

**Conservation of Natural Resources within Mature Tropical
Forests: How an Indigenous Community Uses and Manages
Wild Plants in the Comarca Ngöbe-Buglé, Panama**

by

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**A thesis submitted to the Faculty of Graduate and Postdoctoral
Affairs in partial fulfillment of the requirements
for the degree of**

Master of Arts

in

Geography

**Carleton University
Ottawa, Ontario**

2012

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Ottawa ON K1A 0N4
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Your file Votre référence

ISBN: 978-0-494-91606-3

Our file Notre référence

ISBN: 978-0-494-91606-3

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Abstract

Concerns regarding the degradation of tropical forests and the indigenous communities that rely on them have been growing for decades. However, the use of wild plants and local efforts to manage them remain poorly understood. Using participatory methods, this research examines the use and management of useful wild plants from mature forests by a Ngöbe community in the forested highlands of the Comarca Ngöbe-Buglé in western Panama. Ethnobotanical information about nine plants selected by the participants was obtained through a household survey, interviews, focus groups and harvest trips. The findings show that the use of wild plants is gendered and varies between households, and that a variety of management practices are used within the community, aimed at reducing the impacts of harvesting. The study also identifies limitations of current management practices for long-term sustainability, and highlights the necessity of basing conservation strategies on local priorities for useful plants.

Acknowledgments

I would like to express my gratitude to all those individuals who made this thesis possible. My dearest thanks goes to the community members of Ratón, who so warmly accepted me into their homes, shared their thoughts, concerns and hopes, and in doing so enriched my life experience. I am especially grateful to Ramón Pineda and Denia Montezuma for their friendship and generosity. They allowed me to stay with their family and helped me integrate into the community. In addition, I would like to recognize the contributions of a dozen other community members who supported and assisted me in this project; Cacique Basilio Montezuma, Alfredo Carpintero, Titi Montezuma, Meligo Pineda, America and Omar Montezuma, Ebaristo Palacio G., Aquilino Castillo, Silvia Morales and Micaela Palacio.

I would also like to sincerely thank Dr. Derek Smith, who supervised this thesis, for his continuous support, encouragement and insight. Thank you Derek for giving me the opportunity to undertake this research, and guiding me throughout the process.

Credit should also be given to the research partners, Sr. Antonio Amador (President of the Congreso Regional de Nedrini) and Sr. Jesús Alemanca (Director of the Centro de Estudios y Acción Social Panameño) who offered me the opportunity to participate in the fight for social justice in Panama. I would like to express profound gratitude to Dr. Alicia Ibáñez, researcher at STRI, who was incredibly supportive throughout the field research. Thanks to Charlotte Elton for her encouragement and for sharing her passion for social and environmental justice, and also to Dr. Blas Quintero (Director of Acción Cultural Ngóbe).

I would like to sincerely thank the amazing staff and faculty of Carleton's Department of Geography and Environmental Studies, especially Natalie Pressburger, Michael Brklacich, Doug King and David Bennett. Their warm and cheerful presence and support made my time at Carleton very enjoyable. Thanks to Dr. Gita Laidler and Dr. Theresa Wong for reading earlier drafts of this thesis. Their comments helped me develop a stronger argument and gave me a better understanding of how my work contributes to the field.

I offer my most heartfelt gratitude to my partner Matthew Palmer for his unbelievable support throughout the whole research process, and for spending countless hours discussing and editing my work. Thanks to my parents and grandparents, for planting the seeds of curiosity in me and for encouraging me to follow my passions.

Finally, this thesis would not have been possible without the financial support provided by: IDRC's John G. Bene Fellowship in Community Forestry, the Ontario Graduate Scholarship, the Neil Huckvale Memorial Scholarship, the Ina Hutchison Award, the J. Kenneth and Margaret Torrance Scholarship, the Jack F. Fleming Scholarship and Carleton University's Graduate Entrance Scholarship.

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Introduction

Global concerns for the degradation of rainforests and the indigenous communities that rely on them have been growing for decades. The detrimental impacts of the reduction in forest cover have been widely studied, especially with reference to biological diversity, carbon sequestration, and hydrological cycles (Bunker et al. 2005, Coe et al. 2009, Germer et al. 2009). As this research has been occurring, forest dwelling indigenous people have found themselves in the middle of the forest conservation debate. While the communities living in remote forested areas often have relatively sustainable land use practices, population growth, cultural changes, the introduction of new technologies and the penetration of market economies have been shown to place greater pressure on forest ecosystems (Ghazoul & Evans 2001, Laurance 1999, Potvin et al. 2007). Though many studies have identified the expansion of agriculture as the largest driver of deforestation (Morales et al. 2008), it is becoming increasingly acknowledged that there is no single causal factor given the wide variations in historical, socio-economic and political factors that exist across regions (Appiah et al. 2009, Ghazoul & Evans 2001, Geist & Lambin 2002, Laurance 1999, Vanclay 2005).

Forest conservation and local people

Conservation policies at all governance levels face the challenge of protecting this threatened forest biodiversity while at the same time preserving the vital forest ecosystem services on which local communities depend. Since conservation policies that do not respect the rights of the local people can have detrimental social impacts (Brockington et al. 2006, Stocks 2005, West et al. 2006), involving communities is essential for

successful conservation projects (Salafsky & Wollenberg 2000).

Research in rural communities has shown as well that local people's knowledge is important for understanding environmental and ecological processes (Dalle & Potvin 2002, Donovan & Puri 2004, Lauer & Aswani 2008, Posey 1985, Smith 2008). Because of this, local perceptions of forest and local priorities for conservation are essential if we seek to develop sound conservation strategies that promote sustainable forest management (Ali et al. 2006, Lykke 2000, Pare et al 2010). While local indigenous natural resource use and management practices are recognized as highly diverse (Balée & Gély 1989, Coomes & Burt 1997), the distinctive customary practices of indigenous communities remain poorly understood.

The challenge of protecting threatened biodiversity while at the same time maintaining rural livelihoods is particularly important in Central America, a region witnessing numerous decades of forest loss and degradation (Harvey et al. 2007, Utting 1994). The involvement of remote indigenous communities in developing various conservation strategies has been a growing trend in this region, and as a result there is a need for outsiders to better understand how these communities use and manage their forests.

In Panama, recent studies on harvesting and hunting patterns by indigenous communities have revealed promising opportunities for addressing conservation issues. For example, a participatory study on the hunting patterns of Buglé communities was able to assess if local depletion of animals had occurred in their territory, and demonstrates the value of such study for the delimitation of conservation zones (Smith

2008). Another study in Kuna communities focused on the spatial patterns of useful plants and shed light on the role of land-use and topography in shaping their distribution (Dalle et al. 2002). Both studies used participatory methodologies and highlighted the importance of the involvement of local people in conservation.

1.1 Research Focus

The purpose of this research is to examine the role of mature forest in the local livelihoods of the Ngöbe indigenous people in Panama, focusing specifically on the use and management of wild plants¹. In a given Ngöbe indigenous community, what are the conservation priorities for forest plants from the local people's perspective? In order to address this question, I have developed specific objectives:

- (a) To understand local practices related to the forest and perspectives on the forest's importance.
- (b) To examine the harvest, use, and management of plant species that are considered conservation priorities by the community, using a gender sensitive approach.
- (c) To understand how cultural practices, environmental conditions, socio-political and socio-economic factors shape the conservation of forest plants.
- (d) To provide a forum where the community can reflect on forest conservation, and to facilitate discussion on potential conservation measures that would reflect the priorities of the community.

Before I could examine the way in which the community manages and conserves the plants of concern, it was crucial to understand the local people's use of the forest and their perspectives on its importance. Looking at the forest from their angle provided important insights into their needs and the way that they prioritize useful plants. The gender sensitive approach helped me ensure the participation of women in the study, and

¹ This research took place in a legally established indigenous territory.

showed some of the differences that exist in the use of and concerns for wild plants between men and women. This study does not, however, seek to be a comprehensive gendered analysis of plant use; rather, gender was one of many lenses that I tried to examine the community through. In addition, analyzing the community's cultural practices and the broader environmental conditions and socio-political and socio-economic context within which the community exists allowed me to draw a more comprehensive picture of the factors influencing the harvest of forest resources by local people. Providing a forum in which the community could get together to think about forest resources was a key element in starting a discussion on forest conservation priorities. These discussions provided important information that is needed if the community seeks to develop conservation measures specific to their context.

Situated at the intersection between cultural geography, conservation biology and forest management, this research responds to the need for more multidisciplinary research in conservation as well as for better understanding of community forestry. It contributes to debates on indigenous land rights and on the involvement of indigenous groups in tropical forest conservation. Through this research, I provide new insights into the relationships between indigenous peoples and tropical forests. By sharing the final research findings with the community and indigenous authorities, I hope to provide information and tools that they can use to achieve their goal of conserving biodiversity in their territory. The results of this project will help develop a fuller understanding of local indigenous forest use in threatened neotropical environments, information that can aide academic scholars, non-governmental organizations and government agencies alike.

