimates that offered the conditions for mushrooms to grow, the presence of cattle, and also, the increase in the quantity of people who collect mushrooms.

Areas where they are found (land cover) and distance to the sources of the product
Blackberries and mushrooms can be found in the woody areas close to the town. However, although there may be available, some areas are outside the allowed range for people from Nieves, because these areas belong to other *ejidos*. Nevertheless, collectors from Nieves can still use areas from contiguous *ejidos*, because the people from those *ejidos* usually know who comes from the *ejidos* next to them. There is a tacit agreement that people from surrounding *ejidos* can use common pool resources, particularly NTFPs, from another *ejido.*

Figure 25 presents the result of a participatory mapping session in Nieves. This mapping included the presence of students from the local high school (Colegio de Bachilleres del Estado de Michoacán) and also older men and women from the community. The map is part of the thesis work of Adrian Ortega Iturriaga (In progress).

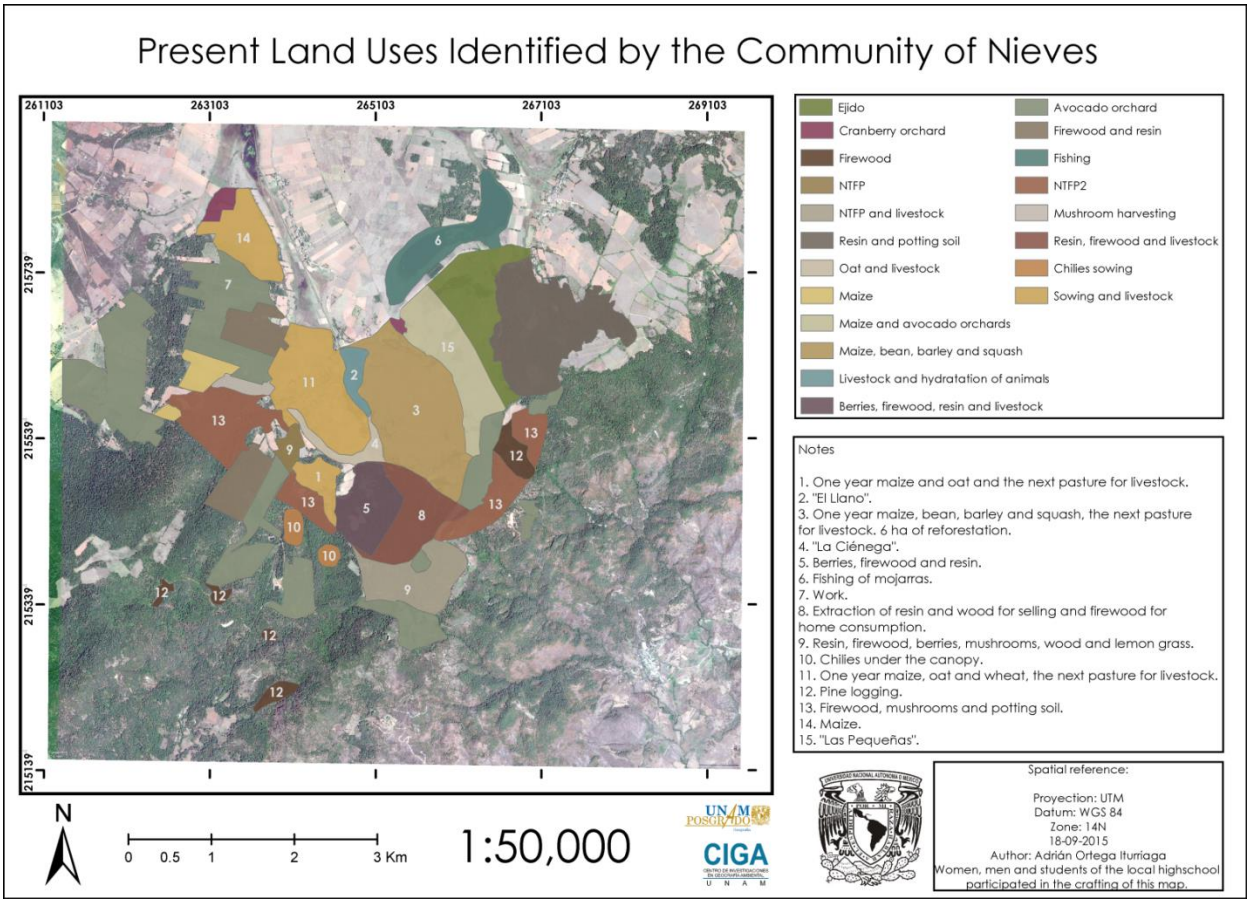
NTFPs are mostly found in forest areas located at a 15-30-minute walk from the town. Although forests are found close to the town, the areas where NTFPs such as mushrooms and cranberries can be found are farther away every year (at a 30-minute to a 1.5-hour walk away), although they are still found within those areas marked as NTFP extraction in the map (Areas 5, 8, 9, and 13). NTFPs are also collected in woody areas further away to the south and southeast of Nieves. These areas belong to other *ejidos*, but can be used by Nieves inhabitants for NTFP collection (logging and cattle are another story. These activities are usually reserved to the owners or people from the *ejido* to whom these lands belong).

Resin, the most important NTFP in this community, is extracted in all forested areas around the town, while there are other NTFPs, such as some medicinal plants and blackberries, which are extracted from areas with secondary vegetation, such as those marked with 3 and 11.

The map also shows those areas occupied by avocado orchards. Orchards occupy large areas, up to 10 hectares or more in many cases. These orchards are surrounded by fences, representing obstacles to transit for people who used to walk from one town to another, or who used these areas to get to forest areas with higher availability of NTFPs. Orchards have also occupied places that used to have forest or secondary vegetation, and which also had NTFPs such as blackberries and mushrooms. The establishment of these orchards has represented a degree of loss for NTFP collectors, for whom these areas represented important collection zones.

The impact of fires on NTFP availability is important, because fires affect regrowth of species such as blackberries.

Figure 23 Present land uses identified by the community of Nieves and aerial photograph of the microbasin as a reference.



Ownership of the resource and benefit distribution

Ownership and distribution of benefits and impacts

In Nieves, as in many other *ejidos* in Mexico, forests have been parcelled so that each *ejidatario* can use and take care of the forest however he/she wants to. About 30 years ago, Nieves had a rotating system in which each *ejidatario* could use his parcel during only 5 years, after which it was another *ejidatario´*s turn to use another parcel of forest, until it went around every *ejidatario*. This system meant that most *ejidatarios* could not exploit the forest at the same time, and they had to wait for their turn. But now the forest has been parcelled and each owner has to take care of it and has the right to use the resources present in their parcel. One of the *ejidatarios* interviewed thinks that this is a better system, because each owner invests the time they think necessary to care for the forest, so they are responsible for their own resources. Organizing people can sometimes be a very consuming task, and not everyone responds with the same compromise. So forest owners are preferring to manage their own parcels, although there are still many activities that they carry on as a community, such as cutting fire lines, putting out fires, or other activities that benefit all the community.

NTFPs can be found in different areas around Nieves, some of these are woody areas and others are areas of secondary vegetation, roads and streams. Most of the places where

NTFPs are collected are common-use areas, even though they do have specific owners. As mentioned before in this chapter, most of the lands used for productive purposes are surrounded by barbed wire, however, this wire can be pushed down or jumped above to pass through. It is customary and people allow this transit of people who are not owners. In the case of NTFPs such as mushrooms and blackberries, people can collect them in land owned by others as long as they do not harm other resources (for example, as long as they do not cut trees). So, although land ownership is mostly in the hands of a small group of *ejidatarios*, the rest of the population can still use resources found in other people´s lands. The photographs show parcels on the sides of the road which are surrounded by barbed wire. This barbed wire can be pushed up or shoved down to open up a space to step through. It is common practice of local inhabitants in communities such as Nieves to step through barbed wires and to walk through other people´s lots in order to get somewhere else. This is however changing, because the idea of private property is becoming more ingrained in the culture, while in the case of orchards, it has become literally impossible to walk through because these are surrounded by fences.

Figure 24 A tipical landscape of rural areas in temperate zones of Michoacán.

The establishment of orchards has created new divisions in the distribution of benefits offered by nature, because it has modified ecosystems that used to provide services and benefits for all the population, such as NTFPs. Once established, these new production systems modify the entire ecological dynamic, first by substituting natural ecosystems with artificial monocultures. Secondly, it physically excludes local inhabitants from using these areas for extraction of NTFPs or other resources, because there are physical barriers, but also because these resources no longer grow in these intensively transformed productive zones. Therefore, the benefits of these new productive systems will always be much more private than the benefits offered by traditional productive systems, which not only produce a diversity of products, such as maize, beans, zucchini, etc., but also allow for other resources to grow there, that can be used by everyone in the community.

Land ownership and organization around natural resource use in rural communities in Mexico is very similar throughout the country. It is primarily *ejidatarios* or *comuneros* who benefit directly from natural resources present in their parcels, such as soil for agricultural

production or resin and firewood from their forest parcels. The rest of the population, that is, the *avecindados*, are also allowed to profit from some of these resources, particularly NTFPs and firewood. However, owners are becoming more and more conscious of their property, and sometimes try to impose stricter rules around trespassing, through the *Asamblea*, which coordinates *ejidatarios* in the town. Regardless of these efforts, the benefits of forests and secondary vegetation to local inhabitants are more or less available for the entire population.

Table 9 Characteristics of users per resource collected

Resource	User	Characteristics
Resin	*ejidatarios*	• Male forest owners between 40-70 years old (or older)
Firewood	*Ejidatarios, avecindados*	• All households collect firewood in some degree • Those who own a truck can collect enough firewood to sell, therefore are better off than other collectors • Buyers of firewood within the community are: older people and people who work outside the community, who do not have time or the transportation means to collect this resource
Blackberries	Mostly female *avecindados* and *ejidatarios*	Collect to sell: Female *avecindados* in their 40´s or older. • The older collectors also have a history of orphanhood • They invest more time in collection • They collect throughout the season, two or three times per week Collect for own consumption: mostly women and their children, both *ejidatarios* and *avecindados* • They collect once in a while during the season, 2 or 3 times per season
Mushrooms	Women and children	Women and children, both *ejidatarios* and *avecindados*. All collection is for consumption purposes. They collect once or twice a week throughout the season
Medicinal plants	Women	Very few women collect, they are usually older women (past their 50´s)
Forest soil	Men and women	Men and women of all tenure status and all ages. Collection is done for own consumption (to use as fertilizer for their gardens)

As can be seen, most NTFPs are still collected as open resources, yet, the presence of physical barriers such as avocado orchards, has an impact on the freedom of transit of most

collectors, regardless of their tenure status. Collection of resin, the most valuable NTFP –in terms of income generation- is very dependent on the land tenure status of the collector; that is, collectors of resin must either be the owners of the forest plot or be hired by an owner.

There is still on other type of users which are more difficult to characterize. These are users for other communities in the region who may go to Nieves territory to extract resources like blackberries, mushrooms and soil. In the city of Morelia it is common to see soil sellers walking around the city carrying soil on horseback. These sellers either collect soil from the areas surrounding Morelia, or buy it from people who are inhabitants of those areas, who collect soil to sell it to these retailers.

Ecological impact of resource extraction and of forest conservation activities

Perceptions of impact of NTFP extraction

The perception of negative impacts of NTFP extraction have to do with the resource extracted, and it is also associated with who carries out the extraction. Resin is perceived as a resource whose extraction is not harmful to the trees or the forests if care is taken not to carve more than the "faces" (caras) allowed per tree. Resin extraction is perceived to be related to the presence of *Dendroctonus frontalis*, a pest that attacks pine trees. There is close surveillance around the forests to detect trees that present this pest, and once a tree is seen to have this pest, it is quickly cut and treated with special pesticides. The wood that results from cutting these trees is used to make posts or other necessary household implements.

Resin extraction is a very "noble" activity. It is due to this activity that forest owners dedicate time and effort to keeping the forests in a good state. Care is taken to control pests, and when there are fires quick responses arise from owners and people in adjacent towns. Because it is also an activity that gives good economic returns, forest owners make sure that, through taking good care of the forest, this activity will last for a long time.

Blackberries: the perception of the impact of blackberry extraction depends greatly on who collects the resource. Collectors from Nieves seem to think of themselves as careful collectors. They worry about not harming the plants when collecting fruits. A comment from local collectors is that outsiders do not know how to extract blackberries, and they damage plants by stepping or pulling them. They also observe that collectors from other communities extract berries even when they are not ripe, diminishing the benefits that can be obtained from the general collector sector. But besides this perception, the general idea from collectors seems to be that NTFP extraction, when it is well done, does not cause serious harm to plants or the ecosystems where they are found.

Mushrooms: because mushrooms are collected for subsistence purposes, the general perception is that collecting them is not harmful as long as people collect for subsistence purposes. This may be an incorrect idea, however, because subsistence extraction may be just as harmful as extraction for marketing purposes. No particular care is taken when extracting a mushroom: sometimes the whole body is extracted including the vulva, some other times the mushroom is cut from the vulva. There is no percpection that trampling over

areas where mushrooms grow may have an adverse impact on mushroom reproduction. The perceived decrease in mushroom availability is associated with other factors, such as climate variability, decreases in humidity and raid, fires and forest degradation in general.

Firewood: extraction of this resource is not seen as harmful to the surrounding environment as long as only dead wood is extracted. On the contrary, picking up dead wood is seen as something that is good for the forest, because it reduces the amount of wood that can burn in the event of fire. Only in the case of blackberry collectors is the clearing of dead wood seen as a factor that may affect blackberry availability, particularly when bushes ar cut down to crear forest floors of bushes and dead wood.

Perceptions of environmental changes that affect NTFP availability

There is a predominant perception among the population (56% of questionnaires) that water quantity has decreased in the past decades. This is attributed to deforestation and the presence of avocado orchards; people say that the orchards are taking what few rain falls to their private wells.

> "De por si no llueve y el día que llueve se va a los pozos de las huertas" (already it does not rain, and the day it rains it all goes to the orchards´ wells)

69% of the people surveyed noticed changes in the state of the forests in the past 10 years and 29% did not observe changes. 43% observed an increase in deforestation, 9% afforestation, 6% saw an increase in forest plagues, 3% changes in temperature, 3% a decrease in springs and 6% an increase in deforestation to establish avocado orchards.
86% has noticed changes in climate, while 14% observes that climate has been the same in the past 15-20 years. 57% observes changes in temperature (hotter, cooler), 6% observe an increase in frost days outside the frost season, 23% that rains occur outside the regular season, 34% that it rains less (in quantity and time). All these changes are attributed to forest degradation due to activities such as illegal logging, incidence of plagues and forest fires.

They also identify the establishment of avocado orchards as a strong promoter of climate change, specifically related to the availability of water in rivers and streams, with the incidence of rain, and other changes; such as changing secondary vegetation zones where they could find NTFPs into inaccessible monocultures. They associate these changes in land use with pollution of soil and water bodies.

They are also concerned with the "bombs" to dissolve hail storms that the avocado orchard owners throw into forming clouds to slow down hail formation. The impact of these bombs on agricultural production is high, because it "dissolves" rain (Information was found of this phenomenon in Argentina, but no serious studies have been done about the impact of these bombs in local/regional climates).

Less water is observed in streams and dams. This impact is associated with the lack of rain, but also with the presence of avocado orchards, which extract water from underground sources through wells. Older people also observe a decrease in the amount of springs. This

is an important observation in many ways, because the presence of NTFPs is associated with zones of specific environmental characteristics, such as the presence of water bodies or humid zones. If springs dry up, many resources that grow around them also disappear.
Changes in infrastructure, such as the building of roads, affect directly NTFP availability, by destroying the environments where these resources grow. Blackberries grow on the sides of roads, so when these roads are paved or opened-up to allow larger vehicles (trucks), blackberries are cut-up and no longer grow in these areas.

Impact of conservation activities on availability of the resource
Conservation activities may have both positive and negative consequences on availability of NTFPs and the state of the forest. In general, conservation activities such as clearing decaying material, digging fire lines, and water capture ditches, are perceived as positive because they help prevent fires. These same activities are perceived as harmful to the environment in which mushrooms and blackberries grow. On the one hand, clearing of decaying material seems to affect mushroom growth in a negative way, because mushrooms require this decaying environment to grow, or at least that is the common perception among collectors. On the other hand, when bushes are carelessly cleared, many blackberry bushes are also cut, reducing the availability of this product- and biologic al diversity in general. Therefore, conservation activities are seen by mushroom and blackberry collectors as harmful to these two resources.

Rural livelihoods, safety nets and marketing of NTFPs

Economic contribution of NTFPs to RPU´s and NTFP markets
As mentioned in an earlier section, those resources which have highest intensity of use index values are those which can be marketed. There are different types of collectors, some of whom specialize on marketing of the resources they collect. The three most marketable resources found in Nieves are pine resin, firewood and blackberries.

Pine resin: is a very marketable and profitable product. There exists in Mexico a stable demand for this resource, although prices do vary throughout the year and through the years. The collected resin is sold to the industry "El Pino", in Morelia. A producer can earn on average 1.166 MX$ / ha every two months, although the value of resin per hectare is closer to 2,400 MX$ per ha per two months (1,200 MX$ per hectare per month). This amount does not represent the income of all *resineros*, as some acquire arrangements to extract resin and divide it in half with the owner of the forest plot, earning about 1086.33 MX$/ ha every two months, while those who extract large surfaces, or who dedicate most of their time to this activity, can get from 14,000 MX$ to 21,120 MX$ every two months. Therefore, the benefits obtained from marketing resin are proportional to the quantity of land owned or worked. It is noteworthy that the resin activity is subject to heavy duties imposed by the organized crime in the area, mainly in the intermediary part of the process (people who collect resin from each one of the extractors and gather it all together to sell it to the processing factories in the area -El Pino, Pinosa, etc.).

Resin is the only resource that has a secure market and this market functions at the local level although it has regional importance. As described in a section above, resin is collected in the woods by the owners of forest plots or their employees; it is then collected (bought)

by local intermediaries, who collect the smaller amounts of resin from gatherers, and later sell this resin to regional intermediaries, who in turn, sell larger quantities of resin to processing plants in Morelia or elsewhere in the state of Michoacan. Resin can be considered a "secure" product, because it can always be sold, there are no losses (it is not perishable), although prices do vary throughout the year. The variation of prices at which gatherers sell to local collectors depends on national or international resin prices, which in turn depend on resin production in other countries, such as China. As was discussed in Chapter 3 (policy), the state of Michoacan is the most important resin producer in Mexico, and resin, in turn, contributes with a large share of the NTFP production volumes accounted for on national production statistics. For Nieves inhabitants who own forest plots, resin is a very secure and dear product, because it is highly accountable.

Firewood: most people extract on average 1000 kg of firewood per household annually (according to this thesis research). This depends on the size of the family. Some individuals collect firewood to sell to other people in the community. People who buy firewood are usually older people who live by themselves, or single mothers, or other vulnerable groups with low mobility or poor accesibility. Collecting wood is an activity that requires some type of transportation option, such as having a horse to carry the wood, or a truck. Almost no one reported collecting the firewood only by human transport. Most people use either a horse, donkey or a truck to bring the firewood back to town. Those who have greater extensions of forest land also have the option of extracting greater quantities of firewood so that they can sell surplus to other people in town. This possibility also depends on household assets such as means of transportation. As mentioned before, a truckful of firewood costs $500.00, therefore, people who have trucks and also forest plots have a greater possibility of obtaining income from collecting and selling firewood.

Blackberries: Doña Rosalinda, one of the principal blackberry collectors, mentions that in the past she used to collect 4-liter buckets which she exchanged for beans or zucchini in the community. Presently, she, aided by her daughters-in-law, collects blackberries about 5 times a year. They gather one 20-liter bucket every two weeks during the blackberry season. This they take to *Independence* market in downtown Morelia. One 20-liter bucket is sold at $250 pesos, which she uses to buy soap and produce in that same market. She spends $64 to travel to the market. There are only two buses that go from this market all the way to Nieves, so when she goes to sell these products she has to plan an entire day of traveling and spending time in the market. It is important to note that before she used to sell more than one 20-liter bucket, but availability and conditions for extraction have made it more difficult to gather enough blackberries to sell. When she collects less than 20 liters, she prefers to eat the blackberries with her family. Thus, in order to market these resources there needs to be a sufficient quantity so that it is profitable to spend time and money on transportation to the city.