1.2 Overview of the Theoretical Framework and Research Design

This research seeks to examine a community's forest management and conservation and in doing so to contribute to debates related to indigenous self-determination and neotropical forest conservation. In examining the local conservation priorities, the theoretical foundations for this project lie in political ecology. Throughout this research, local knowledge comes out as a key concept, both because it is intrinsically important and because it is useful in conservation.

Using a participatory methodology, this research is based largely on my observations and experiences in Ratón, a Ngöbe community located near the mature forest of western Panama. During my fieldwork, which took place from August to December 2010, I spent a total of six weeks living with a single family in Ratón, and I spent the remaining time in more accessible communities and in city centers in Panama. Through a multi-method participatory approach, information and opinions were collected regarding the use, management and perceptions of the nearby mature forest. Participation of women was especially promoted, and as a result this research encompasses a gender dimension.

1.3 Thesis Outline

This thesis encompasses a total of seven chapters. The remaining chapters are divided as follows:

- Chapter II introduces the theoretical foundations of this research in political ecology, and reviews the literature on indigenous forest use.

- Chapter III presents the methodology of the project and includes the research methods and analytical techniques used, and highlights how the research is embedded in a multi-method, participatory approach.
- Chapter IV sets the contextual background of the indigenous group in Panama, exploring the challenges that the community faces and the potential effects of these challenges on forest management.
- Chapter V looks at the local importance given to the forest and examines the practices associated with its control and management.
- Chapter VI turns its attention to the use of wild plants, investigating in detail the use and management of a set of nine plants that are of concern for the community, and revealing important insights on the challenges and opportunities for forest conservation.
- Chapter VII discusses the main research findings and their broader implications.

Chapter II. Theory

The mature forests of western Panama are amongst the most extensive and diverse of the country. This area is mainly populated by indigenous groups including the Ngöbe, the Teribe and the Buglé. The Ngöbe and the Buglé – the indigenous people living in and around the mature forests – were granted legal rights to the land in 1997 in the form of the Comarca Ngöbe-Buglé (ACUN 2003). Despite the establishment of this semi-autonomous territory, they have had little control over the development projects occurring around them (Bort & Young 2001) and are not protected from the state's policies regarding land expropriations, thus rendering the subsurface resources the state's property (Elton 1997). Explorations of copper deposits in the heart of the comarca have already brought controversies and uprising at local and international levels (Gjording 1991). Damming and mining developments have forced the displacement of indigenous populations in Panama and in other parts of Central America (Gjording 1991, Finley-Brook & Thomas 2010, Wickstrom 2003). In addition to violating human rights, these large projects threaten the rich biodiversity of the mature forests. In addition, deforestation arising from agricultural expansion, cattle ranching and road improvements is contributing to the reduction in extent of these forests (Elton 2001, Miller et al. 2001, Parker et al. 2004, Segura et al. 1997).

As a result, conservation agencies along with regional authorities have been considering creating a protected area in the area of the Comarca Ngöbe-Buglé to protect the rich and unique biodiversity, while at the same time respecting the local peoples' use of the forest (Smith 2010). This double protection would support the long-term protection

of both the communities and resources against growing external threats, such as the exploitation of copper deposits.

Some organizations have also targeted indigenous agricultural practices, such as selective logging and slash-and-burn, as being inadequate for sustainable forest management (Jaén et al. 2008). These organizations instead promote capacity building programs in certain areas of the comarca as a means of helping the communities develop more sustainable practices (Jaén et al. 2008). However, in attempting to promote sustainable forest use among indigenous communities, it is crucial for conservation agencies to pay attention to the nuances of resource use; thinking of slash-and-burn, for instance, as a wholly negative and ‘backwards’ practice will simply not suffice. Both conservation agencies and the regional authorities must develop an understanding of the distinctive ways that people living in remote forest regions conceptualize and interact with the forest around them. Having this information would provide these external actors with the broader cultural and socio-economic context in which the use and conservation of specific resources occurs.

The fact that these interactions between communities and forests are highly place and time specific can make this knowledge difficult to come by. To date, there have only been a limited number of studies on the Ngöbe communities’ interactions with mature forests. Past research includes Ngöbe forest use practices, but primarily focuses on lower elevations where forest composition is very different than in the cordillera region (Gordon 1982, PAN 1995b, Young 1971). Thus, the local indigenous residents’ use of the forest resources need to be better understood by the conservation agencies promoting the protected area. Most importantly, the rights of the communities to manage forest

resources according to their needs and cultural practices must be recognized.

This chapter first gives an overview of political ecology and how it can help foster a better understanding of the use and conservation of mature forest plants by situating these practices within their broader context. The following section gives an overview of the field of local knowledge and defines key concepts related to studying how indigenous people use the forest. A literature review of the indigenous use and management of forests in Latin America follows. Finally, the chapter looks specifically at past studies of Ngöbe communities' forest management and resources use practices.

2.1 Political Ecology

In trying to understand local use and management of the forest and its resources, my research draws on political ecology. Broadly speaking, political ecology aims to combine analyses of ecological conditions, socio-political relations and cultural practices (Nygren & Rikoon 2008). Despite many current debates around its interdisciplinary nature (Neumann 2009, Simon 2008, Vayda & Walter 1999, Walker 2005, Zimmerer & Basset 2003), political ecology can be defined as an integrating approach aimed at understanding social and environmental changes through underlying environmental and political processes (Nygren & Rikoon 2008). It can take into account multiscale processes, examining for example how local environmental actions are linked to global policy. It also recognizes communities as being heterogeneous and thus comprising multiple actors with various perspectives, interests and levels of power. As a result, political ecologists propose a novel way of understanding environmental problems such as deforestation and land degradation. Recognizing environmental issues as the result of

social, economic and political forces enables scholars and practitioners to refute the belief that the roots of environmental problems are in “Malthusian pressures, peasant irrationality, and ignorance” (Grossman 1993:348).

In the field of political ecology, studying indigenous use and management of forests is referred to as community forestry, community-based conservation and/or community-based natural resource management (Charnley & Poe 2007, Gruber 2010, Lynch & Talbott 1995). This type of research can be highly normative (Michon et al. 2007, Peluso 1995). Some research on the spatial organization of territories, for example, has been openly political, aiming to claim land rights and empower marginalized people (Herlihy & Leake 1997, Peluso 1995). Nightingale (2003) similarly underlines the importance of challenging the dominant discourses and representations in western natural resource management by demonstrating that they provide only one side of the story. These discourses often advocate the complete protection of forest resources, but to the detriment of the local people who depend on them. In Panama, conservation agencies recognize the importance of collaborating with local people and respecting their forest use, but at the same time are worried about the degradation of the forest. Through mapping local people’s land use or highlighting their use of forests plants, indigenous rights to the land and to control over resources can be documented and supported. While conserving biodiversity is in itself a legitimate goal, it should not come at the expense of local peoples’ forest practices and uses. Indigenous uses of forests are often “invisible” (Michon 2005) on satellite imagery because they take place under the canopy. Similarly, domesticated forests can be indistinguishable for an inexperienced eye walking through them, as they generally conserve many characteristics of natural forests. Nevertheless,

indigenous forest practices exist and are important to consider in any development or conservation measures.

My research seeks to contribute to the political ecology field by documenting one community's forest practices and plant use. The analysis pays special attention to the differentiated access to and use of wild plants that results from rights to the forest, income and gender, in order to highlight the variations within the community. These differences in access have been identified as playing important roles in the harvest of wild plants (Dovie et al. 2008, Nygren et al. 2006, Rocheleau & Edmunds 1997), and thus need to be discussed if we wish to foster sustainable management practices. Nygren and colleagues (2006), for example, stress the importance of paying close attention to the socio-cultural factors influencing the opportunities and constraints that local people face in harvesting wild plants. While a complete contextualization of the cultural, social, political and economic conditions that underlie forest use is beyond the scope of this research, I try to incorporate these contexts into the analysis to help better make sense of the reality within which local people engage with the forest.

In order to examine the challenges related to the use and conservation of mature forest plants, I conducted research on the plant resources that a Ngöbe community considers of special concern. Collecting data about the ecology and the location of plants of special concern helped me to build an understanding of the factors controlling the plants' distributions, which have in turn helped me develop new insights for local conservation measures.

An analysis of power relationships within the community as well as at the

regional, national, international and transnational levels is not the focus of this research. Nevertheless, I provided insight into the community structure and customary practices surrounding resource extraction. By analyzing the differentiated use of forest resources, my research brings insights into the various interests existing within the community. Finally, the approach used here aims to foster the development of local governance regarding the community's management of wild plants.

2.2 Local Knowledge

Given that the study of the use and management of wild plants and their habitats crosses various disciplines, it has been conducted under various titles, including ethnobotany, ethnomycology, ethnoecology, traditional ecological knowledge and traditional geographical knowledge (Berkes 2004;2009, Dalle et al. 2002, Houde 2007, Joly et al. 1987;1990, Lampman 2007, Michon 2005, Ticktin et al. 2003, Toledo et al. 1992). Although there exist variations between these applied categories of research, they are all part of the broader field of local knowledge.

The term “local knowledge” can refer to the idea that “all knowledge is located and geographically and historically bounded, and that the local conditions of its manufacture affect substantially the nature of the knowledge produced” (Barnes 2000: 452). In other words, knowledge can be understood as place-specific, non-universal and never complete. This concept emphasizes the way knowledge is produced, taking into account the fact that specific locations and human interactions influence how one understands the world. As Kobayashi (2009:141) explains:

“It matters...‘where’ [people] are positioned, in buildings, streets, or cities, in what part of the world, and with whom they share proximity, either through direct bodily contact or through the myriad ways in which knowledge is transmitted spatially, shared partially, and embodied meaningfully.”

This idea that knowledge is situated is often contrasted with the idea of universal scientific knowledge (Agrawal 2002, Haldrup 2009). The intimate knowledge of local people is typically based on observations for a long time period and can contradict scientific understandings based on “objective” analysis and more macro level observations (Leach & Fairhead 2000). On the contrary, I argue that local and scientific knowledge can inform and complement each other. For example, people who use plants are seen as the most knowledgeable about what they can observe or manipulate, but it is acknowledged that they can rarely know about phenomena they can’t observe, in which case scientific researchers may be better positioned to understand the phenomena. The local knowledge that people have further constitutes a valuable tool in many regards. It can be used to help empower marginalized groups, articulate different conceptions of spatial knowledge and finally to promote cultural identity (Corbett et al. 2009). More specifically, research in ethnobotany, traditional ecological knowledge and community-based conservation have made important contributions to the identification of threatened habitats, increased the sustainability of ecological management decisions and fostered improvements in the understanding of land-use changes over time (Berkes 2004; 2009, Houde 2007).

Whose knowledge? Participation and representation within a community

Research on local knowledge often uses the village or community as the geographical unit of analysis, as a wide range of community-based studies show.

However, local knowledge is not shared uniformly within a community. Researchers have therefore tried to use research methods that facilitate the participation of all community members, in addition to identifying key informants who are recognized locally as knowing more about the subject or phenomena under study.

Participation of individuals in community-based projects depends on a combination of factors, including the community's rules, social norms and perceptions, as well as personal and household endowments and attributes (Agarwal 2001). These factors can repeatedly disadvantage certain individuals or groups within the community, perpetuating a lack of representation in local knowledge projects. Women as an under-represented group have particularly been given attention. "Only a small percentage [of women] usually attend meetings. If they do attend, they rarely speak up, and if they speak their opinions carry little weight" (Agarwal 2001:1628). It is therefore important to be aware of and identify the marginalized groups within a community, such as women, because these social perceptions can hinder an accurate understanding of their knowledge and perceptions. To counter this kind of power-relationship, which is embedded in social norms, researchers trying to involve a whole community can divide local people into groups such as men and women, to ensure their fair representation (Dovie et al. 2008, Rocheleau & Edmunds 1997, Wilson et al. 2006).

In contrast, representativeness is not necessarily the sole goal when undergoing studies based on local knowledge. Given that knowledge varies from one individual to the other, some scholars claim that trying to incorporate a broad range of stakeholders might not lead to more complete results: "more knowledgeable people making decisions create greater legitimacy, rather than an abstract representation of various putative

categories of stakeholders” (Wilson et al. 2006:800). Following this line of thought, targeting a specific type of local knowledge might result in only a portion of the community being involved in the research. For instance, having only men participate in research designed to map the outer territory of a community may not be a problem if in that community “knowledge of extensive subsistence activities is more the dominion of men” (Herlihy & Leake 1997: 716). As a result, depending on the nature of the activity being investigated, it might be more appropriate to involve the whole community in the research or to target only a subset of individuals. Knowing the community structure and customs prior to beginning participatory research is thus key in identifying the best strategy.

Regarding the knowledge of plants, the differences in use within a community have been the subject of much research, especially in gendered studies (Kainer & Duryea 1992, Rocheleau & Edmunds 1997, Wayland 2001). Plant “use” and “knowledge” are linked by the fact that people will be likely to know more about plant names, characteristics and uses if they use them on a regular basis (Thomas et al. 2009). While there can be a notable difference between somebody’s knowledge and actual use of plants (Ladio & Lozada 2004), studying their uses can give good indications about the extent of their knowledge. It is also becoming increasingly acknowledged in research that community plant use, knowledge and skills change over time, adapting to new realities (Müller-Schwarze 2006).

Two key concepts in this study of local knowledge: Indigeneity and mature forests

The local knowledge of “indigenous communities” regarding “pristine forests”

can be a contested and politically charged area of study (Agrawal 2002, Agrawal & Gibson 1999, Mistry 2009, Smith 1999). In the context of this research, the term “indigeneity” refers to the descendents of people who inhabited the region prior to the arrival of Europeans. They consider themselves as having a different identity and have interest in protecting their territory for the continuation of their lifestyle. Indigenous knowledge refers to knowledge that is rarely written down, but transmitted through myths, songs or verbally (Mistry 2009). Furthermore, the relationship that the community members have with their surrounding environment is understood as complex and evolving through time. Lynch and Talbott (1995) in their reflection on indigenous community forestry, stress the importance of avoiding dichotomizing and stereotypes:

Contrary to enduring stereotypes, sustainable community-based management systems are operated neither by ecological “noble savages” living in symbiotic harmony with nature, nor by self-centered exploiters seeking to maximize short-term gain. Like participants in other sustainable systems, most successful community-based managers are rational strategic-minded individuals who assess existing conditions and act in their own best interests (Lynch & Talbott 1995:24).

This approach can help better understand the subtleties of how individuals and households take forest management decisions.

In addition, terms like pristine, intact, virgin or undisturbed forests are commonly used in discourses on mature forests. These concepts imply that there exist forests that have not been subject to human interventions. However, advances in archaeology, paleoecology and history have brought evidence that most forests have undergone substantial human induced modifications at some point in time (Willis & Brncic 2004). The forests of Panama, despite being highly diverse in fauna and flora, have been inhabited by indigenous groups for centuries (Bush & Colinvaux 1994, Gordon 1982). As

such, this research will use the word “mature” when referring to forests that have attained a later successional stage of development, as opposed to “pristine”. Appellations such as “domesticated”, “modified” or “intermediate” forests further act as reminders that most forests are part of the local land use system (Michon 2005, Wiersum 2004). This approach to local knowledge of indigenous communities will help to shed light on the complexities and subtleties of the community’s relationship with mature forest.

2.3 Indigenous People in Tropical Forests: A Literature Review of Current Knowledge

At the same time as they sustain rich wildlife, mature forests play an important role in the lives of forest dwelling communities. Some households derive their livelihoods primarily from them, while others use them occasionally when their agriculture or formal employment is not sufficient (Charnley & Poe 2007).

Despite important changes in the past decades in socio-political organization and pressures associated with the penetration of markets in rural areas, most indigenous peoples continue to have complex relationships with the forests upon which they depend to meet their daily needs (Davis & Wali 1994). These communities use and manage the forests in various ways, including by harvesting wild species and by practicing management such as selective clearing. Interestingly, Michon and colleagues (2007) refer to indigenous communities’ forests as “domestic”, to illustrate the strong relationship between the forest users and their forest, and to exemplify that the forest fulfills their needs. This section provides a review of the current knowledge of the relationship between indigenous people and tropical forests, with a focus on the uses and practices of Latin American groups.

Indigenous use and knowledge of forest plants

There is a large body of literature on useful plants in neotropical forests. Most studies, however, are either quantitative in nature or focus on the potential economic benefits of plants. Given the increasing number of known useful plants, quantitative research using extensive databases of useful plants is important; this method has facilitated the identification of regional patterns of use. Research on which environments provide the most useful plants, for instance, has led to significant discoveries. Using a database of approximately 3000 Mexican useful plants, Toledo (1992;1995) found that primary and secondary forests both provide important varieties of products. These studies further revealed that products obtained from the primary forests are mainly wood and food, while products from the secondary forests encompass a broader array of products, especially medicines. A Bolivian study found that the forest understorey provides a higher number of plants useful to local people than the overstorey, suggesting that accessibility is a key factor in the use of a plant (Thomas et al. 2009).

Quantitative research has also shown that the uses of plants vary depending on the needs to be met. Some needs require specific plants, such as those used in making remedies, while other needs can be met by a broad range of species, such as those used as construction materials (PAN 1995b, Phillips 1999). Finally, a research project on palm species (Arecaceae family), found that these plants are especially important for forest dwelling communities (Borchsenius & Moraes 2006). They are known to provide a great diversity of products throughout the tropics, especially food and construction materials (Borchsenius & Moraes 2006).