Other blackberry collectors give the collected resources to relatives who live or travel to Morelia, and who sell the products in their neighbourhood. They also take the products themselves to people who they know always buy blackberries, -like ice cream shop owners- but this dependency on fixed traders may also force them to lower prices.

There seems to be a decreasing importance of the blackberry market for the few families that used to rely on collection and marketing of this resource, and this may be associated with changes in the environmental and socioeconomic context. Environmental changes may be impacting availability, as well as economic dynamics that promote land use change. In the socioeconomic sense, the changes that affect marketing preferences can be related to the opening of employment alternatives, be it in avocado or cranberry orchards in the area, or in other places further away, as domestic workers in the city of Morelia. These new opportunities make NTFP collection less attractive, because it implies a lot of effort and what is obtained through trading these products does not compensate for the effort and time invested.

Some collectors think that the number of people who used to collect resources to sell has decreased, due to the diminishing quantities of resources available.

Mushrooms: are products that are difficult to market because they are fragile and perishable, and also due to a diminishing availability which may be associated with environmental conditions (forest degradation and climate change) as well as increasing extraction pressures. Nieves inhabitants do collect this resource, however, it is collected for the household´s own consumption. No mention was made by respondents about collectors marketing this product. In the past, however, some people did market this resource, as mentioned by one of the interviewees. Occupational changes, changes in availability, changes in transportation costs, generational changes, and changes in the availability of necessary products offered in the surrounding markets, may be influencing decisions of collectors to market this resource. When people become less dependent on centralized markets in the capital city of Morelia, trips to the city may be diminishing, making it difficult to spend on transportation costs only to market these products. Usually, when NTFPs are traded, traders try to make the most of transportation costs, and try to accomplish many things in the same trips: marketing is not the only task they wish to carry on. People usually sell many products from their communities, and at the same time they buy goods to take back to their community. With the rise of new markets in the surrounding areas- such as Acuitzio in the case of Nieves- there may be less of a need to travel to Morelia. However, in markets close to areas with mushroom availability, consumers may not be as willing to buy a product that they can collect themselves in their own community.

Importance for subsistence

NTFPs are still very important for subsistence purposes, that is, for household consumption. Mushrooms are of particular importance for local diets. There is a tradition of going to the forest to collect mushrooms during the mushroom season (July to September). Mushrooms are important for local diets, people admit relying on mushrooms to complement their diets during the mushroom season. Firewood collection is also an activity that is performed mainly for subsistence purposes, that is, to fulfil subsistence needs such as that of fuel for cooking and heating up water. Most people collect firewood to fulfil their own fuel needs, only very few households collect this resource to trade it locally. The same happens with blackberries, where many people collect them for their own consumption, although it is more common for people to buy them from local collectors. These three resources are important for subsistence, in the sense that they are products that people

expect to consume, yet, it could also be said that they are not "indispensable", but are still important products that complement local economies.

Impact of other social dynamics on Forest Resource Use

In our 2013 survey, 43% of the participants responded that migration had increased in the past 20 years, compared to 24% in 2007. 56% thought that migration remained the same in the past years, while 24% thought it had increased. None saw a decrease in migration.
7 of the respondents had not migrated ever, while 27 had migrated to the USA or other parts of Mexico. The average time of migration was 2.6 years, however, some had migrated for a period of 10 years.

The impact of migration on forest resource use is not evident, like it is in other productive systems such as agriculture. This is due partly to the fact that forest owners are older men who have either migrated at some point of their lives but have returned to stay in Nieves, or they have never migrated and have a strong dependency on forest activities (resin extraction), therefore, migrating may not be attractive for them because they do have important resources to generate income. Other sectors of the population, however, have a more precarious situation and depend on alternative production systems, including temporary employment in surrounding construction sites or in Morelia city. Daily migration to the city or nearby areas reduces the time that people spend in the community. Therefore performing activities such as NTFP collection is no longer carried on by those who work in these temporary jobs. Moreover, the economic return of collecting and selling NTFPs is not comparable to the kind of returns people can obtain from these temporary jobs. Migration, in combination with a reduced distribution of land tenure among the population, a lack of employment opportunities in the community, and the loss of value of agricultural products, all contribute to a reduction of NTFP collection and marketing by local inhabitants.

Community organization around NTFP use

In the interviews there was mention of immediate actions people take in the forest to reduce the incidence of pests. It is interesting to note that in initial interviews, people reported that they had to go to CONAFOR to ask their technicians to mark infested trees. Without a mark no tree could be felled, but sometimes technicians would take many weeks to visit the communities and the pest would spread. That was the official procedure. Now, as a plagued tree is detected, it is immediately cut and treated with pesticides, and is afterwards used to make poles for fences. One of the main actions to mitigate climate change that people identified clearly, is reforestation and taking better care of the forests (fire fighting, pest management).

People from Nieves can enter anyone´s lands, as long as they are located within the *ejido*. Anyone from the *ejido* can extract resources from any *ejido* land. This is a tacit agreement and is particularly understood that some people from the community have greater dependence on the extraction of NTFPs for their subsistence. However, there is an increasing preoccupation from some *ejidatarios* regarding who enters their parcels to extract resources that they have taken care of. Some people are becoming more protective of their resources (as mentioned in the marketing chapter, some communities are protecting

their resources and no longer allow people from outside the *ejido* to extract their resources), and these people seem to be those who are more interested and active in conserving the forest, such as the case of Nieve´s actual *secretario ejidal*, a man who has occupied many times the post of *comisariado* and other roles in the *mesa ejidal*[35], and who has been exposed to contact with forest technicians from CONAFOR, COFOM and other government organizations. This man is well versed in concepts related to conservation and sustainability, and is very active in all activities related to conserving the forest, but also with those associated with improving infrastructure for the community. Younger people who have achieved higher levels of education (now the community has a high school) are also more aware of their right to protect their resources from outsiders who usually had the habit of extracting resources such as forest soils, mushrooms and moss among other resources.

Regarding organization around forest resources management in general, it is through the *asamblea* that this organization takes place. Although there are no regular meetings of the *asamblea*, *ejidatarios* do meet constantly, particularly when there is an important issue that must be discussed with the rest of the community. Issues discussed in the *asamblea* include new forest programs, the possibility to enter PES, or the need to take care of particular places because of the presence of pests or evidence of deforestation.

Gender, ethnicity, age differences and their impact on NTFP use

Nieves is a mestizo population, therefore there is no clearly differentiated indigenous population. There are, however, differentiated forest resource management activities that are influenced by gender. As mentioned in sections above, NTFPs are mostly gathered by the female population, while other forest management activities, such as clearing of decaying material or digging fire lines, are performed by men. Nieves *ejido* is similar to Crescencio Morales in many ways when it comes to differentiation by age and gender. Below we describe how age and gender affect forest resource management in Nieves.

Differentiation by age and gender

Children aged 7-10 (both sexes): young children accompany their mothers in collection activities, focusing on firewood, but also mushrooms. Collecting blackberry is a difficult activity, it is risky because blackberry bushes are full of thorns, therefore involving children in their collection may be risky for them. Therefore, it is children 13 or older- mostly female- who help their mothers in blackberry collection.

Young men (aged 15-30): just like in Crescencio Morales, this group is usually absent from collection activities because of migration dynamics (be it permanent, temporary or daily migration to urban centers). They do help in agricultural activities and also in forest activities, such as clearing of forest debris. They also accompany their fathers to the forest to perform activities related to resin extraction. They do not collect NTFPs, these are resources associated with the female population.

[35] The *mesa ejidal* is the board of the *ejido*, which is selected through a voting, and is formed by the *Comisariado* ejidal (commissary), the secretary and the treasurer.

Young and middle aged women (15-55): Women perform most of the NTFP gathering activities. Most women in this segment of the population collect these resources for subsistence purposes, except for the few that sell them . Women who market NTFPs invest more time in collection activities, have more precise knowledge of the areas where NTFPs can be found, and also have a better developed marketing network.

Men in the Middle-age group (55-75): men who are *ejidatarios* attend *asamblea* meetings. It is in those meetings where decisions around conservation programs, PES and other government support are taken. Younger men do not participate in these meetings. Women are also a sector of the population that does not participate in these meetings, even though the legal option exists for them to participate. Men in this age group participate in forest programs from Proárbol. Men do most of firewood collection. They also do most of the forest conservation activities such as cleaning decaying material and clearing bushes.

Elders, both sexes (75-): Most older people depend on the firewood collection done by their relatives, or in the case where they live alone, or have to take care of grandchildren, they prefer to buy firewood from other people who market this resource.

Importance of traditional/local knowledge

NTFP collection is a traditional activity because most families turn to the forest every year to collect mushrooms and blackberries for their own consumption. It is possible to tell how important these resources are also as cultural items that are shared with others. Doña Rosalinda for example, says that they collect:

> "Nada más la zarzamora y el hongo, a veces cuando ibanos traibamos pero pá la familia, como pá mi familia que tenemos allá (Morelia) le llevabamos poquito". (Only blackberry and mushrooms, sometimes when we go collecting we bring back for our family, like for family we have (in Morelia), we take a little for them" (mushrooms)).

People turn to the forest to extract resources that used to be collected by their parents. Information regarding the type of mushrooms that can be eaten, or the plants that can be used to cure simple ailments, is information that has been passed on from generation to generation. However, Nieves is a very young settlement, therefore the information that people have about their resources may not be as complex and complete as the information that other communities have- particularly indigenous communities that have lived for generations in the same place. Nevertheless, there is knowledge about medicinal plants and their uses, and people grow these medicinal plants in their gardens or go to the forest or to secondary vegetation to collect medicinal plants. It is the elder women who seem to have more profound knowledge of medicinal plants and their uses. Younger women show interest in learning and there is a connection between the elder women and younger women, sometimes as a relationship with in-laws. Information about medicinal plants is also sometimes discussed in the high school, and some teenagers also have knowledge about the resources present in the forest because they help their parents- mostly their fathers- in chores related to forest care.

In a fieldtrip taken by the researcher to the forest with students from the local highschool (Colegio de Bachilleres), it was observed that most students had no particular idea of the names of plants and the resources that could be used. There are, however, particular cases, like the one described in Box 3.

Box 3.

Among the group of teenagers there was one student, however, who had knowledge about the names of various plants –other students made fun of him because they were funny plant names- and in some cases, he knew about the risks of touching or collecting these plants with bare hands. These plants were collected and later at the UNAM campus, an expert was asked whether the plant that this kid pointed out as poisonous was in fact what he said it was. It was, in fact, a poisonous plant and the common name he gave to the plant was the same the expert used to refer to it. Young female students also had knowledge about other plants, such as chamomile or spearmint, which are commonly used to treat simple ailments such as stomachaches, and these are also plants commonly present in house gardens, so knowledge about applications is more common, even if these plants are not commonly collected.

Policy, regulations and sanctions

Impact of government programs, laws and NGOs

Government programs that focus on rural communities and forest resources are mainly those offered through PRONAFOR (formerly PROARBOL). Of the 35 interviewees, 23 reported not having received any government support to care for the forest. Only two reported receiving government support through PROARBOL, about $2,800 pesos per year, to maintain the forests “clean”, that is, free of small fallen wood, and to “chaponear”, to trim shrubs so that pine trees can grow.

At some point in the past 5-7 years there was an interest from some of the *ejidatarios* to enter a PES program. This idea was discussed among them, however, they could not get to an agreement and finally decided not to apply for this support. One of the main reasons was that people who had cattle were not willing to forego the benefits of grazing in the woods, while there were other people who were willing and convinced of keeping cattle outside recently reforested areas as part of the agreement to enter a PES program. The conflict could not be resolved, and therefore this idea was cancelled. It is interesting to note, however, that many *ejidatarios* do express interest for programs and activities related to forest conservation and restoration, and who would willingly participate in government programs aimed at recovering and conserving their woods.

As mentioned before, forest conservation activities which are now part of forest management practices, affect indirectly availability of blackberries,

mushrooms, and other resources that depend on specific environmental conditions, such as blackberries and mushrooms, which need specific humidity and shadow conditions to grow. One of the management practices that has been incorporated into people´s activities in the past years is the "clearing" of forest debris, an activity that was introduced as part of reforestation programs (possibly PROARBOL, two administrations ago). Doña Rosalinda observes:

> "Si, limpian todo, la zarzamora el barbul y zarzarito, todo lo que hay, el barbul y las jaras todo lo que limpian, para reforestar el pino. Porque pues ya, tienen ya 6/7 años que han tumbado el bosque, lo han limpiado para que reproduzca lo que es nada más el pino, y pues ya zarzamora ya no hay." (they clean everything, blackberry, *barbul* and blackberries, everything there is, the *barbul* and *jaras*, everything they clean, to reforest pine trees. About 6-7 years ago they started cleaning the woods, they have cleaned it so that it reproduces only pine trees, and so there are no more blackberries).
>
> "el año pasado reforestaron harto, y pues limpiaron para poder plantar el pino tumbaron todo el zarzal." (last year they reforested a lot and so they cleared to be able to plant pines, and they threw down all the blackberries).

Identification of Changes in NTFP management in the past three decades: Ejido Nieves

In general, people who are most vulnerable to climate changes, are those who do not have their own land, who are women (and their children), or elderly people. Female heads of households are a group that depends on resources of lesser economic importance, such as blackberries and mushrooms that are sold in local markets (Acuitzio and Morelia). Environmental changes, such as drying of springs, and climatic changes such as the duration of the rainy season, directly affect the availability of these resources, generating direct impacts on the subsistence economy of these families. There is a perception that these climatic changes have affected NTFP availability in the recent years, that is, in less than a decade, local climate changes have affected availability of blackberries and mushrooms because there is less water available for them to grow, but also other changes that affect climate but are related to land uses have an impact on NTFP availability.

Land use changes have a direct and probably irreversible impact on availability and management of NTFPs, because it implies the modification of all ecosystem elements (soil, vegetation, water, temperature). As discussed before, most land use changes are associated with the establishment of avocado orchards (more recently, also cranberry orchards), not only in this area, but in most of the temperate forest zone in Michoacán. These changes bring new production systems into the lives of rural inhabitants, sometimes creating employment opportunities (although very limited permanent jobs are created, most of them are temporary or seasonal and are associated to the harvest season). Therefore, these opportunities become part of the rural production cycle, where seasonal employment outside the household or the community is interlinked with production activities linked to the subsistence economy (maize, beans and pumpkin production, combined with cattle

raising). Land use changes also incorporate a spatial element that complicates NTFP extraction: as fruit orchards are established, local roads and pathways are blocked and closed down. What used to be a way for local people to arrive at forest zones now becomes an orchard that people have to walk around in order to get to that same forest. This going around orchards represents a greater time investment than before, therefore affecting the perspective that NTFP collectors have about the profitability of collecting NTFPs for sale. Most collectors therefore prefer to wait until someone else from the community collects these resources to buy from them. Collectors who market these resources realize that collection represents ever more time and effort (because the more they walk, the more tired they get), and therefore start balancing the options between collecting and selling NTFPs or finding more stable and profitable employment opportunities, mostly outside the community, such as working in the orchards or finding a job in Morelia.

Changes in infrastructure are also important causes of changes in NTFP management. Road and transportation infrastructure has improved in the past 15-20 years. New roads have been built that communicate with the state highway that connects Morelia to other important cities in the state. One of the benefits that collectors have today is the presence of improved infrastructure, such as paved roads and better transportation. This allows inhabitants from Nieves to take their products to the city in less time and at a lesser cost (and effort also) than before. Communications infrastructure also opens new employment opportunities, because it is now easier for local inhabitants to travel daily to the city and surrounding areas to obtain temporal construction jobs, or to travel daily to the city to work as domestic employees. In terms of NTFP extraction, the effect may be that as new employment opportunities arise in the surrounding area, local collectors may prefer other more profitable income-generation opportunities, abandoning less profitable options, such as collecting NTFPs. However, some segments of the population may still rely on these resources, simply because they are caretakers and cannot leave the community, or because they are no longer wanted in these jobs because of their age or gender.

Another factor that has affected not only NTFP management, but forest management in general, is the presence of "organized crime" in the area. In the past years Michoacán has had a strong presence of organized crime bands in all its regions. In the temperate forest regions, one of the products that has been under the control of organized crime is pine resin. Resin collectors themselves do not have to deal directly with organized crime representatives. However, those who buy resin from the small gatherers have a greater risk of dealing with organized crime (personal information from one of the resin collectors). Usually these intermediaries have to pay organized crime a "quota" for every batch of resin collected, so that they can take it to the factories. Avocado orchard owners are also at risk of extortion from organized crime. Another less visible impact is that which the presence of these bands has for people in general. People have become cautious about being in the woods by themselves, because there have been kidnappings and even young men have been murdered and thrown in the midst of the forest near Nieves (these were two teenagers who had disappeared from another town, and after a week of search they were finally found in the woods near Nieves). So people who collect NTFPs, who usually walk into the forests in small groups, and who are also women most of the time, have now become afraid of going into the forest to search for these resources. In recent years, things have calmed down a little, so local inhabitants may again take to the forest.

Forest conservation programs have also brought changes in forest management and availability of NTFPs. Forest conservation programs such as ProÁrbol have had a strong presence and impact in forests since president Calderon´s administration (about 8 years ago). Most of these conservation programs focus on reforestation activities, which in turn involve other activities such as clearing forest grounds of wood debris to prevent fires, and also eliminating other plants that compete with pine saplings (most reforestation programs in this area of the state concentrate on reforesting pines, while other tree species are not given the same attention). The impact of these programs has to do with the elimination of decaying resources which are necessary for other resources to grow, as is the case of mushrooms. As doña Rosalinda suggests:

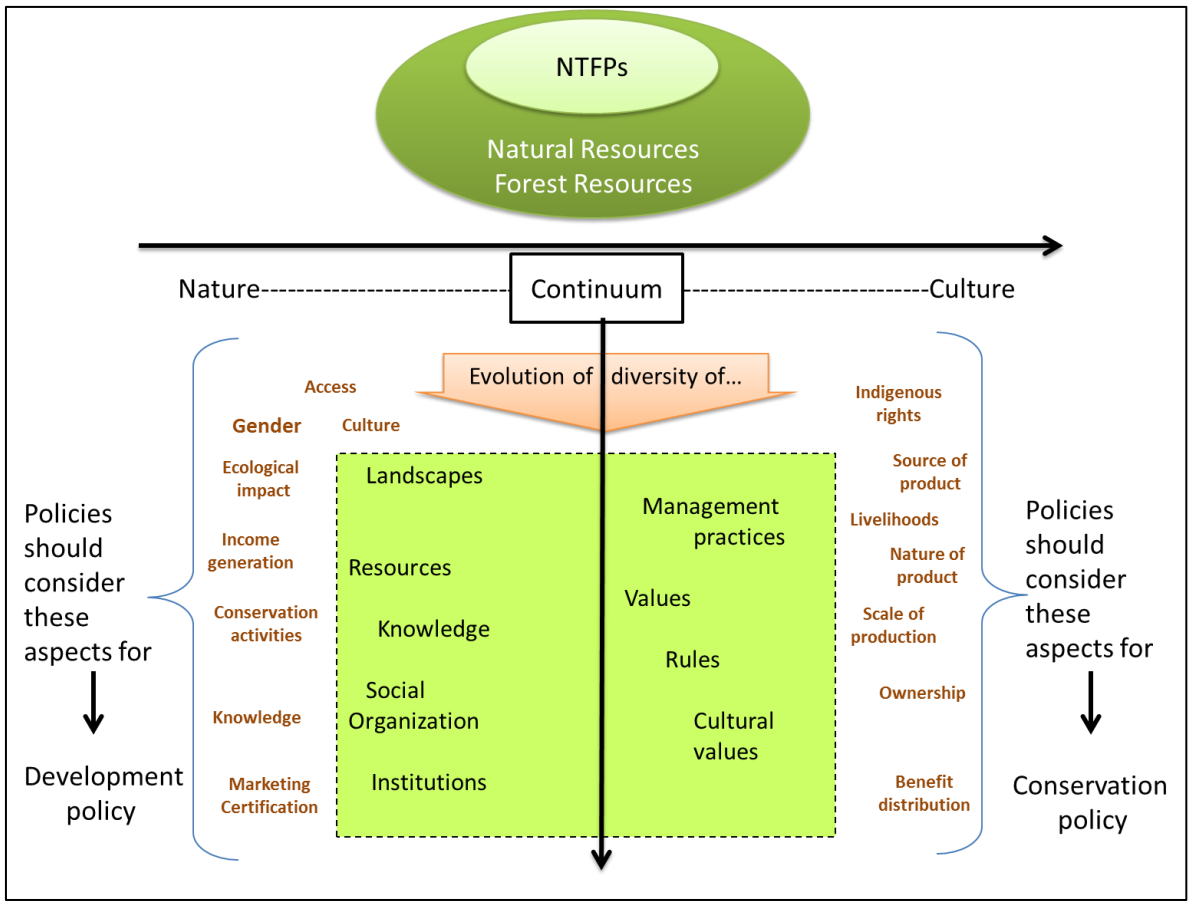
> "Cada dueño de cada predio de cada monte limpia y planta pino para que vaya creciendo, por eso ya se acaba la zarzamora y se acaba el hongo, ya no reproduce porque ya no hay, se acaban las pudriciones de abajo, […] y pues ya no hay sombrita ni nada, porque cuando hay sombra de los zarzales de las hojas que se les están cayendo, pues hay pudrición y va reproduciendo más zarzal y el hongo y todo eso, y si tumban el zarzal pues ya no hay." (Each forest plot owner clears and plants pine so that it grows, but that eliminates blackberries and mushrooms, it does not reproduce anymore because there is no more debris rotting bellow, […] and there is no more shade or anything, because when there is shade from the blackberries and the leaves that fall from them, there is rotting and more blackberries and mushrooms and all that reproduces, but if they clear the blackberry trees, well there is no more of this).