Most detailed studies on local botanical knowledge, however, have focused on either the economic or medicinal values of forest products and their potential as pharmaceuticals or for commercialization (Coe & Anderson 1996, Joly et al. 1987, Mendelsohn & Balick 1995, PAN 1995b, Philips 1993, 1999, Ticktin et al. 2003, Toledo 1995, Sanz-Biset et al. 2009, Villa-Herrera et al. 2009). There is a need to better understand the broad array of useful species that may not be commercially viable or have no application in the western pharmaceutical industry.

Research using databases or focusing on the economic or pharmaceutical potential of wild plants has significant shortcomings, principally surrounding the decontextualization of knowledge and the lack of access and benefits for indigenous communities (Agrawal 2002, Krumenacher 2004). Nevertheless, these studies demonstrate that indigenous communities hold a rich knowledge of plants. Few detailed studies have focused on wild plants useful for other purposes than pharmaceutical, such as their cultural significance (Lincoln & Orr 2011). As such, my research contributes to this body of literature, focusing on wild plants that are of value to the community that uses them.

Indigenous forest management

Forest management practices and systems have evolved as a result of the experience that communities have with the social and environmental impacts of their harvesting practices (Lynch & Talbott 1995). Forest management systems at any given time do not always allow for optimum forest use; this is because the continuously changing environmental, political and social conditions require the constant adaptation of

management practices (Lynch & Talbott 1995).

Numerous studies have shown that a large variety of indigenous forest management practices exist (Balée & Gély 1989, Dounias & Hladik 1996, Michon et al. 2007, Wiersum 2004). Forest management generally aims at favoring useful forest species in two ways: through biologically-oriented practices, such as selective clearing, or socially-oriented measures, such as restricting usufruct rights (Wiersum 2004). However, much remains to be understood as few studies have looked at specific management strategies and the conditions under which they arise; in addition, little research has been done on the indigenous classification of plants, land uses and the natural habitats in which the plants occur (Aporta 2003, Balée & Gély 1989, Johnson 2000, Posey 1989, Thornton 1997). For example, it is often the case that ecological phenomena are categorized and classified by local people differently than the conventional western way (Mistry 2009). Posey (1985) documented that the Kayapo indigenous group in Brazil have their own way of classifying the forest types, recognizing a great variety of biotopes, including transitional and island forest environments. These unique understandings of the forest undeniably influence the way the communities manage the plants' habitats.

Another important aspect of indigenous forest management is that forest practices are often done in conjunction with growing crops or raising cattle, for which the term "agroforestry" is often employed. Broadly speaking, traditional agroforestry is defined as a "sustainable land use that combines natural or planted trees and shrubs with crops and/or livestock on the same unit of land, in ways that increase and diversify farm and forest production while also conserving natural resources" (FAO 2006). We are

discussing here traditional agroforestry, not for commercial purposes. As such, agroforestry practices can be understood as a continuum, including the incorporation of trees in agricultural systems or the incorporation of crops or cattle in forest systems (Wiersum 2004).

Indigenous forest management systems, including agroforestry practices, are known to offer, in addition to local livelihoods, a high potential for conservation biology (Schroth et al. 2004). In homegardens and forestgardens, for example, forest dwelling communities grow a wide variety of food year round, such as vegetables and fruit trees, and they, at the same time, create a great assortment of habitats for wildlife (Fernandes & Nair 1986, Smith 2005, Zaldivar et al. 2002). Other agroforestry practices, such as shaded plantations (Somarriba et al. 2004), silvopastoral systems (Rice & Greenberg 2004) and live fences (Harvey et al. 2004) are also currently studied for their beneficial effects on local plant and animal diversity.

Indigenous land tenure and access rights

Access to forests, their plants and their products are formed by complex, multifaceted tenure regimes, in which social factors such as gender, age and kinships play important roles (Rocheleau & Edmunds 1997). These regimes, which include both individual and groups rights, are the result of long-term relationships between community members, other communities, and their surrounding environments (Lynch & Talbott 1995). Land tenure systems dictate how the land and access to its resources are shared within a given community. For example, some communities have defined community grounds, which are considered public domain (Howe & Sherzer 1975), whereas others

have not. In this study, the residents stated that all land parcels are controlled by someone, except rivers and areas far beyond the community limits.

Amongst these regimes, the rights to trees and plant resources are often distinct from the rights to land, and vary greatly depending on the type of plant and where it is found (Howe & Sherzer 1975). On the one hand, access to trees and plants that are actively managed and found on privately controlled plots of forest is generally highly restricted. On the other hand, access to common plants remains public even when the plants are found within private land (Howe & Sherzer 1975). When making these general statements, Howard and Nabanoga (2007) stress the importance of recognizing the complexity of customary rights to plants that exist within communities:

“We argue that rights to plants are generally uncodified, ubiquitous, and constitute an integral part of power relations; are embedded within cultural systems and regulated by customary institutions and norms; are both consciously and unconsciously respected, contested and negotiated; and are adaptive and dynamic” (Howard & Nabanoga 2007:1543).

As these authors imply, there are important nuances in the rights to plants, which cannot realistically be grasped by an outsider conducting a research project like this one. As such, examining a community’s customary systems of rights can give indications regarding their complexity. To date, no studies have been done on the Ngöbe communities’ customary land tenure and systems of rights to forest plants. Young (1971) gives some indications that men are preferred in the passing on of familial parcels, but much remains to be understood.

Management: extraction or conservation?

While local communities depend on the harvest of wild plants to sustain

themselves, they also need to manage these plants in an ecologically sound way, both to continue to harvest the species, and to protect the forest habitat (Nygren 1999). The ecological implications of wild plant harvest, however, are difficult to measure and are still largely unknown (Phillips & Gentry 1993).

Research has shown that the more a community relies on its environment, the more incentive they have to manage it (Lynch & Talbott 1995). In his research with the Machiguenga in the Peruvian Amazon, Johnson (1989) argues that communities engage in significant resource management when there is population pressure on the natural resources they need, and a customary system of rights ensuring that the rewards of investments are going back to the people managing the resources. Lynch and Talbott (1995) add that “conflict-management mechanisms” at the community level are important components underlying successful customary management regimes. Social ostracism, for instance, ensures that the community members respect each other’s forest access.

Other research has focused on the effects of household incomes on the extraction of wild plants. Godoy and colleagues (1995) suggest that for households with higher incomes, wild plants occupy a less important economic role. However, they also found that households with higher incomes do not necessarily target their harvest toward the most valuable forest products. To better understand this income-extraction relationship, Coomes and colleagues (2004) used an asset-based conceptual approach to examine the variations in forest uses within a community. They argue that, within a given community, the use of wild plants is related not only to incomes, but also to other assets, including familial bonds and land ownership. Coomes’ research (2004) further reveals that a depletion of wild plants would hit the poorer households of a community harder. In the

community he studied, the researchers found that the use of a particular palm species led to its depletion in the local mature forests, and that no communal mechanism had emerged to protect the species (Coomes et al. 2004). These studies underline the importance of examining the conditions under which the use of plants could lead to their conservation, and of taking into account the inequalities existing within a community in the development of sound conservation strategies.

2.4 Forest Management and Plants Use by the Ngöbe Peoples of Panama

Since the 1960s, numerous ethnobotanical studies with the eastern indigenous groups of Panama, such as the Kuna, Wounan and Embera groups, have been conducted (see Joly et al. 1987 for details). Past research on plant use by the Ngöbe communities however, remains comparatively scarce.

Young (1971) looked at the social organization of the Ngöbe peoples living on the Pacific slopes. He showed, for example, that they rely on both subsistence and cash-based economy. He gave a tentative description of land ownership and usufruct rights, concluding that although the land is collectively owned, only the people who live on a plot of land have control over the management of its resources, including plants. He also offered an explanation of the traditional marriage arrangement, revealing the complexity of the kinship linkage and their effects on land use.

Gordon (1982) undertook what is to date the most comprehensive study on Ngöbe communities' land use. As part of his research, he examined forest use by Ngöbe communities living on or near the shores of the Caribbean Sea, north of my study area. He highlighted the incredible variety of wild and domesticated plants that these

communities use, and the types of practices involved in managing forest succession. Gordon demonstrated that the Ngöbe's land use is compatible with high wildlife diversity:

Compared with other uses of the land in this area, and most definitely when compared with the cattle industry, the [Ngöbe] system, with its incorporation of human subsistence activities into the rainforest ecosystem, is ecologically benign (1982:157).

Although local subsistence practices are changing the structure of the forest environments in which they are conducted, these practices have also contributed to the large amount of biodiversity of the area by maintaining a suitable habitat for wildlife (Gordon 1982). Ngöbe communities have an interest in maintaining forest habitats for the resources and services they provide.

However, Gordon also explained that although the Ngöbe communities' land use is ecologically sound, it is done on a necessity basis and does not necessarily support long-term conservation goals:

One will rarely hear the [Ngöbe peoples] themselves ascribe their land use methods to a special ecological folk wisdom, or even to forethought for some comprehensive long-term advantage. Despite its successes and great potential, their land use system appears to be based upon matter-of-fact tradition (a detailed, but piecemeal, folklore of trial-and-error subsistence practices and yield benefits) rather than upon an overall land use concept, much less a philosophy of conservation (1982: 157).