There is an emphasis in reforesting and reproducing trees, particularly pine species, however very little is being done to reforest other plant species that are just as important for ecosystems and people as are trees.

CHAPTER 7 . Discussion of the case studies and general discussion

In order to analyse the changes in management and importance of NTFPs for *Comunidad Indígena* and *Ejido* Crescencio Morales, and *Ejido* Nieves´ inhabitants, this discussion will take as a basis the analytical framework discussed in the introductory chapter. The diagram below shows the main elements of this framework: it emphasizes that the relationship between nature and culture is expressed through a continuum of management practices, landscapes, resources and cultural values, among other related elements. In the evolution of these elements, other issues come into play, such as access to resources, gender dynamics, land tenure, knowledge about the resource, the ecological impact of extraction and of forest conservation activities, among others. All of these dynamics and issues should be taken into consideration when formulating rural development and forest conservation policies (see figure 27).

Figure 27 Proposed analytical framework for the study of NTFPs and their importance for forest conservation, livelihoods and culture.



To facilitate and integrate the analysis the discussion will take the issues that were highlighted in the introduction and also the policy chapter as part of the dimensions analysed, and which also served as a guide for the presentation of results in chapter 5 and 6. The discussion will also include other elements that were highlighted in the analytical framework proposed (pg. 28), which have to do with social organization around CPR management.

The first part of the discussion will be about the specific issues highlighted from the introduction, attempting to integrate these to the more in-depth discussion about CPR management and social organization, being these topics of heightened importance to management of NTFPs.

Before delving into the discussion, a reminder of the general objective of this thesis becomes necessary.

The general objective of this thesis was to develop an understanding of the role of NTFPs as a strategy to achieve livelihoods, forest conservation and cultural goals, with a focus on the impact of forest conservation policies on community organization around NTFP management, as well as changes in NTFP availability and management in the last decades in relation to changes in market demand, migration, land tenure and forest policies, among other social, economic and environmental dynamics. The specific objectives proposed to achieve this general objective were:

- To perform a critical literature review of case studies on NTFPs and of the history of NTFP management in the world and in Mexico (presented in chapter 1 – introduction).
- To develop an analytical framework to understand the role of NTFPs in rural livelihoods, concentrating on the Rural Production Unit (RPU), based on results of the selected case studies in the State of Michoacan (Presented as the analytical framework and in this discussion pg. 28).
- To identify changes surrounding NTFP extraction, availability, management systems and impact of these changes in the livelihoods of the selected case studies. Consequently, identify the time period in which these changes have been more evident, with a focus in the past 30 years (presented in chapter 5 and 6 for each case study).
- To analyze the role played by markets in management of NTFPs, and what are the real social, economic and environmental possibilities/ implications of promoting NTFPs as income-generation alternatives in the selected case studies (Presented in CHAPTER 4. The Marketing of NTFPs).
- To define what is the present stance of environmental conservation policies regarding NTFPs and their relation to ecological conservation in México, what changes has policy been through, and analyze the importance of conservation policies in explaining changes in NTFP management in the past decades (Presented in chapter 3: the policy take on NTFPs…).
- To offer a discussion and conclusions regarding the importance of this work, the analytical framework and methodology proposed and applied, and the findings, for

improving NTFP management, conservation and the livelihoods of those who depend the most on these resources in Mexico´s rural communities (Presented in the following sections of chapter 7).

Discussion part 1: analysis of issues related to NTFPs and how they apply to this study

The source of the product
The NTFPs most used in Crescencio Morales and Nieves are harvested from the wild. In these communities there are no plantations of NTFPs. However, the case of Nieve´s resin is very interesting, because resin is collected in the wild, yet the economic benefits it gives to forest owners are very important. The importance of this product influences the management decisions of owners, who invest a good amount of time and effort in caring for their plots. The possibilities of exploiting this resource as an NTFP under particular NTFP legislation, -for example, that which could be created to promote/protect biodiversity in temperate forests- could be large. Nonetheless, in the present context, resin represents an excellent way of exploting an NTFP, at the same time that other lesser-valued NTFPs can still grow in the wild, that is, in the forests that gave rise to them.

It is important to take the source of the product into account, specially as it is related to the group of users. The characteristics of the group of collectors also determine how resources are used. Agrawal (2001) looks at the overlap between the location of the users and the resources as a factor that may contribute to better resource management. The proximity of users to the resources allows them to be more attentive to the resource situation, as well as to be aware of users from outside who may not be caring for the resources available. In Nieves, the proximity of users to the resources allows them to pay more attention to how these resources are used and who the users are.

In the case of blackberries, although the possibility to store resources is low because these are perishable resources and also availability is low, there is however a certain degree of predictability, that is, collectors know well when the harvesting season starts and ends. This however is changing due to climate changes which affect yield and also the length and time of the season. So as predictability diminishes, these resources will become less reliable for those who collect them, and therefore will no longer be considered as dependable income generation alternatives.

Therefore, aspects such as population densities, the yield of the resource, the regional distribution, the rate of growth, among others, will also be determinant of how reliable are the resources considered, and therefore, how important they remain for local NTFP collectors and traders.

The nature of production of the product
One of the possibilities discussed in the NTFP literature is that of domesticating important NTFPs in order to cultivate them. Many NTFPs are cultivated in Mexico, such as palms, and medicinal plants, among others. In Crescencio Morales, an important resource in terms

of tradition, consumer preferences and traditional knowledge of medicinal applications is *Tabaquillo.* This resource is collected from the wild, but it is also in a transitional phase of being domesticated, and is present in local household gardens. Yet, there is a strong preference for *tabaquillo* that is collected in the forest. The argument is that it tastes better. And there may be in fact some reasons for that (may even be related to the chemical composition of the plant as they grow in different environments). In the case of *tabaquillo*, domesticating the product would take some pressure off the forests, although the demand for this resource was not observed as being high. Nevertheless, as new consumer preferences arise -parallel to new perspectives on the importance of forests and natural products- the demand on *tabaquillo*, -which is already being promoted by a local business in Michoacan´s capital and packaged for sale- may increase. This increase in demand will make cultivation more attractive for local inhabitants, but an increase in demand could also put more pressure on *tabaquillo* that is collected directly from forests. As often the case (as in the Chamaedora palm example, Rico García-Amado et al. 2013), the domestication-cultivation process may have positive effects (decreased pressure on the resource and forests), or negative effects (e.g. reduced biodiversity) effects for local ecosystems and specific NTFPs.

The scale of production of the product

The discussion about the scale of production of the product is closely linked to the alternative of domestication of NTFPs for cultivation, and it also involves an element of the degree of industrialization of the production process. Domestication of a product for posterior cultivation may lead to a completely industrialized, mono-plantation way of production, meaning greater environmental impacts. Here, the distinction between the type of NTFP becomes less relevant than how it is produced. An NTFP can come from the forest and go through a domestication process that also involves many other issues, such as resource access, land tenure and access to economic assets to undertake domestication and cultivation. This process can result in greater social inequality and negative impacts to forests. The process of domestication itself, however, may not necessarily imply the promotion of industrialized production systems. In many parts of the South America and Mexico, for example, people are continually subjecting wild plants to domestication processes, in the hope of producing then in their own gardens for their own consumption, but at different degrees of effort and for diverse purposes, such as cultural, innovative, production, marketing, etc. (Casas, Torres-Guevara, et al. 2016).

Although pine resin, in the case of Nieves, has a potential to become a more industrialized system –and perhaps through selection and clearing, forests may become more like mono-plantations-, current users are presently not invested in this type of alternative. Why? Because resin extraction is only one element- a very important one- of a more complex rural livelihoods system, in which other production systems are also important, such as agricultural production and cattle raising. This is the case for many NTFPs in Mexico, and in general, forest management schemes in rural central Mexico are part of a wider livelihood system. This is a paradigm that is deeply ingrained in the culture of rural populations, who see the forest and the resources that come from it as one element of a wider basket of goods available in the rural landscape.

Ownership of the resource and benefit distribution

In both Crescencio Morales and Nieves, formal land tenure is determinant of access to government programs, and also to resources from funds (such as the Monarch Butterfly Fund). Government programs usually distribute benefits through the *asamblea*, so those who are not part of the *asamblea* (women, the youth, *avecindados*) are not as capable of receiving benefits. Another problem that is highlighted in our analysis is the impact of land use change- which is a consequence of diverse dynamics, including markets for avocado in the case of Nieves, and policy changes that have promoted a land market in rural populations. In Nieves, land use change associated with avocado production is having a definite and profound impact on the use of NTFPs. As mentioned several times, the privatization of "common lands" has caused a decrease in collection trips, because people are no longer able to cross large tracks of land to arrive at areas of higher NTFP availability. On the contrary, resin production still remains a more "equitable" production system, since it is done in what are still considered "common lands" (even though they are managed individually), which can be entered by anyone from the community. There is however a greater preoccupation about this free access, and more and more people are becoming more reluctant to sharing resources from their forest plots with other people from the community. So cultural, -and not only economic dynamics- may also be affecting access to resources,and consequently, the distribution of benefits obtained from them.

In terms of how equitable or fair is the allocation of benefits obtained from common resources, there is an understanding that not all resources are the same, and it is those resources that have lesser economic value which are treated as common resources which can be used by all, but the same cannot be said for products such as resin, because resin has more economic value and requires more care and effort. Therefore, how the benefits from the group of NTFPs found in common areas are distributed depends on the type of resources and the economic value attached to them. This topic will be discussed in the following section.

Marketing and certification of NTFPs

In all the case studies selected, the most important resources marketed are firewood and blackberries, followed by resin in Nieves and mushrooms in Crescencio Morales. There are very important differences in how these resources are marketed. Resin is one of the most important NTFPs marketed in Mexico. Michoacán is the most important producer of this product. Therefore, resin can be considered a reliable resource in terms of its marketing potential- and regardless of how "fair" is the trade, because there may be international commerce dynamics that affect its price. It is however reliable because there is always a demand for this resource. Moreover, the economic benefits obtained from it are considerable. This makes it an important resource, also in terms of caring for the ecosystems that produce it. The rest of the resources mentioned are resources that are marketed in local and regional markets. The potential for growth of markets for these resources is low, due to factors such as: the stationality of the resource (many people collecting and selling at the same time, therefore more competition), the perishability of the resource, (such as the case of mushrooms and blackberries), transportation costs and difficulties (particularly for mushrooms, which are very fragile and take up large volumes), among other marketing limitations. Most of the resources presented in the case studies support the arguments by several authors (Belcher 2003; Belcher & Schreckenberg 2007;

Marshall et al. 2003; Panayatou & Ashton 1992 among others) which highlight the difficulty of relying on NTFPs as income generation alternatives for rural dwellers. Resin, however, exemplifies the arguments proposed by Peters et al. (1989), which proposes that NTFPs can in some instances generate greater incomes than timber exploitation. Therefore, what is necessary is a case-specific analysis of the potential for marketing these resources in order to develop appropriate support alternatives from governments and businesses.

Ecological impact of NTFP extraction

Any level of extraction of a resource is harmful to the resource or the ecosystem. However, management of the resource determines the degree of harm. This study did not include extraction impact studies, but was based on people´s perceptions of impact. In Crescencio Morales, the resource that is perceived as most harmful is wood extraction. An observed increase in mushroom extraction- which may be associated with an increase in unemployment and decaying agricultural gains- may be causing a decrease in the availability of the resource. Mushroom availability is observed to have decreased in the past years, and it is necessary to walk longer distances to arrive at the areas where mushrooms are still available. Thus, the impact of extraction of the NTFP itself may not be as harmful as other factors, such as illegal timber extraction, cattle raising (Endress et al. 2004), forest degradation and climate change .

In Nieves the most important resource, resin, causes a degree of impact when extracted. However, resin extraction is not perceived as being very harmful, especially due to the care given to the forest so that pines can grow and be exploited. On the contrary, resin extraction is seen as an activity that contributes to forest conservation –this, partly, due to the stance of government forest institutions that promote this production system as an alternative that enhances forest conservation, and partly due to the care taken by forest owners to preserve the forests.

In the case of the resources like mushrooms and blackberries in Nieves, the price and level of demand is an important determinant of availability and ecological impact, however, because these resources are collected and sold at the local level, and very few people actually sell them, the demand does not actually determine availability of resources such as mushrooms or blackberries. Here is why: people usually collect what is available, however, when they find low densities of resource populations, or populations that are in a reproduction phase, they take the care of leaving the resources to re-grow. The problem with outside collectors is that they do not put the same care into their collection activity, and they may end up damaging the resource to the point it cannot grow again (the case of blackberries in Nieves). So regarding this problem, it may be true in fact that more sustainable management is possible when there are low levels of user demand, but it may also be true that even though there may be high user demand, the origin (or charactersitics *senzu* Agrawal 2001) of the group of collectors will also be central to sustainable management. This observation has already been mentioned for the case of Crescencio Morales, where the perception of the impact of collection of NTFPs is related to origins of the collectors, being perceived as negative when collectors are outsiders.

Impact of conservation activities on NTFP availability

The impacts of conservation activities on forest ecology and NTFP availability in particular have not been well studied. The work by Juutilainen et al. (2014) mentioned in the introductory chapter hints to the need to study the impact of conservation activities such as clearing forest floors of decaying wood and trimming of branches as part of fire prevention activities. Other forest conservation activities mentioned in previous chapters may also have an impact on NTFP availability. In the case of all the communities studied, NTFP availability is perceived as being affected by these conservation activities, either by reducing decaying material necessary for mushrooms to grow, or by reducing populations of species such as *Ternstroemia pringlei* (Linden flower) through trimming of branches and clearing of bushes of any species. This "pinarization" promoted by forest conservation programs such as the Cutzamala system in the the MBBR, or other forest restauration programs part of PROARBOL, may be reducing biodiversity in temperate forests by promoting conservation of species such as pine, yet ignoring species that are important for local livelihoods and also important in terms of ecological interactions.

Rural livelihoods and safety nets

As mentioned before, the importance of NTFPs for rural livelihoods depends and interacts with other productive systems and dynamics. Some of these systems have been described above, such as agriculture and cattle raising. NTFPs are but another of these systems, all of which are of high importance to the local populations, particularly for subsistence purposes. Generating income in rural communities in Mexico is, however, another story. As has been discussed, there are resources that generate greater revenues in local and regional markets, because they are also more appreciated, and highly demanded. Resources such as firewood and wood, as well as some mushroom species (In Crescencio Morales), are either highly needed for daily activities such as cooking, or highly demanded given consumer´s preferences regarding taste or nutritional properties. Other possibilities to generate income in these communities depend on dynamics at the larger economic scale, for example, the possibility of generating income from marketing corn locally produced is low, because the national market is loaded with "dumped" corn from the United States, a fact that makes it very difficult for local producers to compete with prices (however, the quality of local corn is better in terms of taste and nutritional content and is thus preferred locally). In the MBBR and surroundings, competition of local sawmills makes it very hard to sell highly marketable forest products, and it also lowers wood prices (Honey-Rosés 2009; Merino 1999). A similar situation is found in Nieves. In this context, generating income becomes a very difficult objective to achieve.

A very widespread alternative is to migrate, either temporarily or on a daily basis to seek employment opportunities. As noted before, in Nieves the possibility to work in nearby towns or at the state capital has had an impact on the importance of NTFP collection. The more mobility alternatives there are, the more people will look for jobs outside the community, therefore giving collection activities less importance as income generation activities, because there will be now more employment options –although not secure, mostly temporary- outside Nieves and Crescencio Morales. Low levels of mobility may contribute to better management of forest resources because people are more invested in maintaining their resources, because they are more dependent on them when there are fewer income generation options. When the contrary is true, people will pay less attention to

caring for common-pool resources, because they will have less time to care for them or to get organized around their management.

Community organization around NTFP use and impact of policy, regulations and sanctions
As was discussed in the section on CPR management in the case studies, social organization around the use of forest resources is determinant of their permanence. In Mexico, the *asamblea* (be it of a *Comunidad Indigena* or an *ejido*) is a crucial entity for the organization around natural resource management. There are however many flaws surrounding this type of organization. The principal concerns in terms of equity in the decision-making process and in the distribution of benefits are: the fact that only assembly members can participate in the decision-making process, and that this group is mainly constituted by men in their 40s and older. Therefore, decisions are made by a centralized group of older men, while women of all ages and young men are left out of this process. Another critique is that benefits from government programs are usually distributed through this *asamblea*. This guarantees that only those belonging to the *asamblea* (with formal land tenure within the *ejido* or *comunidad)* have access to these resources.

In the case of Crescencio Morales, making decisions through the *asamblea* is more difficult because there are more people involved (there are communities with more than 1,000 inhabitants within Crescencio Morales *Comunidad Indigena*), while there is only one comisariado who organizes all 17 communities. Community organization in Crescencio Morales also seems to revolve around government incentives and support (mostly monetary), so when there is no support, communities show less interest in organizing conservation activities (what many experts in the field, for a long time, have termed "paternalism" or "dependency" - the idea that people are always waiting for the government to tell them what to do and to give them support, while there are few local successful initiatives independent of the government).

Outside of the *asamblea*, there are efforts to improve community organization around natural resource management, like discussed in the Crescencio Moreales case studies, with the example of the surveillance brigades. This type of organization scheme serves as an example of the possibilities for community organization independent of state or federal governments. However, as hinted by Torres et al. (2015), sometimes community organization to improve management of a specific resource arises only after this community has realized the danger of depletion of that resource.

In the case of Nieves, organization around forest management falls mostly on the hands of those with invested interests in the forests: the *ejidatarios*. It is important to pay attention to this type of organizational examples, because they do not only depend on instrinsic characteristics of the community (something like the "community character"), but also on the economic and even ecological importance of the resource managed. The possibility of reaching good management agreements and creating appropriate rules may have a very close association with the economic value of the resource, and its potential to be successfully marketed (including in PES markets).