Through this passage, the author implies that forest degradation in the area could happen in the future. Although practices fostering the growth of useful plants may be put in place, detrimental activities may not necessarily be put to an end. The continually increasing population pressure on the forest ecosystem and the recent introduction of cattle ranching are especially impacting the regeneration of mature forests and the useful

plants they shelter. No further conservation strategy is discussed to ensure the continuity of the mature forest in the communities' surroundings.

Joly and colleagues (1987) have assessed three Ngöbe communities' knowledge of medicinal plants, and showed that Ngöbe people living in the lowlands on both sides of the continental divide use a great variety of plants for nutritional and medicinal purposes. They treat, for instance, a wide array of illnesses – such as fevers and skin rashes – with infusions and decoctions of specific plant species.

More recently, the Proyecto Agroforestal Ngöbe (Ngöbe Agroforestry Project) produced two documents on the relationship that Ngöbe communities have with their environment (PAN 1995a; 1995b). *Ni tä nünen krörö* in Ngöbere (“This is how we live in Cerro Otoe”) is a monograph on the community of Cerro Otoe (PAN 1995a). Through the eyes of the local people, this comprehensive work presents, among other things, elements of their history, social organization, land use, handicrafts, food and migration, highlighting the diversity and dynamism of the local culture. The same year, the Proyecto Agroforestal Ngöbe published “Árboles de los Ngöbes, una alternativa para el futuro” (“The trees of the Ngöbe, an alternative for the future”) (PAN 1995b). The study looked at the variety in products and services provided by trees to Ngöbe communities, and assessed their market potential. They showed that the vast majority of species used for subsistence (68.2%) have a low potential for commercialization, while a small proportion (8.6%) could be profitable. The study further revealed that trees are mainly used locally as sources of timber and food. These two studies together show the important role that forest and forest plants play in maintaining the livelihoods of Ngöbe communities of the area.

All the studies cited in this section have been conducted in areas of the comarca where the climate and vegetation are markedly different than the area of this research, where higher elevations are associated with different habitats. The forest uses are therefore expected to be considerably different. Furthermore, the communities in which Young and the Proyecto Agroforestal Ngöbe conducted their studies are geographically less isolated than the one involved in my research. As a result, the interplay between the elements that affect forest use at these sites were likely different. Nevertheless, these studies greatly influenced the way I approached my research in the area and gave me crucial insights into the complexity of Ngöbe kinship and land use practices.

Concluding Remarks

The relationship between each forest dwelling community and the forests from which they derive their resources and livelihood is complex and should be given special consideration by state authorities and conservation agencies. The involvement of the community in mature forest conservation projects is crucial if one seeks to ensure respect for local practices. To that end, research looking at local knowledge and rooted in a participatory approach can help improve our understanding of forest uses. However, firsthand research on the use and knowledge of plants is highly place and time specific, as noted above. The area that this research concerns remains especially poorly studied, with only a few studies having occurred between 1970 and 1995. During and since that time, this indigenous area has been undergoing significant social and land use changes.

This research project gives an overview of forest management and plant use in the research area, placing these practices in both their current and historical contexts. It

exposes elements, such as the broader socio-economic conditions within which the community lives and its conservation priorities for plants, which are important to consider when studying the links between local indigenous communities and their forest in tropical environments. The direct participation of local people in this project helps to ensure that the diversity of opinions and activities related to the forest existing within the community are represented.

Chapter III – Methodology

This research was conducted using a multi-method, participatory approach and was designed to highlight the value of local knowledge. Efforts were made to include local people in the research process in hopes of generating dialogue about conservation and participation. Conceptual work and preliminary partnerships were initiated in January 2010 and field research took place in Panama from early August to early December 2010.

Doing research in an indigenous area in a foreign country requires different types of regulatory approval, and special ethical considerations had to be addressed before beginning the fieldwork. Field methods involved independent research as well as working with local assistants to collect qualitative, quantitative and spatial data for analysis. This chapter first explains my methodological framework, presenting the approaches that were used in the design of the research. The subsequent section begins with the steps that were taken to gain approval and develop rapport with members of the study community. The chapter then presents the data collection methods and the analytical techniques that I used. Finally, the last section includes comments on the potential limitations of the study as a whole and an overall assessment of the methodological design.

3.1 Methodological Framework

The methodology used in this research reflects my epistemological foundation in political ecology. While this approach does not have a single set of field research methods or guidelines, it advocates a holistic combination of quantitative and qualitative participatory methods (Doolittle 2010, Nygren & Rikoon 2008). It seeks to transform research into an interactive and reflexive process by combining inductive and deductive

thinking (Doolittle 2010). Furthermore, by using a participatory approach, this research aims to valorize participants' local knowledge and directly involve community members in the research process. In this section, the multi-methods and participatory approaches along with the concepts of objective-subjectivity and inclusivity are discussed.

The multi-methods approach

Combining methods and analytical techniques from both quantitative and qualitative realms at different stages of a research project is usually referred as a “multi-methods” approach (McKendrick 1999). Many scholars have demonstrated how this approach can be efficiently used to reach better results than would be the case if each approach had been used in isolation (Fawcett & Hearn 2004, Nightingale 2003, Philip 1998, Rocheleau 1995). Although this approach is not new in geography, it has become increasingly popular since the mid 1980s (Philip 1998). In this project I used both qualitative and quantitative methods in both my data collection and analysis. For example, to collect data I used methods such as focus groups and surveys, whereas in my analysis, I conducted a descriptive analysis of the concepts revealed through statistics. Combining these methods helped me address the various facets of my research question.

The participatory approach

The “participatory” approach to research emerged in the 1970s and was designed to bring the benefits of research back to the participants. It was a strategy for social movements that aimed to move the less powerful to the center of the knowledge creation process (Hall 1992). This kind of approach can bring important insights for conservation, as has been demonstrated by Dalle and colleagues (2002) and Smith (2008). It is important to note, though, that participation is a broad category that is inclusive of many

differing research frameworks such as adaptive co-management (Berkes 2009), participatory action research (Kindon 2008) and community-based resource management (Gruber 2010). Furthermore, the term also encompasses a variety of specific methods such as participatory mapping (Herlihy 2003, Smith 2003).

Amongst the broad range of research labeled “participatory,” there are important differences in what type and how much the participants are actually involved (see table 1). There is a wide breadth of literature that demonstrates the different levels of participation that can exist (Fawcett & Hearn 2004). Rather than suggesting a constant line differentiating “participatory” and “non-participatory” research, though, it is useful to understand participation as more of a continuum. Agarwal (2001:1624), for instance, proposes a scale of participation ranging from nominal, to passive, consultative, active, active-specific and interactive participation (Table 1).

Table 1. Forms of participation of local people in research (Modified from Agarwal 2001:1624).

Form/Type of participation	Characteristic Features
Nominal participation	Names of locals included, researcher examines a local subject or phenomena
Passive participation	Informing local people of decisions, holding meetings but without seeking their opinions
Consultative participation	Asking the opinion of local people in a specific manner but without influencing the decisions
Active-specific participation	Asking local people to undertake specific tasks
Active participation	Asking local people to express full opinions, take initiatives, or follow training
Interactive (empowering) participation	Local people having voice and influencing decisions, the researcher having a passive role

In all participatory research, it is important that the subjects play a key role

throughout the entire process. If this collaboration occurs, it is more likely that both the researcher and the participants will benefit from the project. In the most participatory of research projects, the project goals and objectives are developed collaboratively; the data collection methods include participants; the community members are involved in the interpretation of the data; and finally the research outputs are shared or returned to the community (Chilisa 2011).

This research project encompasses three key elements of the participatory approach. Firstly, the research objectives were designed to be of interest to the community members. The project sought to ask questions that would generate useful new knowledge for the community and as a result was designed to foster participation (Pound et al. 2003). If the research would have simply been an inventory of the plants that the community uses, for example, the participants may not have been as interested in participating, as they already know which plants they use. By introducing the discussion about conservation priorities for useful plants, the research became very interesting to the participants. While each participant has his or her own opinion about and experience with useful plants, they had never engaged in a common discussion on the subject.

Secondly, the research participants were provided space within the data collection process to give their opinions using techniques such as focus groups (see section: The role of local people). Their involvement and knowledge were valorized and the data collection became a welcoming place to share ideas and learn together. The data collection also involved local people as staff; community members helped facilitate focus groups, review data and administer the survey.

Finally, participatory research generally aims at fostering a relationship of

equality and respect between the researcher and participants and at valorizing their knowledge. By giving local people an active role in the research, the project helped to foster their empowerment. Considering all of these aspects, I argue that this research was participatory, since the participants were given some control over the research process and participated heavily in the data collection, as described below.