Another characteristic that may contribute to sustainable NTFP management is the existence of well-defined boundaries. This is important in the context of Nieves, where, the

only physical boundaries that exist between each producer´s lands are barbed wires that can be pushed down. People have the freedom to trespass these wires and to walk through another owner´s land. So collection in another owner´s lands is permitted, as long as no harm is done to other more important resources. When crossing into another community´s lands, there is less tolerance to NTFP collection from people outside that community, so it is acknowledged that a person can collect only in the lands from the ejido where she/he belongs. A similar observation can be made about tolerance to collection by outsiders in the Crescencio Morales communities we studied, where collection is perceived as more harmful when it is done by outsiders.

As mentioned, the origin and size of the group of users are determinant of organization around NTFP use. Blackberry collectors in Nieves are a small group composed of only women who are considered to have special economic needs, and therefore, they are recognized as people who have special rights to harvesting blackberries and mushrooms, regardless of whether they have tenure of the areas where they collect. The same happens in Crescencio Morales with the few mushroom and blackberry female collectors. Agreements regarding mushroom extraction in all case studies are rather implicit: people collect what they need and because the local mushroom populations are thought to be decreasing, collection is done for subsistence purposes only, except by those who depend on marketing of mushrooms to generate income. In Crescencio Morales, the few people who collect mushrooms for sale are also seen as having special needs (and even as fulfilling a necessary role of offering these resources to people in the community who can no longer collect these resources themselves, due to their age or their occupation). In both case studies, there are no clear rules for extraction but those which are implicitly recognized by the entire community; there are also no clear punishments when rules are broken. This lack of clear punishment for rule breaking allows for those who break the rules to get away with it, setting a bad example for the rest of the community, and also creating distrust in the local law system.

Relationship with the external environment

Considering the relationship between the resource system and the external institutions that impact, directly or indirectly, on its management is of relevance, because these institutions may enhance or hinder sustainable forest management. Agrawal (2001) proposes studying the organization of the nested levels of appropriation, provision, enforcement and governance of forest resources. In each level, different decisions are made, and are part of higher levels of decision-making regarding enforcement and governance of forest resources. In Nieves, the structures that exist to appropriate NTFPs relate to specific groups of users, specifically, the group of resineros (resin collectors and forest owners). These collectors´s relationship with other levels of enforcement and governance is important, because it is through these other institutions that *resineros* receive support to care for the forest, in the form of technical assistance and also as assistance to treat plagues or to perform other conservation activities. Through state and federal institutions, resineros also learn about possibilities to participate in conservation programs that can benefit their forests, the resin production system and also their economy (because they may receive a stipend to care for the forest while they are active in a program). However, these institutions are not always present, as described in a section above, because as programs are

introduced and implemented, representatives (*técnicos*) from these institutions move to work in other communities and seldom monitor or keep contact with former communities.

Agrawal (2001) also suggests that commons sustainability can be achieved when central governments are supportive of local authorities and institutions. In many cases, support from higher levels of government is important in order to enforce local rules, because local authorities do not always have enough legal (or political) power to implement sanctions. Sometimes the structures of the communities themselves make it difficult for rules to be enforced, because families may be extended and related to each other in some way, allowing for other types of interaction to take place and for agreements made between related people to be more important than the rules decided on by the community.

Gender, ethnicity, age differences and their impact on NTFP use

One of the topics that comes up in the literature regarding the influence of gender on forest resources use in rural Mexico is the one already commented, which has to do with inequity in the decision making processes within the *asamblea* (Vazquez-Garcia 2008). This problem also overlaps with age differences. Looking at gender differences is important in the case of NTFP management, because these differences are very clear cut, being women who do most of NTFP collection and marketing in communities such as the ones studied. A significant difference is that when the resource is of high economic value, as in the case of pine resin in Nieves, the tendency is for men to have greater control over management and marketing of the resource. Therefore, the differences become even more acute when there is an economic income-generation factor. This observation supports the argument of Vázquez García (2002) that women are perceived only as mothers and wives, but not as contributors to the household economy. Government programs also lack of this consideration, and end up reinforcing this perspective by creating support schemes that concentrate on supporting resources managed by men, or giving "scholarships" so that mothers can take care of their children, but very few examples of programs for women who use and process forest resources.

Women, however, are holders of important knowledge about natural resources, and they have also demonstrated their ability to become organized around natural resource use in rural communities all over the world (Federici 2004). Moreover, women, with their management and knowledge of NTFPs in the communities studied, contribute to important subsistence resources and also to income generation based on their use of NTFPs. This contribution is however disregarded, because resources are of lesser value than others, such as resin or firewood. Therefore, both women and the resources they manage lack social value, and this only reproduces social inequality within the household and the communities. As main care takers of children, women in the rural communities studied also hold a special place in the reproduction of knowledge and practices related to natural resources. Children are the main companions of women, they accompany them to collect NTFPs and to perform other activities in the community. The relationship of women to children makes them rightful receivers of support from the society as a whole, and thus they should also receive special consideration of governments and other institutions when it comes to generating social and economic development strategies, but also when generating sustainable natural resource management strategies.

Importance of traditional/local knowledge and culture

Knowledge of uses of NTFPs is deeply ingrained in the culture of the communities in Crescencio Morales. The importance of resources such as mushrooms is reflected in the way people arrange their yearly activities in order to integrate NTFP collection into their schedules. The importance of mushrooms in local diets is not only due to their nutritional value, or the possibility of complementing diets with resources that are obtained "for free", but also due to the value that people give to these resources as part of their tradition and culture. NTFP collection is a cherished activity in people´s organization of daily lives. Collection of NTFPs marks the coming and going of the seasons, and is associated with religious holidays. Collection trips are unique times to share with families, to recognize changes in the environments, and to transmit knowledge to the young. Notedly, this activity was recognized by CONANP in the past two decades as being of great cultural importance. This appreciation is reflected in the permission that local inhabitants have to collect NTFPs within the buffer zone of the MBBR, as well as in other NPAs around Mexico. There exists however a vacuum in how forest conservation policies have been created to promote the growth of certain species or ecosystem services of particular value, like pine trees, while dismissing resources such as NTFPs because they are not perceived as being important for income generation or to produce environmental services. These policies could integrate a more holistic view of the landscape, recognizing not only the economic values, but also the cultural value of ecologic systems that form part of a wider livelihoods system, of which income generation is but one of the sustaining elements.

In Nieves there is, as Michon et al. (2007) propose, a piling up of social spaces in the forest. At the plot level, they argue, forest resources are owned and managed by a single domestic unit (household) for specific purposes, but other users or specific groups of users in the community may have different rights to the same space, regarding the same or different resources. This system persists mostly on secondary resources which hold a multiple-use/multiple-users characteristic, while in planted spaces this piling up may fade away because land itself has become a major resource. NTFP collectors in Nieves profit from this piling up of social spaces, particularly when it comes to resources that do not have high economic value, such as blackberries. Culturally and socially, mostly anyone in the community who wishes to collect low-value resources, has recognized collective rights to the use of these social spaces that exist in the same spaces where other resources are used by more specific groups of users, such as in the case of resin. The different groups can coincide in the same spaces because there is a recognition of a multiple-use of the forest which allows for different people to profit from the same land in different ways.

This, however, does not occur in the new uses, such as the avocado orchards in Nieves, where another conception of space governs, a conception that has to do with the private ownership of the land, and which defines rights of use that are specific only to the owners, and only for the purposes of producing marketable products. This new group of users, as well as local groups, define their own rules and norms, which are accepted and reproduced by community members. The integration of new norms, rules and cultural values into the local space complicates the "long-term reproduction" of the forest. Michon et al., (2007; citing Peluso 1996 and Michon 2005) suggest that the rights system- which is based on local cultural values as well as external institutions- serves to create a balance between the rights and needs of the household, and those of the whole group or community. These

rights are bound by collective institutions and rules aimed at ensuring the long-term maintenance of the whole forest system as a basis for the social reproduction of the whole group. But when these rights -which are tangible in the spaces where they are enacted- happen in spaces where different rights and cultural values about the uses of the space occur, the reproduction of the forest system may be compromised.

National or international economic dynamics are changing not only the way people use the space, that is, their productive systems, but also their cultural conceptions about the value of forests and forest resources. In accordance with Michon et al. (2007), in many cases, farming is no longer considered for subsistence but as a source of additional cash income. Monocrop plantations, such as avocado orchards, fulfill many of the requirements that producers seek currently: they secure the land holding, need less labor and supervision and provide high returns. These new preferences go hand in hand with economic policies that promote production of goods for export markets, while they give preference to imported products in domestic markets. Local producers therefore see more benefits in export production systems that allow them to make higher profits, even if this means sometimes changing land uses from forest or secondary forest or fallows to intensively-managed monocrops. The weight of social ideas about the increased economic profit obtained from orchards is heavy, and it ends in many cases influencing people´s conception about the value of land and of traditional agricultural or forest products. The result is that in many cases, the idea of the opportunity to increase profits –even if there are many risks implied and benefits are almost always not what expected- actually drives the adoption of new production systems and the cultural values attached to them.

Discussion part 2: advantages and limitations of the analytical framework

As can be seen, the integration of all the issues associated with NTFP management into a coherent framework is a monumental task, because resources are diverse, as well as the environments where they grow. Added to that, there is also a great diversity of users, and the characteristics of users also interact with characteristics of the resources to produce unique management systems. Therefore, generating a framework that is able to generalize the study of NTFP management is impossible. What is possible is to extract from the experiencies in studying NTFPs, the themes that have received more attention in the literature, and to locate these themes in the historical and social context of the resources being studied (what could be called its place in the nature-culture continuum). No matter from which angle we look at the study of NTFPs: it will always be necessary to consider the issues discussed above and how these issues relate to the others.

The work here presented had as an objective to “develop an understanding of the role of NTFPs as a strategy to achieve livelihoods, forest conservation and cultural goals, with a focus on the impact of forest conservation policies on community organization around NTFP management, as well as changes in NTFP availability and management in the last decades in relation to changes in market demand, migration, land tenure and forest policies, among other social, economic and environmental dynamics”.

After the research was completed, several conclusions were reached. The first, regarding the importance of NTFPs for livelihoods. As the case studies and the literature review demonstrate, NTFPs are an important element in the livelihoods of the rural populations of

the communities studied. The importance for livelihoods lies principally on the role that NTFPs play for subsistence. NTFPs continue to be an important subsistence base, be it for food or to fulfill other needs, including those associated to culture and tradition. What is more important to highlight here is the fact that for many people in Mexico and the world, collection of NTFPs holds major significance as a livelihoods strategy that fulfills nutritional needs, as well as other needs that cannot be valued in monetary terms. These are values associated with the meaning of the collection activity itself, represented as a walk through the woods with family and friends, and through which people also connect with their forest and the changes through which they go: trees that grow, trees that die or fall, birds that sing, orchids that can be collected to take home. These are values that cannot be considered in any environmental accounting system, not are values that can be included in Gross National Product statistics. These are value systems that are confronted with other value systems, to the point of violence. It is here –as Escobar (2005) would suggest, that distributional conflicts come into play, and where local people who have a strong connection to the forest and these intangible values become advocates of the forest as holistic entities, and as part of a way of life where natural resources are not only managed for economic purposes, but as part of complex socio-ecological, cultural, political and religious systems.

The second conclusion is that NTFPs hold a significant place as a strategy to enhance forest conservation. Some resources, such as pine resin, have great potential for development of stronger links between resource use and conservation. Other resources merit more promotion and recognition as important alternatives to timber exploitation. An example is *tabaquillo*, which is used for subsistence and cultural purposes in the Crescencio Morales communities, however, this resource could benefit from improved management, processing and marketing, so that it could have a more substantial contribution to forest conservation and rural livelihoods.

The use of NTFPs is deeply ingrained in the cultures of all the communities studied. The importance of these resources is however under the influence of dynamics of various kinds, which are changing the value that people attach to them, as well as the management practices and also the social organization around their use. A very important change observed is that promoted from forest (CONAFOR; COFOM) and conservation (MBBR) institutions themselves, which emphasize a view of forest conservation based on the idea that those resources that must be protected are those which have a monetary value (be it use value or as exchange goods and services). NTFPs are therefore usually left out of conservation policies because they are not recognized as valuable, particularly for livelihoods purposes.

It then becomes very important to give more time to the analysis of how NTFPs can be integrated into forest conservation and economic/social development policies. The use of NTFPs, as well as NTFPs themselves, are under strong pressures from dynamics such as land use change, climate change, economic pressures and cultural transitions. the availability of these resources is decreasing, knowledge about their uses is being lost, yet they continue to be of high importance- and perhaps even more importance in the current socioeconomic and environmental scenarios. In the context described and analyzed in the previous chapters, NTFPs may pose an important safety net as other elements of rural

livelihoods lose importance as providers of subsistence and income for rural populations. Forest conservation policies have not been successful at integrating these resources in a framework that benefits both forest conservation and rural livelihoods. The analytical framework proposed in this thesis attempts to integrate the matters that have been left out or that have not been successfully integrated into an integral forest policy discourse.

Therefore, in the hope to contribute to a better understanding and treatment of NTFPs as valuable resources for rural livelihoods in Mexico, within the setting of forest/environmental policy, this thesis gives the following recommendations:

Discussion part 3: Recommendations

- There needs to be greater **recognition** by policy makers of the importance of NTFPs for rural livelihoods, as part of intricate and diverse livelihoods systems
- Government instances need to make a greater effort to modify the way government support and other resources are **distributed** among rural inhabitants, to make the process more equitable and inclusive of the sectors of the population that do not have land.
- Forests represent a **safety-net** for rural dwellers, therefore any attempt at valuation by public policy should include the multiple functions of forests.
- Forest conservation policies should integrate a more **holistic view** of the **landscape**, recognizing not only the economic values, but also the cultural value of ecologic systems that form part of a wider livelihoods system, of which income generation is but one of the sustaining elements.
- Greater weight should be given to the **recognition** of the **knowledge** and **traditions** of rural populations (indigenous, mestizo) around NTFPs, and this knowledge should be protected and fairly integrated into forest policies.
- More **support** should be given to **women** as principal users of NTFPs. This support should start with promoting greater inclusion of women in the decision-making schemes in rural communities so that women´s concerns can be considered.
- More **financial** and **economic** support should be given by governements, businesses and other institutions, to **improving NTFP management**, and to increase their potential as income generators.
- There needs to be a more profound **understanding** of **market dynamics** and their relationship to rural subsistence, so that producers of NTFPs can successfully enter and profit (not lose) from marketing NTFPs.
- The **demand** for sustainable NTFPs is not clearly felt among the consumer population**,** therefore, more work needs to be done to **educate consumers** about the importance of these resources for rural economies and to enhance forest conservation.
- **PES** programs should attempt to **integrate NTFPs** as one more element to be conserved, that is, they should strive to incorporate a more ample perspective of the "needed" species in terms of conservation and also livelihoods, not only conservation.
- There is a need to **integrate concepts -such as livelihoods and culture-** into a cohesive framework for the analysis of the importance of NTFPs for rural livelihoods.

- A need to consider this framework in the creation and implementation of development/forest policies in rural populations in Mexico.

More work is needed to improve our understanding of the role NTFPs play in rural livelihoods. Hopefully, the research presented here is a small contribution to this understanding.

Weaknesses of the methods used in this study

The focus of this study was not to learn about the specificities of plant species used and their particular ecology or biology, but to learn about changes in the importance of these resources for rural livelihoods in the past decades and the causes of those changes. Therefore, the methods used (interviews, questionnaires, participatory mapping) were meant to obtain information about uses, economic and cultural importance rather than ecological information about distribution or diversity. However, the "freelisting" method of asking people to make lists of resources they use (Frei et al. 1998) proved an effective method for learning about the NTFPs most used, their uses, the quantities extracted and where they can be found.

The point here was to attempt to describe a context of use, management and value of these resources for rural peoples. For some, the information collected may not be considered sufficiently "rigorous"; yet the assumption that rigorous scientific research can provide a "real" representation of reality can also be questioned. All scientific methods attempt to represent reality and make many assumptions about it; however, we must recognize that uncertainty is part of life, and that our efforts to represent this reality will always come short of the truth. We must act and adapt our management and living strategies based on our limited knowledge of the dynamics of life. On the other hand, in many regions of the world there exists already an ample repertoire of studies performed on topics such as NTFPs and their extraction and availability. Using the work that has already been done in the past, following rigorous scientific methods, is a way of recognizing the value of past research efforts, as well as a way to use the resources invested in past research to benefit present work that uses a different take on the subject, without repeating methods that have already been used. Therefore, through triangulation and the use of research performed in the past, this work attempts to offer a different understanding of the problem to complete an already elaborated stance.

Cited references

Agrawal, A., 2001. Common property institutions and sustainable governance of resources. *World Development*, 29(10), pp.1649–1672.

Alcorn, J.B., 1983. El te´lom huasteco: Presente, Pasado y Futuro de un Sistema de Silvicultura Indígena. *Biotica*, 8(3), pp.315–331.

Alcorn, J.B., 1981. Huastec noncrop resource management: Implications for prehistoric rain forest management. *Human Ecology*, 9(4), pp.395–417. Available at: http://dx.doi.org/10.1007/BF01418729.

Alexiades, M.N. et al., 2013. The missing skill set in community management of tropical forests. *Conservation Biology*, 27(0), pp.635–637.

Alexiades, M.N. & Shanley, P., 2004. *Productos forestales, medios de subsistencia y conservación. Estudios de caso sobre sistemas de manejo de productos forestales no maderables.* M. N. Alexiades & P. Shanley, eds., Bogor Barat, Indonesia: Center for International Forestry Research (CIFOR).

Anderson, P.J., 1998. Using ecological and economic information to determine sustainable harvest levels of a plant population. In E. Wollenberg & A. Ingles, eds. *Incomes from the forest. Methods for the development and conservation of forest products for local communities*. Bogor Barat, Indonesia: Center for International Forestry Research (CIFOR), pp. 137–156.

Del Ángel-Mobarak, G., 2012. *La Comisión Nacional Forestal en la historia y el futuro de la política forestal de México* G. Del Ángel-Mobarak, ed., Mexico D.F.: Centro de Investigación y Docencia Económicas (CIDE)- Comisión Nacional Forestal (CONAFOR).

Angel, R., 2002. Situación actual del comercio de plantas medicinales en América Latina. *Boletin Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas*, 1(4), pp.35–40.

Angelsen, A. et al., 2014. Environmental income and rural livelihoods: A global-comparative analysis. *World Development*.

Angelsen, A. & Wunder, S., 2003. *Exploring the Forest — Poverty Link : Key Concepts , Issues and Research Implications*, Bogor Barat, Indonesia. Available at: http://www.cifor.org/publications/pdf_files/occpapers/op-40.pdf.

Anta, F.S. et al., 2009. Consecuencias de las políticas públicas en el uso de los ecosistemas y la biodiversidad. In J. Sarukhán et al., eds. *Capital Natural de México Vol. III. Políticas públicas y perspectivas de sustentabilidad.* Mexico D.F.: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, pp. 87–153.

Arellanes, Y. et al., 2013. Influence of traditional markets on plant management in the Tehuacán Valley. *Journal of ethnobiology and ethnomedicine*, 9, p.38. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3698157&tool=pmcentrez&rendertype=abstract.

Argueta, A., 1981. Fuentes y datos para el estudio de la medicina tradicional p´urhépecha. In F. Miranda, ed. *La Cultura P´urhé.* El Colegio de Michoacán-FONAPAS., pp. 121–141.

Arnold, J.E. & Ruiz-Pérez, M., 2001. Can non-timber forest products match tropical forest conservation and development objectives? *Ecological Economics*, 39(2001), p.437–447.

Arnold, J.E. & Ruiz-Pérez, M., 1998. *The Role of Non-timber Forest Products in Conservation and Development*, Bogor Barat, Indonesia: Center for International Forestry Research.

Arts, B. & Babili, I., 2013. Forest and Nature Governance. *Forest and Nature Governance*, 14, pp.111–132. Available at: http://www.springerlink.com/index/10.1007/978-94-007-5113-2.

Assies, W., 1996. *Amazon nuts, forests and sustainability in Bolivia and Brazil. NTFP research in the Tropenbos programme: Results and Perspectives*, Zamora, Mexico.

Babigumira, R. et al., 2014. Forest Clearing in Rural Livelihoods : Household-Level Global-Comparative Evidence. *World Development*, 64, pp.S67–S79. Available at: http://dx.doi.org/10.1016/j.worlddev.2014.03.002.

Baland, J.M. & Platteau, J.P., 1996. *Halting degradation of natural resources: is there a role for rural communities?*, Oxford: Clarendon Press.

Batagoda, B.M.S. et al., 2006. *Towards policy relevant ecosystem services and natural capital values: rainforest non-timber products.*, Centre for Social and Economic Research on the Global Environment (CSERGE). UK.

De Beer, J.H. & McDermott, M., 1989. *The economic value of non-timber forest products in South East Asia.*, Amsterdam.

Belcher, B., 1998. Production-to-Consumption Systems Approach: Lessons from the Bamboo and Rattan Sectors in Asia. In E. Wollenberg & A. Ingles, eds. *Incomes from the forest. Methods for the development and conservation of forest products for local communities*. Bogor Barat, Indonesia: Center for International Forestry Research, pp. 57–84.

Belcher, B. & Schreckenberg, K., 2007. Commercialisation of Non-timber Forest Products: A Reality Check. *Development Policy Review*, 25(3), pp.355–377.

Belcher, B.M., 2003. What isn´t and NTFP? *International Forestry Review*, 5(2), p.161–168.

Berenice., F.H., 2001. *Aspectos Etnobotánicos de los Recursos Vegetales de la Comunidad Mazahua Francisco Serrato, Municipio de Zitacuaro, Michoacan, México.* Universidad Michoacana de San Nicolás de Hidalgo.

Berkes, F., 2004. Rethinking community-based conservation. *Conserv. Biol.*, 18(3), pp.621–630.

Blancas, J. et al., 2013. Ecological and socio-cultural factors influencing plant management in Nahuatl communities of the Tehuacan Valley, Mexico. *Journal of ethnobiology and ethnomedicine*, 9, p.39. Available at: http://www.ethnobiomed.com/content/9/1/39.

Blancas, J. et al., 2010. Plant Management in the Tehuacán-Cuicatlán Valley, Mexico. *Economic Botanay*, 3, pp.3323–31. Available at: http://www.ncbi.nlm.nih.gov/pubmed/22246047.

Bocco, G., Mendoza, M. & Masera, O.R., 2001. La dinámica del cambio del uso del suelo en Michoacán. Una propuesta metodológica para el estudio de los procesos de deforestación. *Investigaciones Geográficas. Boletín del Instituto de Geografía. UNAM.*, 44, pp.18–38.

Bolton, G., 2012. *Rainforest Alliance Global Non Timber Forest Product Certification Addendum*, Rainforest Alliance.

Boot, R.G.A. & Gullison, R.E., 1995. Approaches to Developing Sustainable Extraction Systems for Tropical Forests Products. *Ecological Applications*, 5(4), pp.896–903.

Bravo Marentes, C., 1999. *Informe final del Proyecto J002 Inventario nacional de especies*

vegetales y animales de uso artesanal, Mexico D.F. Available at: http://www.conabio.gob.mx/institucion/proyectos/resultados/InfJ002.pdf.

Brenner, L., 2009. Aceptación de políticas de conservación ambiental: el caso de la Reserva de la Biosfera Mariposa Monarca. *Economía, Sociedad y Territorio*, IX(30, Mayo–agosto), pp.259–295.

Brenner, L., 2006. Areas Naturales Protegidas y Ecoturismo: El Caso de la Reserva de la Biosfera Mariposa Monarca, México. *Relaciones, Colegio de Michoacan*, XXVII(105), pp.237–265.

Brenner, L. & Job, H., 2006. Actor-Oriented Management of Protected Areas and ecotourism in Mexico. *Journal of Latin American Geography*, 5(2), pp.7–27.

Bressers, H. & Klok, P.-J., 1988. Fundamentals for a theory of policy instruments. *International Journal of Social Economics*, 15(3/4), pp.22–41.

Brower, L., 1995. Understanding and Misunderstanding the Migration of the Monarch Butterfly (Nymphalidae) in North America: 1857-1996. *Lepidopterists´ Society*, 49(4), pp.304–385.

Burgos Guevara, H., 1964. *Medicina de transición en una comunidad campesina.*, Mexico, Organización de Estados Americanos, Programa Interamericano de Ciencias Sociales.

Bye, R.A.J., 1993. The Role of Humans in the Diversification of Plants in Mexico. In T. P. Rammamoorty et al., eds. *Biological Diversity of Mexico*. Oxford: Oxford University Press, pp. 707–731.

Caballero, J. et al., 2000. Patrones en el Conocimiento, uso y manejo de plantas en los pueblos indígenas de México. *Revista de estudios Atacameños*, 16:13-31.

Caballero, J. & Cortés, L., 2001. Percepción, uso y manejo tradicional de los recursos vegetales en México. In B. Rendón et al., eds. *Plantas, Cultura y Sociedad. Estudio sobre la relación de los seres humanos y plantas en los albores del siglo XXI*. UAM y SEMARNAP. México., pp. 79–97.

Calderón de Rzedowski, G. & Rzedowski, J., 2005. *Flora fanerogámica del Valle de México* G. Calderón de Rzedowski & J. Rzedowski, eds., Pátzcuaro, Michoacán: Instituto de Ecología A.C., Centro Regional del Bajío, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad.

Campbell, B. & Luckert, M.K., 2002. *Uncovering the hidden harvest: valuation methods for woodland and forest resources.*, Earthscan, London, UK.

Cañas, R. & Ortiz Monasterio, A., 2007. Hacia la mercantilización de las relaciones naturaleza-sociedad: un ejemplo legislativo. Contribución a un debate. *Revista de Investigaciones Jurídicas (Escuela Libre de Derecho)*, 31, pp.161–187.

Carabias, J., de la Maza, J. & Provencio, E., 2008. Evolución de enfoques y tendencias en torno a la conservación de la biodiversidad y el uso de la biodiversidad. In J. Sarukhán et al., eds. *Capital Natural de México Vol. III. Políticas públicas y perspectivas de sustentabilidad.* Mexico D.F.: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, pp. 29–42.

Carlón Allende, T., 2006. *Regionalización hidrológica en la Cuenca Cuitzeo*. Universidad Michoacana de San Nicolás de Hidalgo.

Carton de Grammont, P. & Cuarón, A., 2010. Lista de Especies en Riesgo: Herramienta de Conservación. In J. Carabias, J. de la Maza, & C. Galindo, eds. *Patrimonio Natural de México: Cien Casos de Éxito*. Mexico City: Comision Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO).

Carton De Grammont, P.M., 2012. *Dimensión Geográfica de las Políticas Públicas*

Ambientales para la Conservación de la Biodiversidad en México. Universidad Nacional Autónoma de México (UNAM). Available at: http://www.ciga.unam.mx/index.php/servicios/2014-04-08-23-00-28/tesis-ciga.

Casas, A., Torres-Guevara, J., et al., 2016. Domesticación y agricultura en América: historia y perspectivas del manejo de recursos genéticos en el Nuevo Mundo. In A. Casas, J. Torres-Guevara, & F. Parra, eds. *Domesticaion en el Continente Americano Vol. 1*. Mexico: Universidad Nacional Agraria La Molina del Perú, Universidad Nacional Autónoma de México, pp. 13–24.

Casas, A., Torres, I., et al., 2016. Ethnobotany for Sustainable Ecosystem Management: A Regional Perspective in the Tehuacan Valley. In R. Lira, A. Casas, & J. Blancas, eds. *Ethnobotany of Mexico. Interactions of Peoples and Plants in Mesoamerica*. Utrecht, pp. 179–206.

Casas, A. et al., 1997. Manejo de la vegetación y domesticación de plantas y origen de la agricultura en Mesoamerica. *Boletín de la Sociedad Botánica de México*, 61, pp.31–47.

Casas, A. et al., 2017. Manejo y Domesticación de Plantas en Mesoamérica. Una estrategia de investigación y estado del conocimiento sobre los recursos genéticos en México. In A. Casas, J. Torres-Guevara, & F. Parra, eds. *Domesticación en el Continente Americano Vol. 2*. Universidad Nacional Autónoma de México y Universidad Nacional Agraria La Molina del Perú, p. 575.

Casas, A. et al., 1996. Plant management among the Nahua and the Mixtec in the Balsas River Basin, Mexico: An ethnobotanical approach to the study of plant domestication. *Human Ecology*, 24(4), pp.455–478.

Casas, A. et al., 2001. Plant resources of the Tehuacán- Cuicatlán Valley, Mexico. *Economic Botany*, 55, pp.129–166.

Casas, A., Caballero, J. & Valiente-Banuet, A., 1999. Use management and domestication of columnar cacti in south-central México: a Historical Perspective. *Journal of Ethnobiology*, 19(1), pp.71–95.

Casas, A., Viveros, J. & Caballero, J., 1994. *Etnobotánica mixteca: sociedad, cultura y recursos naturales en la Montaña de Guerrero. México.*,

Cavendish, W., 2000. Empirical regularities in the poverty-environment relationship in rural households: Evidence from Zimbabwe. *World Development*, 28(11), pp.1979–2003.

CDI, 2010. *Catálogo de Localidades Indigenas*, Mexico D.F.

CDI-PNUD, 2006. *Regiones Indígenas de México*, Mexico. Available at: http://www.cdi.gob.mx/regiones/regiones_indigenas_cdi.pdf.

Chambers, R. & Conway, G., 1992. Sustainable rural livelihoods: Practical Concepts for the 21st century. *IDS Discussion Paper*, (296).

Chandrasekharan, C., 1995. Terminology, definition and classification of forest products other than wood. In: Report of the International Expert Consultation on Non-Wood Forest Products. Yogyakarta, Indonesia. *Non-wood forest products*, No. 3.

Chapela, G. & Barkin, D., 1995. *Monarcas y Campesinos*, Mexico, D.F.: Centro de Ecología y Desarrollo.

Chipeta, M. & Michaelsen, T., 1995. Post-UNCED Forestry and Mountain Development: New Challenges for FAO. *Unasylva*, 46(3), pp.16–24.

Chupezi, J. et al., 2015. Forest Policy and Economics How governance impacts non-timber forest product value chains in Cameroon. *Forest Policy and Economics*, 61, pp.1–10.

Available at: http://dx.doi.org/10.1016/j.forpol.2015.08.003.
CIFOR, 1993. *Annual Report*, Bogor Barat, Indonesia.
Clayton, M.H. & Radcliffe, N.J., 1996. *Sustainability. A Systems Approach*, Boulder, Colorado, USA: Wesview Press Inc.
Clements, T.O.M., Suon, S. & Wilkie, D.S., 2014. Impacts of Protected Areas on Local Livelihoods in Cambodia. *World Development*, 64, pp.S125–S134. Available at: http://dx.doi.org/10.1016/j.worlddev.2014.03.008.
Clifford, J. & Marcus, G., 1986. *Writing Culture: The Poetics and Politics of Ethnography* J. Clifford & G. Marcus, eds., Berkeley and Los Angeles, CA: University of California Press.
Cocks, M., 2006. Biocultural Diversity: Moving Beyond the Realm of "Indigenous" and "Local" People. *Human Ecology*, 34(2), pp.185–200. Available at: http://link.springer.com/10.1007/s10745-006-9013-5.
Cocks, M., Lopez, C. & Dold, T., 2011. Cultural Importance of Non-timber Forest Products: Opportunities they Pose for Bio-Cultural Diversity in Dynamic Societies Shackleton, ed. *Tropical Forestry*, 7(Non timber forest products in the global context). Available at: http://link.springer.com/10.1007/978-3-642-17983-9.
CONABIO, 2000. *Estrategia Nacional sobre Biodiversidad*, Mexico: Comision Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO).
CONABIO, 2012. Malezas de México. Available at: http://www.conabio.gob.mx/malezasdemexico/2inicio/home-malezas-mexico.htm.
CONAFOR, 2012a. *CONAFOR_ProgramaCuencasPrioritarias_2012.pdf*, Mexico: Comision Nacional Forestal. Available at: http://www.conafor.gob.mx:8080/documentos/docs/20/4790Programa de restauración de cuencas hidrográficas prioritarias.pdf.
CONAFOR, 2004. *Evaluación del Proyecto de Conservación y Manejo Sustentable de Recursos Forestales en México. Informe Final.*,
CONAFOR, 2011a. PROCYMAF. Available at: file:///C:/Users/tzitzi/Documents/Literatura/Politicas Publicas/PROCYMAFpagina conafor.htm.
CONAFOR, 2012b. *Programa Estratégico Forestal para México 2025*, México: Comision Nacional Forestal.
CONAFOR, 2005. *Reglamento de la Ley General de Desarrollo Forestal Sustentable*, Diario Oficial de la Federación.
CONAFOR, 2013. *Reglas de Operación del Programa Nacional Forestal 2014*, Mexico: Diario Oficial de la Federación.
CONAFOR, 2011b. *Reglas de Operación del Programa ProÁrbol 2011*, Mexico: Diario Oficial de la Federación. Available at: http://www.conafor.gob.mx:8080/documentos/ver.aspx?grupo=6&articulo=1420.
CONANP, 2001. *Programa de Manejo Reserva de la Biósfera Mariposa Monarca, México.*,
CONANP/SEMARNAT, 2007. Programa Nacional de Áreas Naturales Protegidas 2007-2012.
CONEVAL, 2013. *Ficha Monitoreo 2012-2013. ProÁrbol Desarrollo Forestal*, Meico D.F.
Corbin, J.M. & Strauss, A., 1990. Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), pp.3–21. Available at: http://dx.doi.org/10.1007/BF00988593.

Cortez Noyola, M., 2009. *La Revista México Forestal (1923-1953), un acercamiento a la conservación forestal en México.* Universidad Michoacana de San Nicolás de Hidalgo.

Costanza, R. et al., 1997. The value of the world's ecosystem services and natural capital. *Nature*, (387), pp.253–260.

Daly, G., 1997. *Nature´s Services. Societal dependence on natural ecosystems*, USA: Island Press, Center for Resource Economics.

Deal, R.L. et al., 2010. *Ecosystem Services and Climate Change: Understanding the Differences and Identifying Opportunities for Forest Carbon* T. B. Jain, R. Graham, & J. Sandquist, eds., Fort Collins, CO.

Delgado-Lemus, A., Torres, I., et al., 2014. Vulnerability and risk management of Agave species in the Tehuacán Valley, México. *Journal of ethnobiology and ethnomedicine*, 10, p.53. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4106216&tool=pmcentrez&rendertype=abstract.

Delgado-Lemus, A., Casas, A. & Téllez, O., 2014. Distribution, abundance and traditional management of Agave potatorum in the Tehuacán Valley, Mexico: bases for sustainable use of non-timber forest products. *Journal of ethnobiology and ethnomedicine*, 10, p.63. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4237816&tool=pmcentrez&rendertype=abstract.

Delgado, T., 2009. *Evaluación de Sustentabilidad de los Sistemas de Producción Rural en Tres Comunidades de la Microcuenca Umécuaro-Loma Caliente, Michoacán.* Universidad Autónoma de San Luis Potosi.

Denzin, N., 1970. *The Research Act in Sociology*, Chicago, Aldine.

DOF, 2012. *Ley Agraria*, Mexico: Diario Oficial de la Federación.

DOF, 2001. *Ley de Desarrollo Rural Sustentable*, Mexico: Diario Oficial de la Federación.

DOF, 2008. *Ley General De Desarrollo Forestal Sustentable*, Mexico: Diario Oficial de la Federación. Available at: http://www.ncbi.nlm.nih.gov/pubmed/19302767.

DOF, 2003. *Ley General De Desarrollo Forestal Sustentable*, Mexico: Diario Oficial de la Federación. Available at: http://www.ncbi.nlm.nih.gov/pubmed/19302767.

DOF, 2014. *Ley General del Equilibrio Ecológico y la Protección al Ambiente*, Mexico: Diario Oficial de la Federación.

Dove, M.R., 1994. Marketing the rainforest: "Green" panacea or red herring? *Asia-Pacific Issues*, No. 13.

Downes, D.R. & Laird, S., 1999. *Innovative Mechanisms for Sharing Benefits of Biodiversity and Related Knowledge*, Available at: http://www.ciel.org/Publications/InnovativeMechanisms.pdf.

Edouard, F., 2004. Factores de Éxito y Fracaso. El mercado de la fibra de pita (Aechmea magnalenae) en Mexico.

Endress, B.A., Gorchov, D. & Noble, R.., 2004. Non-timber Forest Product Extraction: Effects of Harvest and Browsing on an Understory Palm. *Ecological Applications*, 14(4), pp.1139–1153.

Escobar, A., 2005. *Mas Allá del Tercer Mundo. Globalización y Diferencia.*, Bogotá, Colombia: Instituto Colombiano de Antropoligía e Historia.

ExpokNews, 2011. Sólo sobrevive 55% de plantas de Pro Árbol. *3 enero 2011*. Available at: http://www.expoknews.com/solo-sobrevive-55-de-plantas-de-pro-arbol/.

Falconer, J., 1990. *The major significance of "minor" forest products: the local use and*

value of forests in the West African humid forest zone., FAO, Rome.
FAO, 2002. *Forest Products.*, Rome: Food and Agriculture Organization of the United Nations.
FAO, 2015. *Global Forest Resources Assessment*, Roma, Italy. Available at: http://www.fao.org/forest-resources-assessment/explore-data/en/.
FAO, 2010. *Global Forest Resources Assessment 2010*, Rome, Italy.
FAO, 1992. *Non-wood forest products: The way ahead*, Rome. Available at: http://www.fao.org/docrep/t0431e/t0431e00.HTM.
FAO, 2007. *Situación de los bosques del mundo*, Rome: Food and Agriculture Organization of the United Nations.
FAO, 2012. *State of the World´s Forests*, Rome: Food and Agriculture Organization of the United Nations.
FAO, 1999. Towards a harmonised definition of non-wood forest products. *Unasylva*, Vol. 50.(No. 198).
Farfán, B., 2001. *Aspectos ecológicos y etnobotánicos de los recursos vegetales de la comunidad Mazahua Francisco Serrato, Municipio de Zitácuaro, Michoacán*. Universidad Michoacana de San Nicolás de Hidalgo.
Farnsworth, N.R., Akerele, O. & Bingel, A.S., 1985. Medicinal plants in therapy. *Bulletin of the World Health Organization*, 63, pp.965–981.
Federici, S., 2004. Mujeres, lucha por la tierra y globalización: una perspectiva internacional. In *Revolución punto cero. Trabajo doméstico, reproducción y luchas feministas.* Madrid: Traficantes de Sueños, pp. 223–242.
FMCN, 2012. Fondo para la Conservación de la Mariposa Monarca. Available at: http://fmcn.org/bosques-y-cuencas/fondo-monarca/ [Accessed June 18, 2015].
Ford, R., 1985. *Prehistoric Food Production in North America.*, Ann Arbor, Michigan: Museum of Anthropology, University of Michigan.
Francisco-arriaga, F. & Kido-Cruz, A., 2011. Ingreso generado por la recolección de recursos forestales en pichátaro, michoacán, méxico. *Agricultura, Sociedad y Desarrollo*, (Enero-abril).
Frei, B. et al., 1998. Medical ethnobotany of the Zapotecs of the Isthmus-Sierra (Oaxaca, Mexico). Documentation and assessment of indigenous uses. *Journal of Ethnopharmacology*, 62(2), pp.149–165.
Gallopín, G., 2003. *Sustentabilidad y Desarrollo Sostenible: Un Enfoque Sistémico*, Santiago de Chile.
García-Fernández, C., Ruiz-Pérez, M. & Wunder, S., 2008. Is multiple-use forest management widely implementable in the tropics? *Forest Ecology and Management*, 256, pp.1468–1476.
Godoy, R. et al., 2000. Valuation of consumption and sale of forest goods from a Central American rain forest. *Nature*, 406, pp.62–63.
Godoy, R. & Bawa, K., 1993. The economic value and sustainable harvest of plants and animals from the tropical forest: Assumptions, hypotheses, and methods. *Economic Botany*, 47(3), pp.215–219.
Godoy, R., Brokaw, N. & Wilkie, D., 1995. The effect of income on the extraction of non-timber tropical forest products: Model, hypotheses, and preliminary findings from the Sumu Indians of Nicaragua. *Human Ecology*, 23(1), pp.29–52.
Gómez P., M. & Angón T., M. del P., 2004. *Recursos Forestales No Maderables Aprovechados en Morelia*, Morelia: Secretaría de Urbanismo y Medio Ambiente,