Objective-subjectivity and representing the Other

Research that aims to better understand indigenous forest use from a local point of view must take into account the positionality of the researcher. Numerous social scientists argue that a key element of research in a different cultural context is to understand how our position as a researcher is influencing our research. According to Philip (1998), researchers are aiming at “acknowledging the subjectivity inherent in social research while concurrently acknowledging that most researchers strive to present as realistic (objective) a picture of the world they have investigated as possible” (1998:270). While “scientific objectivity” is not possible or even desirable when doing research in indigenous communities, understanding our influence on the research process will help us reach a higher level of objectivity. Philip (1998) refers to this reflection as “objective-subjectivity.” This reflexive approach necessitates being self-aware of one’s position and the way in which one’s identities may be influencing his/her inter-personal encounters and more broadly his/her collaboration with the community (Nicholls 2009).

Reflecting on the fieldwork and the participatory process has allowed me to become more aware of my identities. I was particularly conscious of the fact that I am not indigenous myself. Throughout the research, I reflected on my position as a researcher, volunteer, and friend of community members, and the potential contradictions stemming

from these overlapping identities.

Furthermore, my identity as a white, middle-class, female Canadian student influenced the way I carried out the research. Most importantly, although I spend a considerable amount of time with other local people, I stayed with a relatively smaller, wealthier and better educated family who spoke Spanish. As a Canadian (the mining rights in the area are partly owned by a Canadian company), some members of the community were suspicious of my intentions. Finally, I could not have an in-depth conversation with people who were not fluent in Spanish, and as a result might have underrepresented or misrepresented their thoughts.

Most importantly, I recognize that the process of representing the community (the indigenous “Other”) is inevitably limited. I have tried to interpret the information that I garnered while completing the research in a reflexive and respectful way, but do not suggest that the recommendations I make are a direct representation of the community’s hopes and aspirations. Because I was integral in the design and execution of the project, the recommendations do, to some extent, reflect my background, my interests and my understanding of the current needs of the community. They may differ from what the community would have come up with without the involvement of an outsider.

In addition to influencing the way I carried out the research, differences in gender roles and my identity surely influenced the perceptions of local people regarding my role. In particular, I became aware that my position was influencing how some people were interacting with me. Polygamy, for example, is a local custom that is generally not discussed with outsiders; one of the research facilitators avoided mentioning his second wife in front of me until I directly inquired about her. Involving local investigators in the

research helped to counter the barriers that local people may have had if I would have asked the questions myself. To avoid local people thinking that I was positioning my opinion and knowledge above theirs, I intended to present my stay amongst the community not as a project or as research but as a reflection on their culture and their forest. I explained that I was not there to tell them how to manage their land, but to learn and discuss their views of the forest and wild plants. I strived to maintain an open attitude toward their knowledge and practices, and to adapt the research agenda to put it more in line with their interests. The research became a dynamic process, as the objectives and methods were discussed and modified according to the community members' suggestions along the way.

Making the research inclusive

It has been demonstrated that men and women use natural resources in different ways (Dovie et al. 2008, Rocheleau & Edmunds 1997, Wilson 2006) and as a result have different concerns and conservation priorities. Given the lack of research specific to the study area, the roles of men and women in relation to natural resources in the comarca remain poorly understood. As such, care was taken in my research to examine the differing perspectives of both men and women regarding the use and conservation of forest areas. For example, one activity focussed on mapping the community from the perspectives of men and women separately. This revealed that women spend more time in the vicinity of their houses and gardens, compared to men who spend more time in the mature forest. The research further sought to include the voices of women at every stage of the research. During meetings, women's opinions were asked for, and men and women were separated during group activities. Women's participation in discussions was notably

higher when they were given their own forum to speak. Furthermore, a survey was designed to enable women to answer the questions individually without having to compete with their husband's answers. An equal number of men and women were chosen as research assistants.

In addition, the research sought to reach people regardless of their level of Spanish, literacy and age. Research activities were conducted in both Spanish and Ngöbere, and adjustments were made when necessary to ensure that everybody could participate. For example, one research assistant was illiterate and was allowed on her request to conduct the survey with the help of her son, as her role as an interviewer required being able to read the questionnaire and write down the respondents' answers. Visiting almost every home for the household survey also brought important insights; it helped me reach elders and gain a different perspective on household realities such as wealth distribution within the community and the diversity of daily activities that go on in the village. Overall, I believe that the nuanced and diverse participatory methods by which I conducted this research promoted individual and community respect at every possible juncture.

3.2 Research Approvals and Ethical Considerations

This section presents the research partners and the various approvals that were required to conduct research in the Comarca Ngöbe-Buglé. It then explains how the participants were compensated and discusses important ethical concerns, such as those related to conducting participant observation and those regarding transparency and mapping.

Research partners

This research project was funded by the International Development Research Centre (IDRC) through the John G. Bene Fellowship in community forestry. It was conducted in collaboration with the indigenous authorities of the Comarca Ngöbe-Buglé and the Centro de Estudios y Acción Social Panameño (CEASPA), a Panamanian non-profit research center. The research was part of an existing collaboration between the indigenous authorities of the Comarca Ngöbe-Buglé and researchers at the Smithsonian Tropical Research Institute (STRI), the University of Panama and Carleton University. Important technical assistance and advice was provided by Dr. Alicia Ibáñez, researcher at the STRI and by Jesus Alemancia, director of CEASPA. This research project was independent, but fits within a larger project funded by the Secretaría Nacional de Ciencia, Tecnología e Innovación (SENACYT) of Panama (Smith 2010). This research was therefore designed to meet the IDRC community forestry purposes and to contribute to CEASPA's focus on promoting social justice and enhanced participation of the poor and marginalized people of Panama.

The research took place in the community of Ratón, located in the central part of the Comarca Ngöbe-Buglé (Figure 1). This specific community was selected thanks to the connections provided by the research partner Ramón Pineda. Ramón, who is from the village and graduated with a Bachelor's degree in agroforestry, had been recommended by the director of the Acción Cultural Ngóbe (ACUN). The community provided an ideal setting for the study as it is located near a mature forest, on which the households depend for food, medicine and house construction materials. Furthermore, the area was not so remote that it would have jeopardized my personal safety.

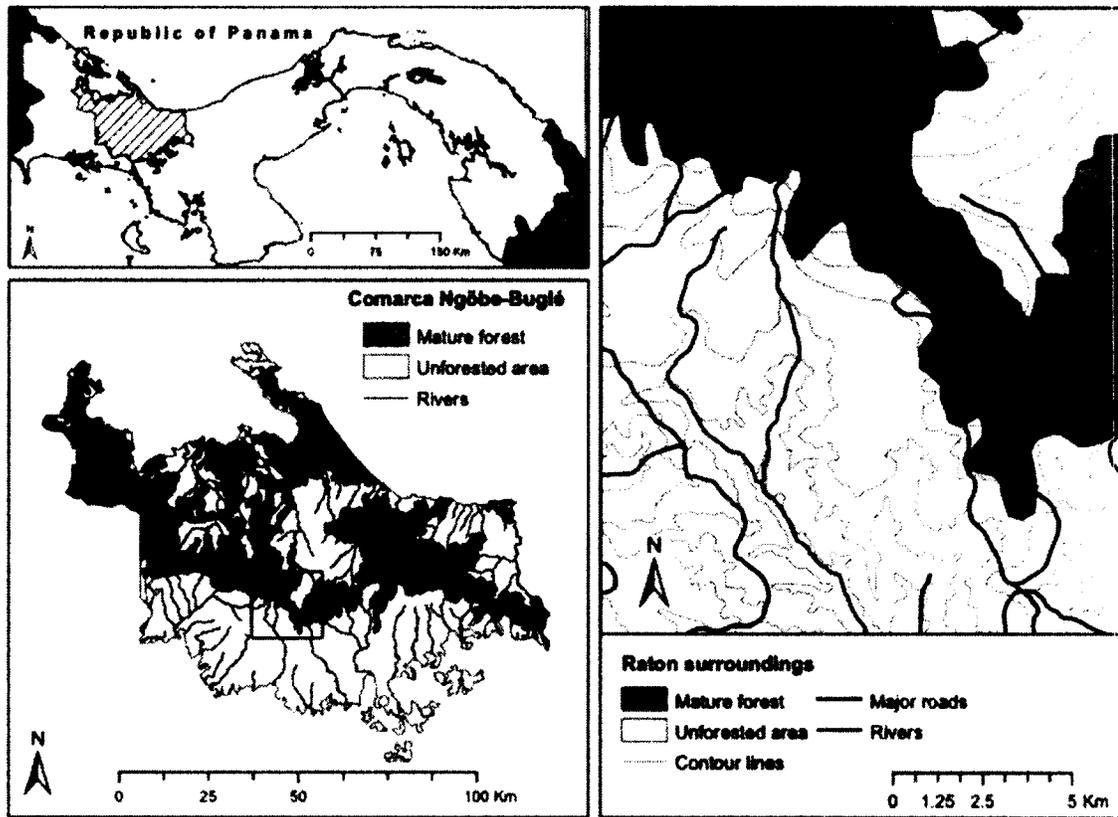


Figure 1. Geography and location of the community of Ratón, in the Comarca Ngöbe-Buglé, Panama, 2010².

Research approvals

This research was approved by the Carleton University Ethics Committee in Canada, the Comarca Ngöbe-Buglé authorities and the community of Ratón. The Carleton University Ethics Committee examined in detail the aspects related to research participants, and adheres to the principles and requirements set out by the Canadian Tri-Council guidelines.

Before gaining permission to enter the study community, various meetings took place in Panama with researchers from the STRI, representatives of the Comarca Ngöbe-

² All figures are from the author, unless otherwise stated.

Buglé and of the non-governmental organizations CEASPA and ACUN. These discussions revolved around the history of indigenous rights in research, the danger of adverse effects arising from research on plants in indigenous communities, as well as my intentions regarding use and dissemination of the findings and research material. After weeks of meetings, a Cooperation and Research Agreement was reached and signed between the president of the Congreso regional de Nedrini³, the director of the partner organization CEASPA and myself (see Appendix A). This tripartite agreement respected the Carleton ethical requirements and the Panamanian laws regarding research in indigenous territories.

In the community, an initial meeting was held in mid-October 2010 to present the research project and assess the community's willingness to participate. A verbal agreement allowing me to undertake the research took place in the community's common plaza. Two representatives of the Comarca Ngöbe-Buglé were present, along with 48 community members. The requirements of informed and free consent were explained to the community members who were there. With the help of an interpreter, the meeting was translated into Ngöbere, and care was taken to explain the research in detail. I explained my research objectives and timeline, the benefits and risks for the community, the potential roles of research assistants, and how the research data would be used. Copies of the Cooperative Research Agreement, the Informed and Free Consent statement (see Appendix B), and a research proposal in Spanish were distributed to the local government and traditional representatives. A question period was held, in which eight people asked for clarification and commented on the research. A vote was subsequently held, with the

³ The community of Ratón, where this research took place, is located in Nedrini, one of the three regions of the Comarca Ngöbe-Buglé.

results of 40 people accepting, 5 refusing and 3 abstaining.

The roles of local people

In a research project, participants can play different roles, which in turn influence the extent to which their knowledge is incorporated into the research. In this research project, wide participation from different families and age groups was encouraged as fully as possible throughout the project to ensure their local knowledge and opinions were included in the research. Nevertheless, levels of participation varied greatly between community members, from quietly attending meetings to proactive volunteering. Out of the 50 or so participants, 11 played a formal role in assisting with the research.

Ramón and Denia Pineda were the community research partners. Their involvement was a decisive factor in conducting the research in the community, and their insights were essential. The research purpose and objectives were reviewed with Ramón before they were presented to the community. During the fieldwork, both of these individuals were in charge of facilitating the research logistics and coordinating community gatherings. They also recommended cooks and research assistants. They acted as translators, but more importantly as cultural intermediaries, giving me important insights into the community's social norms and forest use. To date, they remain my contacts in the community.

Three people acted as facilitators for the research activities. These volunteers were selected on the basis of their fluency in both languages, their availability for the duration of the activity and their interest in the project. They were chosen at the beginning of each activity, and helped in translating the conversations and in facilitating the discussions.

Six participants were selected as local research assistants at a community

workshop. They included three male and three female volunteers. Local investigators played a key role in reviewing and administrating a household survey, which was designed to measure the variations in plant use within the community as it related to households assets, forest importance and frequency of harvest. The assistants helped in phrasing and prioritizing the topics, and modified or added questions that they thought were relevant. They were also essential in translating the respondents' answers from Ngöbere to Spanish, and shared their interpretations and thoughts on various issues. We met for a three half-day training session where we discussed how to conduct interviews and administer survey questionnaires using a gender sensitive approach. It was explained that women and men's opinions were equally important, and that we needed to give them the same opportunity to express their opinions separately. To do so, each woman had to interview the women of the household, and each man interviewed the men. The community was divided into three sections, and one man and one woman were paired to visit each household in their section. The session also provided a space to test the questionnaires and to get the local investigator's input regarding the questions.

In addition to the 11 people who played a formal role as research assistants, many women volunteered to be cooks. For the 20 days or so of formal research activities, one or two women were in charge of preparing the meals. The women were chosen the previous day, according to their interest and availability. Finally, many men and women helped in gathering and chopping wood for the meals.

Compensation

Adequate and fair compensation for the participating community is an important principle that requires careful consideration. The topic was brought up many times with

the research partners during the discussions preceding my entrance into the community. On one hand, the administering organization, CEASPA, put emphasis on the fact that too generous a compensation rate would hinder future research projects that lack financial means. An indigenous leader, on the other hand, stressed the overwhelming needs of his people living in extreme poverty. These concerns were discussed with the community research partners and a compensation package that was comprised of a mix of food, goods and cash was decided upon.

Different types of compensation were offered according to the involvement of the community members in the research. Firstly, after each day-long activity (e.g., workshop, focus group, guided trip, or training) a complete meal of rice, accompanied by canned or locally grown vegetables was offered to all participants. Coffee and snacks were also offered during and after the activities. Serving the meal at the end of an activity instead of before or during was decided upon with the community research partners, in accordance with local customs. Secondly, every household participating in at least one of the many research activities was eligible to receive a package of food that would feed a large family. It included coffee, sugar, rice, lentils, salt and chicken broth. Thirdly, while administering the household survey questionnaires, the six local investigators were given two meals per day, with coffee, snacks and a small honorarium and purchased goods at the end of the fieldwork in recognition of their enthusiasm and contribution to the research.

Ethical considerations

Beyond official approvals, working with an indigenous community required ethical considerations, especially regarding my role in the community, transparency, and

the collection and use of local knowledge. As part of my methodology, I spent time living in the community and participating in the daily activities of my host family. This required adapting to their customs and considering “ethics from the participants’ point of view” (Piquemal 2001:68). To prevent embarrassing situations, upon my arrival with my host family, both myself and the host pledged to handle any misunderstanding that would arise with a positive attitude. I became close with the mother of my host family, and she became my “ethical advisor” for the duration of the fieldwork.

When working with the indigenous community, transparency was crucial as a means of countering the power-relationship that emerged from my privileged position as a researcher (Nicholls 2009: 122). While the informed consent of the community was collected prior to the research, I continued to explain my project and intentions throughout the research process, especially when working with people who were not present at the initial meeting. I explained as clearly as possible the purpose of my research, including the possible uses of the findings, in order to enable every participant to make an informed decision about whether they were willing to invest their time and energy into the project. Care was taken to define and agree upon the role and responsibilities of the different participants in the research. While I hope that this research will influence conservation and development projects undertaken at a larger scale, I tried to avoid fostering unrealistic expectations within the community.

A last ethical concern arose from the use of participatory mapping in the research. Although this methodology is widely employed (see, for example, Aporta 2003, Dalle & Potvin 2004, Herlihy 2003, Herlihy & Knapp 2003, Smith 2003), it is important to keep in mind that mapping in general, including mapping indigenous forest resources, is a

highly political process (Chapin et al. 2005, Harley 1989, Peluso 1995). This research, however, did not map sensitive subjects such as endangered species, medicinal plants and ritual practices, nor did it map sites that included resources of high economic value or contested boundaries. The focus, rather, was on gaining a better understanding of local conceptions of land and forest use, including broad geographical patterns of plant use. Nevertheless, through the mapping itself and the discussions on the use of local forests, this research did discuss and support the local people's forest resource use rights. Reflecting upon my role in the community and being sensitive to the local context and concerns helped me to avoid ethical problems.

3.3 Field Research Methods and Data Collection

This section presents in detail each method used to collect field data along with the techniques used to analyze them. My field methods included participant observation, guided tours, informal interviews, community workshops, focus groups, surveys and archival research. Table 2 presents a summary of the research activities.

Recording and field notes

The use of a digital voice recorder to document activities and interviews was approved during the vote of the community meeting. After a few trials, however, it became clear that the physical environment (which included wind, rain and fire crackling) was not conducive to recording. Heavy reliance on field notes was therefore decided upon, and detailed notes were taken either during or at the end of each activity and day. These notes encompass personal observations, summaries, approximations of what was said, and short verbatim comments.

Table 2. Summary of research activities, Ratón, Comarca Ngöbe-Buglé, Panama 2010.