Gobierno del Estado de Michoacán.
de Groot, R., Wilson, M.A. & Boumans, R.M.J., 2002. A typology for the classification , description and valuation of ecosystem functions , goods and services. *Ecological Economics*, 41, pp.393–408.
Guariguata, M.R., Sist, P. & Nasi, R., 2012. Reprint of: Multiple use management of tropical production forests: How can we move from concept to reality? *Forest Ecology and Management*, 268, pp.1–5. Available at: http://dx.doi.org/10.1016/j.foreco.2011.12.047.
Hardin, G., 1968. The Tragedy of the Commons. *Science*, 162(3859), p.1243 LP-1248. Available at: http://science.sciencemag.org/content/162/3859/1243.abstract.
Harris, D.R., 1996. *The Origins and Spread of Agriculture and Pastoralism in Eurasia.*, London: University College of London Press.
Harris, D.R. & Hillman, G.C., 1989. *Foraging and Farming: The Evolution of Plant Exploitation*, London: Unwin Hyman, One World Archaeology 13.
Harrison, S., Herbohn, J. & Niskanen, A., 2002. Non-Industrial, smallholder, small-scale and family forestry: What´s in a name? *Small Scale Forest Economics, Management and Policy*, 1(1), pp.1–11.
Hayes, T. & Ostrom, E., 2003. Conserving the World´s Forests : Are Protected Areas the Only Way ? *Indiana Law Review*, 38(3).
Hernández-X., E. & Ramos, A., 1977. Metodología para el Estudio de Agroecosistemas con Persistencia de Tecnología Agrícola Tradicional. In E. Hernández-X., ed. *Agroecosistemas de México*. Mexico: Colegio de Posgraduados, Chapingo, pp. 321–333.
Hernández, M.S., 2005. *Flora útil no maderable de la comunidad indígena Nuevo San Juan Parangaricutiro, Michoacán*. Universidad Michoacana de San Nicolás de Hidalgo.
Higgs, E.S. & Jarman, M.R., 1972. The Origins of Animal and Plant Husbandry. In E. S. Higgs, ed. *Papers in Economic Prehistory*. Cambridge: Cambridge University Press, pp. 3–13.
Hobley, M. & Shah, K., 1996. What Makes a Local Organization Robust? Evidence from India and Nepal. *Natural Resources Perspectives*, 11.
Holling, C.S., 2001. Understanding the Complexity of Economic , Ecological , and Social Systems. , pp.390–405.
Homma, A., 1992. The dynamics of extraction in Amazônia: a historical perspective. *Advances in Economic Botany*, 9, pp.23–31.
Homma, A., *Utilization of Forest Products for Amazonian Development: Potential and Limitations* R. Lieberei, C. Reisdorff, & A. D. Machado, eds., Hamburg, Germany.
Honey-Rosés, J., 2009. Illegal Logging in Common Property Forests. *Society & Natural Resources*, 22(915843961), pp.916–930. Available at: http://www.tandfonline.com/doi/abs/10.1080/08941920903131120.
Huacúz Elías, D. del C., 2001. *Estado de conservación del género Ambystoma en Michoacán, México*. Universidad Michoacana de San Nicolás de Hidalgo.
Humphreys, D., 2007. *Logjam: Deforestation and the Crisis of Global Governance*, London: Earthscan, London, UK.
IFC, *Creating new value based on nature*, Available at: http://www.ifc.org/wps/wcm/connect/43c301004885552eb5dcf76a6515bb18/Biodiversity%252BBrochure.pdf?MOD=AJPERES.

IIED, 1996. *Towards a Sustainable Paper Path* World Business Council for Sustainable Development, ed., London: International Institute for Environment and Development.

Illsley-Granich, C. et al., 2001. Contribuciones al conocimiento y manejo campesino de los palmares de Braheadulcis(HBK) Mart. En la región de Chilapa, Guerrero. In *En Plantas, Cultura y Sociedad. Estudio sobre la relación entre seres humanos y plantas en los albores del siglo XXI. Beatriz Rendón et al. Eds.* México. UAM Iztapalapa and SEMARNAT., p. 259–285.

Illsley-Granich, C. & Ibáñez-Couoh, I., 2012. Diálogo de saberes y sustentabilidad en el manejo campesino de recursos naturales: aprengizajes desde Acateyahualco, Guerrero. In Morelia, Michoacán: II Congreso Nacional de Antropología Social y Etnología.

Illsley, C. et al., 2012. Commentarios al Proyecto de Norma Oficial Mexicana PROY-NOM-005-SEMARNAT-2012. Available at: http://www.geaac.org/index.php?option=com_content&view=article&id=486%3Apor-una-nom-sobre-no-maderables-construida-participativamente&catid=1%3Alatest-news&Itemid=1.

Illsley, C. et al., 2000. *Politicas públicas ambientales y prácticas comunitarias normativas del manejo de recursos forestales no maderables*, Mexico D.F. Available at: http://www.geaac.org/index.php?option=com_content&view=article&id=168:proyecto-3-linea-5-macarena&catid=1:latest-news&Itemid=106.

INALI, 2015. OTOMI. *Catálogo de las lenguas indígenas nacionales: Variantes lingüísticas de México con sus autodenominaciones y referencias geoestadísticas.* Available at: http://www.inali.gob.mx/clin-inali/html/v_otomi.html#9 [Accessed June 17, 2015].

INEGI, 2006. *Guía para la interpretación de cartografía*, Aguascalientes, Ags.

INEGI, 2011. *Principales resultados por localidad (ITER). Censo de Población y Vivienda 2010.*, Mexico D.F. Available at: http://www3.inegi.org.mx/sistemas/biblioteca/ficha.aspx?upc=702825002398.

Iqbal, M. 1, 1993. *International Trade in Non-Wood Forest Products: An Overview*, Rome, Italy.

Jaramillo-López, P.F., Ramírez, M.I. & Pérez-Salicrup, D.R., 2015. Impacts of Bokashi on survival and growth rates of Pinus pseudostrobus in community reforestation projects. *Journal of Environmental Management*, 150, pp.48–56. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301479714005295.

Jensen, A., 2009. Valuation of non-timber forest products value chains. *Forest Policy and Economics*, 11(1), pp.34–41. Available at: http://dx.doi.org/10.1016/j.forpol.2008.08.002.

Johnson, N.W., 2011. *Turkey - Anatolia Watershed Rehabilitation Project : P070950-Implementation Status Results Report : Sequence 13*, Washington, D.C. Available at: http://documents.worldbank.org/curated/en/2011/06/14460874/turkey-anatolia-watershed-rehabilitation-project-p070950-implementation-status-results-report-sequence-13.

Junninen, K. & Komonen, A., 2011. Conservation ecology of boreal polypores: A review. *Biological Conservation*, 144(1), pp.11–20. Available at: http://dx.doi.org/10.1016/j.biocon.2010.07.010.

Juutilainen, K. et al., 2014. The effects of forest management on wood-inhabiting fungi occupying dead wood of different diameter fractions. *Forest Ecology and Management*, 313, pp.283–291. Available at:

http://dx.doi.org/10.1016/j.foreco.2013.11.019.
Kilchling, P., Hansmann, R. & Seeland, K., 2009. Demand for non-timber forest products: Surveys of urban consumers and sellers in Switzerland. *Forest Policy and Economics*, 11(2009), p.294–300.
Kim, I.-A., Trosper, R.L. & Mohs, G., 2012. Cultural uses of non-timber forest products among the Sts'ailes, British Columbia, Canada. *Forest Policy and Economics*, 22, pp.40–46. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1389934112000068.
Klooster, D., 2002. Towards Adaptive Community Forest Management: Integrating local forest knowledge with scientific forestry. *Economic Geography*, 78(1), pp.43–70.
Kull, C.A., Ibrahim, C.K. & Meredith, T.C., 2007. Tropical Forest Transitions and Globalization: Neo-liberalism, Migration, Tourism and International Conservation Agendas. *Society & Natural Resources*, 20, pp.723–737.
de la Maza, R., 1999. Una historia de las áreas naturales protegidas en México. *Gaceta Ecológica*, (51), pp.15–43.
Laird, S., Wynberg, R. & Mclain, R.J., 2009. *Wild Product Governance : laws and policies for sustainable product use*, United Nations University, Centre for International Forestry Research, People and Plants International, Environmental Evaluation Unit, University of Cape Town, Institute for Culture and Ecology.
Laird, S., Wynberg, R. & McLain, R.J., 2011. Regulating Complexity: Policies for the Governance of Non-Timber Forest Products. In S. Shackleton, C. Shackleton, & P. Shanley, eds. *Non-Timber Forest Products in the Global Context*. New York: Springer, p. 227.
Leach, M., Susan, J. & Cathy, G., 1995. Editorial: Gender Relations and Environmental Change. *International Development Studies Bulletin*, 26(1), pp.1–8.
Liss, B.M., 1999. The Role of the Tropical Forest Action Programme and National Forest Programs in Sustainable Forest Development. In P. Glück et al., eds. *Formulation and Implementation of National Forest Programmes Vol. I*. Joensuu, Finland: European Forest Institute.
López-Feldman, A., 2014. Shocks , Income and Wealth : Do They Affect the Extraction of Natural Resources by Rural Households ? *World Development*, 64.
López, C., Chanfón, S. & Segura, G., 2005. *La riqueza de los bosques mexicanos: más allá de la madera. Experiencias de comunidades rurales.*, México D.F.: Secretaría de Medio Ambiente y Recursos Naturales (Semarnat).
López, M.B. et al., 2007. Efectos del manejo hidráulico en un sistema de pulsos "Presa de Umécuaro, municipio de Morelia, Michoacán." In *Memorias del VI congreso internacional y XII nacional de ciencias ambientales*.
Lowenhaupt Tsing, A., 2016. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*, New Jersey: Princeton University Press.
Maass, J. et al., 2005. Ecosystem services of tropical dry forests: insights from long-term ecological and social research on the Pacific Coast of Mexico. *Ecology and Society*, 10 (1)(17). Available at: http://www.ecologyandsociety.org/vol10/iss1/art17/.
Madrigal Sánchez, X., 1997. Ubicación fisiográfica de la vegetación en Michoacán, México. *Ciencia Nicolaita*, 15, pp.65–75.
Mahapatra, A.K. & Shackleton, C.M., 2011. Has deregulation of non-timber forest product controls and marketing in Orissa state (India) affected local patterns of use and marketing. *Forest Policy and Economics*, 13(8), pp.622–629. Available at:

http://dx.doi.org/10.1016/j.forpol.2011.07.009.
Mantau, U., Wong, J.L.G. & Curl, S., 2007. Towards a Taxonomy of Forest Goods and Services. *Small Scale Forestry*, (6), pp.391–409.
Marshall, E. & Newton, 2003. Non-timber forest products in the community of El Terrero, Sierra de Manantlán Biosphere Reserve, Mexico: is their use sustainable? *Economic Botanay*, 57(2), pp.262–278.
Marshall, E., Newton, A.C. & Schreckenberg, K., 2003. Commercialisation of non-timber forest products: first steps in analysing the factors influencing success. *International Forestry Review*,, 5(2), pp.128–137.
Marshall, E., Schreckenberg, K. & Newton, A.C., 2006. *Comercialización de productos forestales no maderables: factores que influyen en el éxito. Conclusiones del estudio de México y Bolivia e implicancias políticas para los tomadores de decisión.* E. Marshall, K. Schreckenberg, & A. C. Newton, eds., Centro Mundial de Vigilancia de la Conservación del PNUMA.
Marshall, E., Schreckenberg, K. & Newton, A.C., 2006. *Commercialization of non-timber forest products. Factors influencing success.* A. C. Marshall, E., Schreckenberg, K., Newton, ed., UNEP, WCMC. Available at: www.unep-wcmc.org/forest/ntfp.
Martin, A.J., 2002. El manejo forestal contrastante en dos núcleos agrarios de la reserva de la biosfera mariposa monarca. *Relaciones, Colegio de Michoacan*, 23(89), pp.53–82.
Martin, A.J., 2001. Procesos de Lucha y Arreglos Institucionales: El Manejo Forestal en la Reserva de la Biósfera Mariposa Monarca.
Martínez, M.Á. et al., 2007. Flora útil de los cafetales en la Sierra Norte de Puebla , México. *Revista Mexicana de Biodiversidad*, 78(1), pp.15–40.
MEA, 2003. *Ecosystems and human well-being: a framework for assessment*, Washington, D.C.
MEA, 2005. Ecosystems and Human Well-being - Current State and Trends: Findings of the Condition and Trends Working Group of the Millennium Ecosystem Assessment. *The Millennium Ecosystem Assessment Series (v. 1)*, p.xxi, 917.
Van der Meer, S., 2007. *The Butterfly Effect: Butterflies, forest conservation and conflicts in the Monarch Butterfly Reserve (Mexico)*. Wageningen University, Wageningen. The Netherlands.
Merino-Pérez, L., *Conservación o deterioro. El impacto de las políticas públicas en las instituciones comunitarias y en los usos de los bosques en México*, Available at: http://www2.inecc.gob.mx/publicaciones/consultaPublicacion.html?id_pub=428.
Merino, L., 2004. *Conservación o Deterioro: El Impacto de las Políticas Públicas en las Instituciones Comunitarias y en las Prácticas de uso de los Recursos Forestales*, Mexico, D.F.: SEMARNAT.
Merino, L., 1995. *La Reserva Especial de la Biosfera Mariposa Monarca: Problemática y Perspectivas*, Mexico D.F.: El Colegio de México.
Merino, L., 1999. Reserva Especial de la Biosfera Mariposa Monarca: Problemática General de la Región. In R. de A. del N. sobre la M. M. 1997, ed. Departamento de Comunicación y Difusión Pública del Secretariado de la Comisión para la Cooperación Ambiental (CCA).
Merino, M., 2006. La política autista *. , pp.411–456.
Molnar, A., Scherr, S. & Khare, A., 2004. *Who conserves the world's forests? Community-driven strategies to protect forests and respect rights*, Washington, D.C.: Forest Trends and Ecoagriculture Partners.

Muradian, R. et al., 2010. Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services. *Ecological Economics*, 69, pp.1202–1208.

Murillo, A., 2009. *El Manejo Forestal y sus Implicaciones en la Cubierta Vegetal y en la Estructura Demografica de Especies Comerciales: Reserva de la Biósfera Mariposa Monarca*. Universidad Nacional Autónoma de México. Facultad de Filosofía y Letras. Posgrado en Geografía.

Navarrete, J.L., Isabel Ramírez, M. & Pérez-Salicrup, D.R., 2011. Logging within protected areas: Spatial evaluation of the monarch butterfly biosphere reserve, Mexico. *Forest Ecology and Management*, 262, pp.646–654.

Navia, J. & Barsimantov, J., 2007. Cambio de Uso de Suelo, entre la Legalidad y la Impunidad. In Morelia: VIII Congreso Mexicano de Recursos Forestales.

Nepstad, D. & Schwartzman, S., 1992. Non-timber forest products from tropical forests. Evaluation of a conservation and development strategy. *Advances in Economic Botany*, 9.

O´Brien, K.A., 2001. *Factors Affecting Consumer Valuation of Environmentally Labelled Forest Products*. University of Maine.

Ostrom, E., 1990. *Governing the commons: The Evolution of institutions for collective action.*, Cambridge: Cambridge University Press.

P., Merino, L. & Hernández A., M., 2004. Destrucción de institutciones comunitarias y deterioro de los bosques en la Reserva de la Biosfera Mariposa Monarca, Michoacán, México. *Revista Mexicana de Sociología*, 66, pp.261–309.

Padoch, C. & Pinedo-Vasquez, M., 1997. Smallholder forest management:looking beyond non-timber forest products. In M. R. Pérez & J. E. M. Arnold, eds. *Current Issues in non-timber forest products research.* CIFOR, Indonesia., pp. 103 –117.

Pagiola, S. & Platais, G., 2007. *Payments for Environmental Services: From Theory to Practice*, Washington.

Panayotou, T. & Ashton, P., 1992. *Not By Timber Alone: Economics and Ecology for Sustaining Tropical Forests*, Washington, DC: Island Press.

Papanek, H., 1990. To each less than she needs, from each more than she can do: allocations , entitlements and value. In I. T. (coord), ed. *Persistent Inequalities*. New York: Oxford University Press, p. Pp. 163-181.

Payne, G., 2004. Key Concepts in Social Research J. Payne, ed. Available at: http://methods.sagepub.com/book/key-concepts-in-social-research.

Peluso, N.L., 1992. *Rich Forests, Poor People: Resource Control and Resistance in Java*, Berkeley, CA: University of California Press.

Penttilä, R., Siitonen, J. & Kuusinen, M., 2004. Polypore diversity in managed and old-growth boreal Picea abies forests in southern Finland. *Biological Conservation*, 117(3), pp.271–283.

Perevochtchikova, M. & Beltrán, A.V., 2012. The Federal Program of Payment for Hydrological Environmental Services as an Alternative Instrument for Integrated Water Resources Management in Mexico City. , pp.26–37.

Pérez Negrón Souza, E., 2007. *Aspectos Ecológicos para el Manejo y Conservación de Cactáceas Columnares en Santiago Quiotepec, Oaxaca.* Universidad Michoacana de San Nicolás de Hidalgo.

Peters, C., 1996. *The ecology and management of non-timber forests resources.*, Washington, DC.

Peters, C.., Centry, A.H. & Mendelsohn, R.., 1989. Valuation of an Amazonian Rainforest. *Nature*, 339(29), pp.655–56.

Peters, C.., Gentry, A.H. & Mendelsohn, R.O., 1989. Valuation of an Amazonian rainforest. *Nature*, 339(29), pp.655–56.

Pierce, A., Shanley, P. & Laird, S.A., 2008. Non-timber forest products and certification: Strange bedfellows. *Forests, Trees and Livelihoods.*, 18, pp.23–35.

Pinto-correia, T., Gustavsson, R. & Pirnat, J., 2006. Bridging the gap between centrally defined policies and local decisions – Towards more sensitive and creative rural landscape management. *Landscape Ecology*, 21, pp.333–346.

Prado Rentería, X., 1988. *Plantas y Medicina Tradicional en San Andres Tsirondaro, Michoacan, México.* Universidad Michoacana de San Nicolás de Hidalgo.

Prat, C., Márquez, A. & Esteves, M., 2007. Estudio batimétrico de la presa de Cointzio y de Umécuaro. In Morelia, Michoacán: Simposio, Acciones y Resultados para el Desarrollo Sostenible de la Cuenca del Lago de Cuitzeo.

Purnomo, H., Guizol, P. & Muhtaman, D.R., 2009. Governing the teak furniture business: A global value chain system dynamic modelling approach. *Environmental Modelling and Software*, 24(12), pp.1391–1401. Available at: http://dx.doi.org/10.1016/j.envsoft.2008.04.012.

Ramírez, I., Giménez de Ascárate, J. & Luna, L., 2003. Effects of Human Activities on Monarch Butterfly Habitat in Protected Mountain Forests, Mexico. *The Forest Chronicle, Canadian Institute of Forestry, Mattawa*, 79(2), pp.242–246.

Ramirez, I. & Zubieta, R., 2005. *Análisis regional y comparación metodológica del cambio en la cubierta forestal en la Región Mariposa Monarca.*, Mexico: WWF.

RAN, 2013. Padrón e Historial de Núcleos Agrarios. Available at: http://phina.ran.gob.mx/phina2/Sessiones.

RAN, 2014. PHINA. Available at: http://phina.ran.gob.mx/phina2/Sessiones [Accessed January 9, 2014].

RAN, 2003. PROCEDE. *2003*. Available at: http://www.sct.gob.mx/obrapublica/MarcoNormativo/3/3-3/3-3-5.pdf.

Rangel Landa, S. & Lemus Fernández, R., 2002. *Aspectos Etonobotánicos y Ecológicos de los Recursos Vegetales Entre los Ixcatecos de Santa Maria Ixcatlán, Oaxaca, México*. Universidad Michoacana de San Nicolás de Hidalgo.

Rendon-Salinas, Valera-Bermejo, Ramirez-Galindo, Perez-Ojeda, G.-L.C., 2005. Segundo foro regional Mariposa monarca. Memorias. In Secretaría de Medio Ambiente y Recursos Naturales, p. 48.

Restrepo Ramírez, D., 1995. *Gender Entitlements in Colombian Families*. Guelph University.

Rico-García, A. et al., 2011. Efficiency of Payments for Environmental Services: Equity and additionality in a case study from a Biosphere Reserve in Chiapas, Mexico. *Ecological Economics*, 70, pp.2361–2368.

Rico García-Amado, L. et al., 2013. From wild harvesting to agroforest cultivation: A Chamaedorea palm case study from Chiapas, Mexico. *Forest Policy and Economics*, 28, pp.44–51. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1389934112002857.

Rindos, D., 1980. Symbiosis, Instability and the Origins and Spread of Agriculture: A New Model. *Current Anthropology*, 21, pp.751–772.

Rist, L. et al., 2012. The impacts of selective logging on non-timber forest products of

livelihood importance. *Forest Ecology and Management*, 268(March), pp.57–69.
Robbins, P., Emery, M. & Rice, J.L., 2008. Gathering in Thoreau ' s backyard : nontimber forest product harvesting as practice. , 40(2), pp.265–277.
Rodríguez, L.C. et al., 2011. Towards a unified scheme for environmental and social protection: Learning from PES and CCT experiences in developing countries. *Ecological Economics*, 70, pp.2163–2174.
Rojas Soriano, R., 2013. *Guía para realizar investigaciones sociales*, Mexico D.F.: Plaza y Valdés. Available at: http://raulrojassoriano.com/cuallitlanezi/wp-content/themes/raulrojassoriano/assets/libros/guia-realizar-investigaciones-sociales-rojas-soriano.pdf.
Ros-Tonen, M.A.F. et al., 1998. *Methods for non-timber Forest Products Research. The Tropenbos Experience.*, Wageningen, The Netherlands.
Ruiz-Pérez, M. et al., 2004. Markets drive the specialization strategies of forest peoples. *Ecology and Society*, 9(2). Available at: http://www.ecologyandsociety.org/vol9/iss2/art4/.
Rzedowski, J., 1978. *Vegetación de México*, Mexico D.F.: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad.
SAGARPA, 2004. *Plan rector de producción y conservación de la microcuenca Umécuaro, Mpio.. de Morelia, Michoacán*, Mexico: Fideicomiso de Riesgo Compartido.
Salas-Canela, L., 2013. *CAUSAS DIRECTAS DEL CAMBIO EN LAS CUBIERTAS DEL SUELO EN LA REGIÓN MARIPOSA MONARCA: UN ANÁLISIS MULTIESCALAR*. Universidad Nacional Autónoma de México. Available at: http://132.248.9.195/ptd2014/enero/0707322/Index.html.
Santos, C., Maria, E. & Kyalo, D., 2015. The Impact of Payments for Reforestation in the Mexican State Michoacán. In *Beiträge zur Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung - Theorie und Politik - Session: Effectiveness and development impacts of environmental policies in developing countries D19-V1*. EconStor. Available at: http://www.econstor.eu/handle/10419/113036.
Sarukhán, J. et al., 2009. *Capital Natural de México. Síntesis. Conocimiento actual, evaluación y perspectivas de sustentabilidad*, Mexico D.F.
Savko, M.S., 2002. *Ejidos, Monarchs, and Sustainability: Forest Management and Conservation in the Monarch Butterfly Biosphere Reserve of Mexico*. Oregon State University.
Schoendube, B.B. et al., 2002. *Los estudios del agua en la cuenca Lerma-Chapala-Santiago* B. B. Schoendube, ed., Zamora, Michoacán: El Colegio de Michoacán. Universidad de Guadalajara.
Scoones, I., 1998. *Sustainable Rural Livelihoods a Framework for Analysis*, Brighton. Available at: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:SUSTAINABLE+RURAL+LIVELIHOODS+A+FRAMEWORK+FOR+ANALYSIS+IDS+WORKING+PAPER+72#1.
SE, 2012. *Monografías del Sector Aguacate en México: Situación Actual y Oportunidades de Mercado*, Available at: http://www.economia.gob.mx/files/Monografia_Aguacate.pdf.
Segura Warnholtz, G. & García-Peña, E., 2001. Desarrollo Forestal Comunitario: El caso del proyecto de conservación y manejo sustentable de recursos forestales en México

(PROCYMAF). In B. Rendón-Aguilar et al., eds. *Plantas, Cultura y Sociedad. Estudio sobre la relación de los seres humanos y plantas en los albores del siglo XXI*. Universidad Autónoma Metropolitana Iztapalapa, Secretaría de Medio Ambiente, Recursos Naturales y Pesca, pp. 189–220.

SEMARNAP, 1999. *Reglas de Operación para el Otorgamiento de Subsidios para los Proyectos Comunitarios del Programas de Desarrollo Regional Sustentable*, Mexico: Diario Oficial de la Federación.

SEMARNAT, 2013. *Anuario Estadístico de la Producción Forestal*, Mexico City.

SEMARNAT, 2006. La gestión ambiental en México. , p.472. Available at: http://www.semarnat.gob.mx/archivosanteriores/informacionambiental/Documents/06_otras/Gestion_Ambiental.pdf

SEMARNAT, 2012a. *Ley general de vida silvestre*, Mexico: Diario Oficial de la Federación.

SEMARNAT, 2009. *Manejo de Vida Silvestre: Manual Técnico para Beneficiarios*, Secretaría de Medio Ambiente y Recursos Naturales. Available at: http://www.conafor.gob.mx/biblioteca/manejo-de-vida-silvestre.pdf.

SEMARNAT, 2012b. *Proyecto de Norma Oficial Mexicana PROY-NOM-005-SEMARNAT-2012*, Mexico: Diario Oficial de la Federación.

Shackleton, C.M. & Pandey, A.K., 2014. Positioning non-timber forest products on the development agenda. *Forest Policy and Economics*, 38, pp.1–7. Available at: http://dx.doi.org/10.1016/j.forpol.2013.07.004.

Shackleton, C.M. & Shackleton, S.E., 2004. The importance of non-timber forest products in rural livelihood security and as safety nets: a review of evidence from South Africa. *South African Journal of Science*, 100, pp.658–664.

Shackleton, S., Shackleton, Ch. & Shanley, P., 2011. *Non timber forest products in the global context*, New York.

Shackleton, S., Shanley, P. & Ndoye, O., 2007. Invisible but viable: recognising local markets for non-timber forest products. *International Forestry Review*, 9(3), pp.697–712.

Shackleton, S., Shanley, P. & Ndoye, O., 2007. Invisible but viable: recognizing local Markets in non-timber forest products. *International Forestry Review*, 9, pp.697–712.

Shanley, P. et al., 2008. *Beyond Timber: Certification and Management of Non-timber Forest Products* P. Shanley et al., eds., Bogor Barat, Indonesia: CIFOR.

Sheinbaum, C., Masera, O., 2000. Mitigating carbon emissions while advancing national development priorities: the case of Mexico. *Clim. Change*, 47, p.259–282. Available at: http://dx.doi.org/10.1023/A:1005610923555.

Sills, E. et al., 2011. Non-Timber Forest Products in the Global Context. In Shackleton, ed. *Tropical Forestry*. Available at: http://link.springer.com/10.1007/978-3-642-17983-9.

Simonian, L., 1999a. *La Defensa de la Tierra del Jaguar* First Edit., Comision Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO). Available at: http://www2.ine.gob.mx/publicaciones/libros/118/cap5.html%5Cnhttp://www2.ine.gob.mx/publicaciones/consultaPublicacion.html?id_pub=118.

Simonian, L., 1999b. Medio Ambiente y Políticas en México (1970-1993). *Gaceta Ecológica*, (53).

Sippola, A.-L., Lehesvirta, T. & Renvall, P., 2001. Effects Of Selective Logging On Coarse Woody Debris And Diversity Of Wood-Decaying Polypores In Eastern Finland. *Ecological Bulletins*, 49(Ecology of Woody Debris in Boreal Forests).

Sloan, S., 2008. Reforestation amidst deforestation: Simultaneity and succession. *Global Environmental Change*, 18(3), pp.425–441. Available at: http://www.sciencedirect.com/science/article/pii/S095937800800023X.

Solis, L., 2006. *Etnoecología cuicateca en San Lorenzo Pápalo, Oaxaca*. Universidad Nacional Autonoma de Mexico.

Sosa-montes, M. et al., 2013. Contribución de los productos forestales no maderables a la economía familiar en el ejido San José Cieneguilla , Oaxaca Contribution of non-timber forest products to the family income in San Jose Cieneguilla , Oaxaca. , 11.

Southgate, D., Coles-Ritchie, M. & Salazar-Canelos, P., 1996. CAN TROPICAL FORESTS BE SAVED BY HARVESTING OF NON-TIMBER PRODUCTS ? In Center for Social and Economic Research on the Global Environmentl (CSERGE).

Steele, M.Z. et al., 2015. The influence of livelihood dependency, local ecological knowledge and market proximity on the ecological impacts of harvesting non-timber forest products. *Forest Policy and Economics*, 50, pp.285–291. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1389934114001427.

Stockdale, M., 2005. *Steps to sustainable and community-based NTFP management. A manual written with special reference to South and Southeast Asia*, Non Timber Forest Products-Exchange Programme for South and Southeast Asia.

Stoian, D., 2005. Making the Best of Two Worlds : Rural and Peri-Urban Livelihood Options Sustained by Nontimber Forest Products from the Bolivian Amazon. *World Development*, 33(9), pp.1473–1490.

Sunderland, T. et al., 2014. Challenging Perceptions about Men, Women, and Forest Product Use: A Global Comparative Study. *World Development*, 64, Supplement 1, pp.S56–S66. Available at: http://www.sciencedirect.com/science/article/pii/S0305750X14000692.

Tapia-Tapia, E. & Reyes-Chilpa, R., 2008. Productos forestales no maderables en México: Aspectos económicos para el desarrollo sustentable. *Madera y Bosques*, 14, pp.95–112.

Ticktin, T. et al., 2002. Effects of variation on harvest limits for nontimber forest species in Mexico. *Conservation Biology*, 16(3), pp.691–705.

Ticktin, T., 2004. The ecological implications of harvesting non-timber forest products. *Journal of Applied Ecology*, 41, pp.11–21.

Tieguhong, J.C. et al., 2015. How governance impacts non-timber forest product value chains in Cameroon. *Forest Policy and Economics*, 61, pp.1–10. Available at: http://dx.doi.org/10.1016/j.forpol.2015.08.003.

Toledo, V., 2002. Ethnoecology: a conceptual framework for the study of indigenous knowledge of nature. *Ethnobiology and biocultural diversity*, 10.

Toledo, V. et al., 2003. The Multiple Use of Tropical Forests by Indigenous Peoples in Mexico: a Case of Adaptive Management. *Conservation Ecology*, 7(9).

Toledo, V.M. 1988., 1988. La diversidad biológica de México. *Ciencia y Desarrollo. Mexico.*, 80, pp.17–30.

Torres, I., 2004. *Aspectos etnobotánicos y ecológicos de las comunidades vegetales de San Luis Atolotitlán, Municipio de Caltepec, Puebla*. Universidad Michoacana de San Nicolas de Hidalgo Facultad de Biología.

Torres, I. et al., 2015. TEK, local perceptions of risk, and diversity of management practices of Agave inaequidens in Michoacán, Mexico. *Journal of Ethnobiology and Ethnomedicine*, 11(1), p.61. Available at:

http://www.ethnobiomed.com/content/11/1/61.
Trauernicht, C. & Ticktin, T., 2005. The effects of non-timber forest product cultivation on the plant community structure and composition of a humid tropical forest in southern Mexico. *Forest Ecology and Management*, 219(2–3), pp.269–278. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0378112705005384.
Turner, T., 1995. Neoliberal Ecopolitics and Indigenous Peoples : The Kayapo , The " Rainforest Harvest ," and The Body Shop. *Yale F&ES Bulletin*, 98.
UN, 1992. *Convention on Biological Diversity*, New York, USA: United Nations. Available at: http://www.cbd.int/doc/legal/cbd-en.pdf.
UN, 2000. *United Nations Millenium Declaration*,
UNAM, 2009. Biblioteca Digital de la Medicina Tradicional Mexicana. Available at: http://www.medicinatradicionalmexicana.unam.mx/creditos.php.
UNAM., 1959. *Francisco Hernández. Obras Completas. Historia Natural de la Nueva España.* Tomo II, I., Universidad Nacional Autónoma de México.
UNCCD, 2007. *United Nations Convention to Combat Dessertification*, New York.
UNCED, 1992. *Agenda 21*, United Nations Conference Commission on Sustainable Development. Available at: http://www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf.
UNFF, 2006a. *Report of the Sixth Session (24 May 2005 and 13 to 24 February 2006).*, United Nations, New York.: United Nations Forum on Forests. Economic and Social Council Official records, 2006. Supplement No. 22.
UNFF, 2006b. *United Nations Forum on Forests. Report of Sixth Session.*, New York: United Nations Economic and Social Council.
UNFF, 2013. *United Nations Forum on Forests. Report of the Tenth Session. (4 February 2011 and 8 to 19 April 2013)*, New York.
Vazquez-Garcia, V., 2008. Gender, ethnicity, and economic status in plant management: Uncultivated edible plants among the Nahuas and Popolucas of Veracruz, Mexico. *Agriculture and Human Values*, 25(1), pp.65–77.
Vázquez García, V., 2002. *¿Quién cosecha lo sembrado? Relaciones de género en un área natural protegida mexicana.*, México.: Plaza y Valdés Editores y Colegio de Postgraduados.
Vedeld, P. et al., 2004. *Counting on Forest Incomes*, Washington.
Vedeld, P. et al., 2007. Forest environmental incomes and the rural Poor. *Forest Policy and Economics*, 9(2007), p.869–879.
te Velde, D.W. et al., 2006. Entrepreneurship in value chains of non-timber forest products. *Forest Policy and Economics*, 8(7), pp.725–741.
Villalobos, I., 2000. Áreas Naturales Protegidas: instrumento estratégico para la conservación de la biodiversidad. *Gaceta Ecológica*, (54), pp.24–43.
Vira, B., Wildburger, C. & Mansourian, S., 2015. *Forests, Trees and Landscapes for Food Security and Nutrition A Global Assessment Report*,
Wade, R., 1988. *Village republics: Economic conditions for collective action in South India.* I. Press, ed., Oakland.
Warman, A.G., 1994. La Reforma al Articulo 27 Constitucional. *Procuraduría Agraria*. Available at: http://www.pa.gob.mx/publica/pa070203.htm.
WCED, 1987. *Report of the World Commission on Environment and Development: Our Common Future (The Brundtland Report)*,
De Wet, J.M.J. & Harlan, J.R., 1975. Weeds and domesticates: Evolution in the man-made

habitat. *Economic Botany*, 29(2), pp.99–107.
Wiersum, K.F., 1997. Indigenous Exploitation and Management of Tropical Forest Resources : an Evolutionary Continuum in Forest-People Interactions. *Agriculture, Ecosystems and Environment*, 63, pp.1–16.
Wiersum, K.F., Humphries, S. & Bommel, S. Van, 2013. Certification of community forestry enterprises : in a global system for forest governance. *Small Scale Forestry*, 12, pp.15–31.
Wiersum, K.F., Ingram, V.J. & Ros-Tonen, M. a. F., 2013. Governing access to resources and markets in non-timber forest product chains. *Forests, Trees and Livelihoods*, 0(0), pp.1–13. Available at: http://www.tandfonline.com/doi/abs/10.1080/14728028.2013.868676.
Wiersum, K.F. & Shackleton, C., 2005. Rural Dynamics and Biodiversity Conservation in Southern Africa. In M. A. F. Ros-Tonen & T. Dietz, eds. *African Forests: Between Nature and Livelihood Resources. Interdisciplinary Studies in Conservation and Forest Management*. Lampeter, U.K.: Edwin Mellen Press. Available at: http://www.narcis.nl/publication/RecordID/oai%253Alibrary.wur.nl%253Awurpubs%252F341146 [Accessed April 16, 2015].
Woods, M., 2007. Engaging the Global Countryside : Globalization , Hybridity and the Reconstitution of Rural Place Progress in Human Geography. *Progress in Human Geography*, 31(January), p.485.
World Bank, T., 2010. *Project Performance Assessment Report. Mexico. First and Second Community Forestry Projects.*,
Wunder, S., 2005. *Payment for Environmental Services: Some Nuts and Bolts*, Bogor-Barat. Indonesia. Available at: www.cifor.cgiar.org/publications/pdf_files/OccPapers/OP-42.pdf.
Wunder, S., Börner, J., et al., 2014. Safety Nets, Gap Filling and Forests: A Global-Comparative Perspective. *World Development*, 64, Supplement 1, pp.S29–S42. Available at: http://www.sciencedirect.com/science/article/pii/S0305750X14000710.
Wunder, S., Angelsen, A. & Belcher, B., 2014. Forests, Livelihoods, and Conservation: Broadening the Empirical Base. *World Development*, xx. Available at: http://dx.doi.org/10.1016/j.worlddev.2014.03.007.
Yeasmin, S., 2012. â€™ Triangulation â€™ Research Method as the Tool of Social Science Research. , 1(1), pp.154–163.
Young, J.C., 1978. *Health Care in Pichátaro: Medical decision making in a tarascan town of Michoacan, México.* University of California Riverside.

Annex I. Journals Reviewed
Acta Botanica Mexicana (4 documents)
CIFOR (Center for International Forestry Research) (12 documents)
Conservation Biology Journal (9 documents)
Ecological Applications (4 documents)
Ecological Economics (2 documents)
Ecology and Society (8)
Economic Botany (13)
FAO (18 documents)
Forest Ecology and Management (15)
Human Ecology (7)
International Forestry Review (6)
Small Scale Forestry (16)
United Nations (8, reports of UNFF, CBD, MEA, other)
World Bank (6)
Total journals: 10, total documents: 136

Annex II. Plant inventory, common uses and sources of information

Plant name	Species	Family	Other common names	Reported in C. M.	Reported in Nieves	Reported in La Viguita	Reported by Farfán (2001)	Location	Uses reported	Parts used	Other uses reported
Alamo	*Populus spp.*	Unknown				1	No	Barranca	medicinal		
Amargosa	*Eupatorium petiolare Moc.*					1	No		medicinal		
Anís	*Tagetes lucida Cav.*					1			medicinal		
Apio	*Apium graveolens L.*	Apiaceae				1	No	Solar	medicinal		Stomachache, cramps, bone pain, rheumatism
Aretillo	*Fuchsia thymifolia HBK.*	Onagraceae				1	Yes		medicinal	whole plant	Rashes, cough, diarrhea, thrush
Arnica	*Tanacetum parthenium Schultz-Bip.*	Asteraceae		1			No	Barranca-solar, buys	medicinal	whole plant	Muscle pain rubbed fresh onto body; for skin rashes, cuts, and to treat scabies, cramps, labor, postpartum symptoms (UNAM 2009)
Camote	*Unknown*					1			medicinal		
Capulín	*Prunus serotina Ehrenb subsp. capuli (Cav.) McVaugh*	Rosaceae		1			Reports Prunus capuli Cav. *And* Prunus brachybotrya Zucc.	slopes, orchards, riverside, gullies		fruit	
Cervatana	*unknown*					1		Forests, upper side	medicinal		
Cilandrillo	*Adiantum andicola Liebm.*	Adiantaceae		1					medicinal		
Epazote bueno	*Teloxys ambrosioides (L.) Weber*	Amaranthaceae				1	No		medicinal		Medicinal, used as a spice, to treat stomachache
Epazote de zorrillo	*Chenopodium graveolens (Willd.) Weber*	Chenopodiaceae				1	No	Barranca, milpa	medicinal		
Flor de	*unknown*					1		Milpa	medicinal		

gatitos											
Plant name	**Species**	**Family**	**Other common names**	**Reported in C. M.**	**Reported in Nieves**	**Reported in La Viguita**	**Reported by Farfán (2001)**	**Location**	**Uses reported**	**Parts used**	**Other uses reported**
Flor de naranja	*Citrus sp. (Lime, lemon, orange).*	Rutaceae				1	No		medicinal	Flowers of trees	
Flor te tila	*Ternstroemia pringlei*			1			(Merino 2004b)	Forest	medicinal		Tranquilizer (Calderón & Rzedowski, 2005)
Floripondio	*Brugmansia candida Pers.*	Solanaceae				1	No	Solar	medicinal	flowers, leaves	Flowers and leaves are boiled in water and then applied to rashes, bruises or muscle pain. Has psicothropic symptoms if tea is drunk, very toxic (UNAM, 2009)
Gobernadora	*Larrea tridentata (DC.) Cav.;*	Zygophyllaceae				1	No		medicinal		Urinary problems (UNAM 2009)
Gordolobo	*Gnaphalium sp.*			1			Medicinal	Barranca	medicinal	whole plant	cough, asthma
Heno	*Tillandsia usneoides (L.) L*	Bromeliaceae		1	1				ornamental		gastritis, bronquitis, diabetes, mumps
Hierba de burro	*Eupatorium pycnocephalum Less.*	Asteraceae		1			Reports Eupatorium sp.		medicinal		to cure "Susto", for birthing and stomachaces, rashes in babies
Hierba del burro	*Salvia elegans Vahl.*	Labiatae		1			yes		medicinal		Stomachache, bruises, "aire", "espanto", labor, to bathe newborn (UNAM 2009)
Hierbabuena	*Mentha sp.*	Labiatae				1	No	forest, slopes, gardens	medicinal	whole plant	Chest pain, twisted body parts, hair fall, "aire", stomachaches, diarrhea, "susto", "coraje", stress, headache (UNAM 2009)

Hierbabuena de monte	*Didymaea alsinoides (Schlechtendal & Cham.) Standley*	Rubiaceae		1			No	slopes	medicinal	whole plant	stomachache, headache, "aire" (UNAM 2009)
Plant name	**Species**	**Family**	**Other common names**	**Reported in C. M.**	**Reported in Nieves**	**Reported in La Viguita**	**Reported by Farfán (2001)**	**Location**	**Uses reported**	**Parts used**	**Other uses reported**
Hongo aile	*Coriolus versicolor*	Polyporaceae		1					edible		
Hongo amarillo	*Cantharellus cibarius Fr.*	Cantharellaceae	Amarillos, calabacitas, flor de calabaza, flor de cempasúchitl, hongos de calabaza	1	1				edible		
Hongo añil	*Lactarius indigo*	Russulaceae		1					edible		
Hongo borrego	*Sparassis sp.*	Sparassidaceae	panza de borrego, oreja de borrego						edible		
Hongo clarín	*Gomphus sp.*	Gomphaceae	oreja de res, trompetas, cornetitas	1					edible		
Hongo clavo	*Lyophyllum decastes*	Lyophyllaceae		1					edible		
Hongo cote, ocote, gachupín	*Helvella elastica B ull.*	Helvellaceae	Cabeza de cerillo, cerillo, gachupín café, gachupín de ocote, gachupín negro, gachupines, patitas de	1					edible		

			cerillo								
Hongo elote	*Morchella sp.*	Morchellaceae	Borreguitos, elotitos, hongos de elote, mazorcas, olotes	1					edible		
Plant name	**Species**	**Family**	**Other common names**	**Reported in C. M.**	**Reported in Nieves**	**Reported in La Viguita**	**Reported by Farfán (2001)**	**Location**	**Uses reported**	**Parts used**	**Other uses reported**
Hongo enchilado	*Lactarius deliciosus (L.)*	Russulaceae	catalinas, hongo enchilado, hongo de tomate	1					edible		
Hongo oreja puerco	*Russula brevipes Peck*	Russulaceae	enchilado blanco, oreja de borrego, orejas, orejas blancas	1	1				edible		
Hongo patitas	*Ramaria spp.*	Gomphaceae	patitas de pájaro	1					edible		
Hongo tecomate	*Amanita caesarea*	Amanitaceae	tecomate amarillo, tecomate	1					edible		
Hongo tejamanil	*Clitocybe sp.*	Tricholomataceae	Hongo de tejamanil, señoritas, tejamanil de encino, tejamanileros	1					edible		
Hongo trompa de	*Gomphus sp.*	Gomphaceae	trompetas floreadas	1					edible		

puerco											
Hongos llano	*Agaricus campestris*	Agaricaceae	Champiñon		1			forest	edible		
Leña (firewood)	*Alnus sp*	Betulaceae				1	Reports *Alnus acuminata* ssp. *Arguta Schl.*		firewood	wood	
Plant name	**Species**	**Family**	**Other common names**	**Reported in C. M.**	**Reported in Nieves**	**Reported in La Viguita**	**Reported by Farfán (2001)**	**Location**	**Uses reported**	**Parts used**	**Other uses reported**
Leña (firewood)	*Arbutus sp*	Ericaceae				1	Reports *Arctostaphylos discolor* Hook. DC. And *Comarostaphylis longifolia* Benth		firewood	wood	
Leña (firewood)	*Quercus sp*	Fagaceae		1	1	1	Reports Quercus crassifolia H. & B., Quercus laurina H. & B., Quercus rugosa Née.		firewood	wood	
Leña (firewood)	*Pinus sp*	Pinaceae		1	1	1	Reports Abies religiosa HBK. Cham & Shcl., Pinus pseudostrobu		firewood	wood	

							s Lindl.				
Madera construccion (wood for construction)	*Pinus sp, Cedrus sp, Abies sp*	Pinaceae		1	1	1	Reports *Pinus* sp and *Abies* sp	forest, barranca	construction	wood	
Madroño	*Arbutus xalapensis,*	Ericaceae				1	No	Barranca	construction		
Plant name	**Species**	**Family**	**Other common names**	**Reported in C. M.**	**Reported in Nieves**	**Reported in La Viguita**	**Reported by Farfán (2001)**	**Location**	**Uses reported**	**Parts used**	**Other uses reported**
Mirto	*Salvia sp*	Labiatae				1	Yes. Farfán also reports *Salvia fulgens* Cav., *Salvia gracilis* Benth., *Salvia helianthemifolia* Benth., *Salvia lavanduloides* Benth., *Salvia mexicana* L. and other species of *Salvia*	Solar	medicinal	Whole plant	Species such as *Salvia elegans* Vahl., *Salvia fulgens* Cav., and *Salvia microphylla* Kunth, are used to treat stomachaches, bruises, "aire", postpartum pain, to bathe newborns, "susto", "espanto", as a tranquilizer, to treat insomia in children (UNAM 2009).

Musgo	*Selaginella sp*	Selaginellaceae		1	1		No	forest	ornamental		urinary problems, ulcers, rheumatism, to aid labor (UNAM 2009)
Ocote	*Pinus sp*	Pinaceae		1	1	1	Various uses		firestarter		
Ortiga	*Solanum tribulosum Schauer*	Solanaceae		1		1	No	Solar	medicinal	seedless fruits	scabies, dandruff (UNAM, 2009)
Quelites	*Amaranthus sp.,*	Amaranthaceae				1	No	Milpa, water ways	edible	Many types, all edible plants.	
Quelites	*Chenopodium sp.*	Chenopodiaceae				1	No	Milpa, water ways	edible	Many types, all edible plants.	
Resina	*Pinus sp, Cedrus sp, Abies sp*	Pinaceae		1	1	1	no	forest, barranca	sell	resin	
Romero	*Rosmarinus officinalis L.*	Lamiaceae				1	No	Solar	medicinal		"aire", hair fall, dandruff (UNAM 2009)
Plant name	**Species**	**Family**	**Other common names**	**Reported in C. M.**	**Reported in Nieves**	**Reported in La Viguita**	**Reported by Farfán (2001)**	**Location**	**Uses reported**	**Parts used**	**Other uses reported**
Ruda	*Ruta chalepensis L.*	Rutaceae				1	No	Solar	medicinal	soaked with other fruits and rubbed onto bruises; for vomiting in children, boiled and drunk as tea	"aire", vomiting, (UNAM, 2009)
Sábila	*Aloe vera Burm*	Xanthorrhoeaceae				1		Solar	medicinal		
Salvia de	*Salvia sp.*	Lamiacea				1	No	Barranca	medicinal		Medicinal, edible

monte		e									
Té de monte (tabaquillo)	*Satureja macrostema Bentn.*	Labiatae				1	No	Forest	edible		used as tea, very popular and appreciated among the population, also to treat stomachaches (UNAM 2009)
Tecata de Encino	*Quercus sp*	Fagaceae				1	Yes	Barranca	medicinal	Fruit, wood, bark	Bark for rashes (UNAM, 2009)
Tejocote	*Crataegus pubescens (Kunth) Steudel*	Rosaceae		1	1		Edible, commercial	pathways, forest, backyard, fallow, river,	edible	Fruit	
Tierra de monte	*Forest soil*							Forest	fertilizer	Soil from the forest (hummus)	
Valeriana	*Valeriana ceratophylla HB K*	Valerianaceae				1	No		medicinal		Bruises, boiled with other plants (UNAM, 2009)
Vesana	*Geranium seemannii Peyr.,*	Geraniaceae				1	Yes	colindancias	medicinal	whole plant	to treat rach "chincual", Forage (CONABIO 2012)
Zarzamora	*Rubus sp*	Rosaceae		1	1	1	Atole, marmalade, juice	Barranca, pathways, forest, backyard, fallow, river,	edible	Fruit	Tonsilitis, diarrhea, diabetes, ear pain, as an anti-inflammatory (UNAM 2009)

Annex III. Pilot survey

Nombre del productor _____Edad ____ Comunidad _____
Fecha _____ Ejidatario Si ___No___

1. ¿Que actividades productivas realiza?

a. Agricultura ___b. Ganadería___ c. Bosque ___ d. trabajo fuera ___ e. Huertos___ f. otras __

2. ¿Hace usted uso del bosque? Si ___ No ___
3. ¿Qué tipo de productos forestales obtiene? Resina _____ Madera ____

Leña para gasto familiar_____ Leña para construcción de casas particulares____
Otros productos_____ Cantidad _____a la semana___ mes___ año___

4. ¿Recibe algún tipo de apoyo del gobierno para cuidar el bosque? Si___ No___
5. ¿De cual programa y cuanto recibe? _____
6. ¿Cómo considera el estado del bosque? Bueno ___ Regular ____ Malo ____
7. ¿Recibe ayuda de programas de gobierno? ¿Cuáles y cuanto recibe por programa? _____
8. ¿Existen conflictos entre los pobladores sobre el uso de los recursos naturales o de otro tipo? _____
9. Ha escuchado hablar de los servicios ambientales? Si____ No ____
10. Explique qué es un servicio ambiental _____
11. Ha escuchado sobre los programas de PSA, que opinión tiene?_____
12. ¿Cómo ha cambiado el uso de los RFNM en los últimos años? _____
13. ¿de qué manera afectan los programas de conservación de gobierno la forma en que se han utilizado los recursos? _____
14. Desde cuando se han dado los mayores impactos en el uso de los RFNM y qué tipo de manejo se está dando ahora? _____
15. Cuales son algunas fechas importantes relacionadas con cambios en el manejo de los recursos? _____

Annex IV. Questionnaires

Fecha _____ Nombre _____ Edad ____ Sexo M [ ] F[ ]
Localidad _____ Escolaridad _____ Ejidatario [ ] Comunero [ ]
Avecindado [ ] Sexo del (la) jefe de familia M [ ] F [ ]

Generales

1. ¿Qué actividades productivas realiza?
a. Agricultura ___b. Ganadería___ c. Bosque ___ d. trabajo fuera ___ e. Huertos___ f. otras _____

2. ¿Qué superficie de terreno tiene en el ejido? _____

3. ¿Qué porcentaje de su terreno tiene para cada una de las actividades?
a. Agricultura ____ b. Ganadería____ c. Bosque ____ d. Huertos _____e. Renta a otros____ f. Otras ____

4. ¿Cuál es la contribución de cada actividad a la economía familiar? (%)
a. Agricultura_____ b. Ganadería_____ c. Bosque_____ d. Recursos No Maderables_____
d. trabajo fuera (lugar y tipo de trabajo) _____e. Huertos_____ Otras, cuales _____

5. ¿Si tiene ganado cuántas cabezas tiene? ___
6. ¿Que comen sus animales a lo largo del año? En el monte [ ] cuántos meses ___
Rastrojo [ ] Cuántos meses ___ Compra [ ] Cuantos meses ___

7. ¿Recibe algún tipo de apoyo del gobierno para cuidar el bosque? Si___ No___
8. ¿De cuál programa y cuánto recibe? _____
9. ¿Qué tipo de actividades le piden que realice para recibir estos apoyos? _____
10. ¿Cómo considera el estado del bosque? Bueno ____ Regular ____ Malo ____
11. ¿Ha notado cambios en el bosque en los últimos 10 años? Si ___ No___
12.. ¿Qué tipo de cambios? _____
13. ¿Cuál cree que sea el motivo del cambio en el bosque? _____
14. ¿Qué actividades cree que son más dañinas para el bosque? _____
15. ¿Ha notado cambios en el clima en los últimos 15-20 años? Si ___ No___
16. Tipos de cambios _____
17. ¿Cuál cree que sea el motivo de los cambios? _____
18. ¿Qué ha hecho para adaptarse a estos cambios? 1._____, 2. _____, 3. _____, 4. _____,

19. De los siguientes problemas, ¿cuál cree que está afectando su comunidad?, valórelos entre (1) si no afecta, (2) si afecta poco, y (3) si afecta mucho.

Inundaciones ( ) Sequías ( ) Incendios forestales frecuentes ( )
Cambios en la época de inicio y termino de las lluvias ( ) Pérdida de la fertilidad del suelo ( )
Disminución/aumento de animales salvajes ( ) Pérdida de cultivos por plagas ( ) Salinización del suelo ( )
Disminución de la calidad del aire ( ) Polinización(_)
Otros_____

20 ¿Cree que estos problemas podrían relacionarse con que la gente migre a otros sitios? Si ( ) No ( ) No sabe [ ]

21 ¿Cree que alguno de estos cambios puede estar afectando su economía?
Nada ( ) poco ( ) moderadamente ( ) mucho ( )
Cómo?_____

22 ¿Ha tenido que emigrar alguna vez a otro lugar? A. Si ___ No ____ b. ¿Por cuánto tiempo? ___ años
23. ¿En los últimos 20 años el número de gente que emigra a EU ha:
a .aumentado ____ b .disminuido ____ c. permanecido igual ____
24. ¿Cuántas personas son en su hogar?_____ De éstas, cuántas trabajan ____
25. ¿Recibe algún programa de gobierno, cuál?_____ ¿Cuánto recibe? _____
26. ¿Existen conflictos entre los pobladores sobre el uso de los recursos naturales o de otro tipo?
Si__ No___ Razón _____

Cuáles de estos recursos consume (C) o vende (V)

Planta	**Uso**	**Temporada**	**Veces que recolecta X temporada**	**Zona de recolección (monte, barbecho, otro)**	**Tiempo de recorrido para llegar a la zona**	**Cantidad que recolecta X vez**	**Veces que Compra X temporada**	**Cantidad que compra X vez**	**Veces que vende X temporada**	**Cantidad que vende X vez**	**Precio X unidad**	**Contribución al gasto familiar mensual**
a. Zarzamora												
b. Tejocote												
c. Musgo												
d. Heno												
e. Hongos												
f. Hongos												
g. Hongos												
h. Hongos												
i. Hongos												
j. Resina												
k. Madera construcción (Es. _____												
l. Ocote												
Planta	**Uso**	**Temporada**	**Veces que recolecta X temporada**	**Zona de recolección (monte, barbecho, otro)**	**Tiempo de recorrido para llegar a la zona**	**Cantidad que recolecta X vez**	**Veces que Compra X temporada**	**Cantidad que compra X vez**	**Veces que vende X temporada**	**Cantidad que vende X vez**	**Precio X unidad**	**Contribución al gasto familiar mensual**
m.Leña Es. _____												
n.Leña Es.												

_____												
ñ.Té de monte												
o.Medicinal												
p.Medicinal												
q.Pastura												
r.												
s.												
t.												
u.												
v.												

Index of terms

Epilogue

When I entered this graduate program I had decided not to repeat the same mistake I made with the Masters thesis. My Masters thesis was a study of the "sustainability" of production systems in a microbasin in the State of Michoacán. In that work, I went out to study several aspects of various productive systems: the ecological aspects, such as biological diversity, the social aspects, such as differences in participation between generations, or the economic aspects, such as the relationship between costs and benefits of maize production. And all of this, related to each of the main productive systems: agriculture, cattle raising, and forestry. It was chaos. And most importantly: it was impossible. So I had decided to stick to one topic and one resource for my Doctoral project. But I was lazy and didn't want to go into the forest to measure trees and shrubs (although that was fun). I also didn´t want to study just one resource (for example, only blackberries), because that had already been done for many many resources. What I wanted to know was how the group of NTFPs was managed, who used them, how important they were for the economy of rural populations in Michoacán, and what were the changes that these resources- and their users- were going through, and what caused these changes. Well, I ended up with the same problem: studying too many resources, and too many issues. So that became an issue. Added to that, other personal real-life experiences (managing a restaurant, for example) were showing me how important it was to work with consumers, and how difficult it was to please consumers who expect constant availability of "sustainable" and "local" products when the reality is that "sustainable" products are seasonal, come in small quantities, are difficult to transport and preserve, and are paid at very low prices, so people who depend on these resources get almost nothing. Well, my head exploded. And this is as much as I could do. The reality is that I tried to grasp too much, but at the same time I suffered with the idea that most of this thesis work would serve no-one but myself, it would get me a degree. And perhaps help me understand better that life is not what we would like it to be. I have an urgency to do something about the problem, and still, after all these years, I have no idea, no response. But gratefully, the thesis is done (yes, today, 21 April 2018), and now I am free (of the thesis, at least) to try to do something about the problem. What? I don´t know. I will figure it out. Thanks for reading.

A Little more reflection:
El trabajo es una expresión del ser creativo. Como las poblaciones rurales, que usan su creatividad para desarrollar múltiples actividades, mi reflexión personal es cómo desarrollar un sentido del éxito y del bienestar personal, explorando las múltiples facetas de ese ser creativo que soy yo. La tesis de doctorado fue un proceso que se empalmó con otras experiencias creativas: el trabajo en una ONG sobre temas de movilidad urbana, la creación de un foro/centro cultural, la crianza de las hijas, todos estos procesos totalmente creativos. De estos, la investigación fue para mí la menos creativa, pues siempre estuvo supeditada a cánones y exigencias académicas basadas en el método científico, en formas de hacer las cosas y de presentarlas, y hasta por convenciones sociales de cómo interactuar en un espacio académico. Mi proceso como doctorante sufrió profundamente de la influencia de las otras experiencias. Como una gran mayoría de mis compañeros doctorantes (sobre todo quienes trabajamos temas sociales) sufrí una fuerte desilusión al pensar en los alcances del trabajo de investigación. Esta desilusión se hizo más fuerte cuando ví la realidad concreta de otras actividades, cuyo impacto se puede observar en el corto plazo: la creación de empleos, la producción culinaria o artística, la organización social para lograr cambios en la movilidad, etc. Sin embargo, finalmente he reconocido la importancia de la investigación y de la difusión de la información que se recopila a través de esta actividad. Tristemente, me parece que hace falta un mayor esfuerzo por parte de investigadores y académicos, para sacar esta información de la élite académica, y encontrar maneras de transmitirla a quienes viven los problemas en su vida cotidiana: los productores, los consumidores. Espero poder contribuir a esa labor, y no dejar que la sed por el reconocimiento (académico, social) y por ganar mucho dinero, me secuestren.