Time Period	Field Research Activity	Data Generated	Number of Participants
August 28 - September 10 (14 days)	Participatory observation	Notes	n.a.
October 21 (Half-day)	Presentation meeting	Informed Consent	48
October 22 (One day)	Community workshop 1: Cultural mapping	Six sketch maps with personal summaries; Notes	42
October 23-24 (Two days)	Community workshop 2: Useful wild plants	Comprehensive lists of useful wild plants, with details on their uses, users, life forms, environments, status and prioritization for conservation; Notes	38
October 25 (One day)	Guided trip to mature forest 1	Notes and pictures of the plants, their environments and harvesting techniques; GPS coordinates of harvesting areas	1
October 31 (One day)	Guided trip to mature forest 2	Notes and pictures of the plants, their environments and harvesting techniques; GPS coordinates of harvesting areas	6
November 3 (One day)	Focus group 1: Mapping of land uses and harvesting areas	Comprehensive sketch map of the community and its surrounding area, featuring physical and human elements in addition to harvesting areas and toponyms; Notes	10
November 21 (One day)	Focus group 2: Nine useful wild plants	Comprehensive tables of local knowledge for each selected plant, including harvesting methods, life forms, reproduction and habitat; Notes	10
October 26 to 29, November 7 to 9 (Seven days)	Local investigators training (three half-days), and survey assistance (four days)	No direct data	6
October 28-29, November 8-9 (Four days)	Survey interviews	Coded spreadsheets comprising information on various subjects	49
November 22 (One day)	Guided trip to mature forest 3	Notes and pictures on the plants, their environments and the harvesting techniques; GPS coordinates of harvesting areas.	1

Participant observation

Participant observation consists of “extended periods of fieldwork in which the researcher attempts to immerse him- or herself in the daily life of the people involved in the study” (Piquemal 2001:66). This technique is useful to complement and inform the other research methods (Kearns 2000). During my stay, in addition to field notes, I kept a journal of my everyday experiences, and noted my observations and thoughts. Introspection and reflection throughout the research process on what was said and what was observed also informed my analysis by allowing me to recreate the context in which certain claims were made (Kearns 2000).

I spent an initial two-week period living in the central part of the community with a host family. This period allowed me to learn about local customs related to appropriate social conduct and the use of wild plants. This period further helped me adapt to a lifestyle that is directly dependent on its environment and kinship ties. I decided to stay with the same family during subsequent stays, due to the good relationship and trust that we had developed. I spent the most time with the woman who hosted me, accompanying her in most of her daily activities. My time was spent primarily around the house and in the home and forest gardens. I also spent time with the traditional *cacique* (a term which translates more or less as “chief”), with whom I discussed political matters such as the threat of the potential mine, and shared traditional songs and stories.

In the early stages of the research, I spent a considerable amount of time with the local investigators and facilitators. We engaged in discussions on conservation and the use of the plants, visited families and went on harvest trips to the mature forest. I shared meals with and visited the home and forest gardens of various families. Each of these

opportunities brought new insights on the importance of the plants in the lives of the people. By the end of the field research, I had been able to observe and participate in the harvesting, processing and final use of most of the plants targeted in the research. During my stay in the community, I also documented with a GPS the important community infrastructure and plant harvesting areas.

Throughout the research, participatory observation allowed me to gain a better understanding of the complexity of the local socio-economic context and to avoid making reductionist claims about resource distribution and use within the community. As a participant observer I was well positioned to reach “a better understanding of the cultural meanings of the group” (Piquemal 2001:67). Staying in a host family and participating in everyday activities also proved very helpful in building trust with research participants. Notwithstanding the short duration of my stay, my relationship with the local people quickly evolved from formal and mired in doubt to very friendly and open as I spent time living in the village. Playing with children, washing laundry, and accepting local food thankfully are examples of daily activities that brought smiles to people’s faces and lessened the apparent cultural differences that stood between us. I also became comfortable walking the numerous village paths by myself and exchanging a few words or ideas in the local language, which was welcomed by community members.

Guided trips

I participated in three separate day-trips to the mature forest. The guides brought me to their plots of forest, where I documented through pictures and notes the useful plants and the environments in which they grow. The guides also explained or demonstrated the practices related to the plants’ management and harvest. We also

discussed the participants' uses, perceptions and concerns regarding the forest.

Informal interviews

During guided trips and throughout my time living with the community, I had informal conversations with numerous local people about their forest management practices and their use of the plants (Appendix E). These conversations proved to be a very good means of studying plant use in this setting. Given the complexity of factors influencing plant uses, it helped to investigate in more depth the cultural, economic and political aspects of the research. Furthermore, these conversations allowed people to express themselves outside of the peer pressure that may have been felt during the community meetings and focus groups (Dunn 2000). In general, people were more inclined to discuss ideas and opinions in relaxed situations. While going on harvest trips to the forest or enjoying a soup of local wild plants, conversations were fluid and dynamic. These interactions enabled me to clarify aspects of the use of plants that were confusing, and to hear personal opinions which hadn't been mentioned during the community meetings.

Community workshops

Meeting with the community at the beginning of the fieldwork can bring local people into the research process by enabling their opinions to play an important role in refining the research focus. During discussions "both the researcher and the [participants] may *simultaneously* obtain insights and understanding of particular social situation during the process of research" (emphasis in the original) (Goss & Leinbach 1996: 116-117). This collaboration provides opportunities to actively involve the participants and serves to highlight the importance of local knowledge.

Two workshops were organized with the help of research assistants in the early stages of the field work to give me a better understanding of how local people perceive their community and identify local useful wild plants. These workshops were open to everyone and, thanks to the wide promotion done by research assistants, had a very good turnout. These activities enabled me to get to know more people and observe social interactions; in addition, they let local people observe me and better understand the purpose of my stay amongst them. The meetings were very useful in exposing me to the community's land use and how people perceived the mature forest, as well as giving me a portrait of the community's concerns regarding forest plants. Amongst other things, people were asked to identify the main plants used by the community, their concerns about them, and to prioritize them through consensus. While I had initially planned to hold separate workshops for men and women, the participants preferred to host a single activity, but subdivide participants into groups based on gender.

The first workshop sought to build a better understanding of the representation that local people have of their community, using a community mapping technique. The 42 participants were split into six groups according to age and gender, and were invited to draw the community as they perceived it. This enabled me to gather information on the differentiated representations within the community. White boards, pens and pencils were provided, and directions were kept very simple: participants were asked to represent their community as they perceive it. No further direction regarding which elements to put on the map was given, as this activity aimed to give me an understanding of local peoples' perceptions of their community. The focus of the maps varied between the groups. Some put emphasis on animals and houses, whereas other maps drew attention to

hydrographical features. All participants presented their work at the end of the activity to the other groups for discussion. The resulting maps revealed some important variations in how men and women use the mature forests, which informed the analysis of the community use and management of wild plants.

The second workshop focused on forest resources and extended over two days. The purpose of the first day was identifying the wild forest plants that the community uses. Using free listing, the participants listed all the wild plants species they could think of under four specific use categories that had been agreed upon in advance with the key informants: construction materials, plants used to make handicraft and/or housewares, edible plants, and plants with ritual, cultural and/or other uses (Appendix C). This technique is used in other research on useful plants, and aims at identifying the most important plants for the people using them (Lykke 2000). As with the previous workshop, the participants were split into groups according to age and gender to expose the differences in knowledge within the community. Each group had four sheets of paper with different colours for each category. They were invited to write down or draw all the plants that they knew under each category. The answers were then tallied on white boards and discussed. In total, 38 people participated and together identified around 80 useful wild plants, including both forest plants and others found in agricultural fallows. Another 90 cultivated or non-native wild plants were named but removed from the list. This free listing method implies that each plant in this research has been identified by at least one group as useful, and that the final list only includes plants that were accepted by the whole group as being useful during the transcription to the board. On the second day, I asked the groups to classify the abundance of the identified useful wild plants and to

agree upon a smaller group of plants which would be selected for more detailed study. In order to represent the interests of both genders, it was decided that men and women would be divided. Each group was asked to select five plants that it perceived as being the most important for the community and as under threat. One plant species was selected by both men and women, resulting in a list of nine plants which became a primary focus of this research. These plants were later identified by Dr. Alicia Ibáñez from STRI with the help of the community research partner, Ramón Pineda.

The participation level in both community workshops was higher than expected. These meetings were an effective way to look for volunteers and to identify potential research assistants for the later stages of the research.

Focus groups

A small group of ten key informants with particular expertise and interest in forest plants emerged during the early stages of the research. A higher level of trust was reached between these participants and myself, and two focus group meetings were held with them. This enabled me to gather detailed information on the ten selected plants in a relatively short period of time.

Two of these focus group meetings were held in late November 2010, toward the end of the field work period. The group was composed of six research assistants and another four people who are knowledgeable about forest plants and who had participated in other research activities, including guided trips. The first workshop consisted of a second mapping activity. While the first community mapping activity had focussed on the ways in which local people mentally pictured their community, this activity aimed at mapping the geography and land use of the community and its surrounding forest.

Topographic maps were used for reference and to help visualize the broader area. The two resulting maps show human elements (e.g., paths and houses), the main topographical and hydrographical features (e.g., rivers and mountains), the main land uses and the major wild plants harvesting areas. The patterns revealed in these maps helped me gain a fuller understanding of community forest management practices. In addition, names in Ngöbere and Spanish of rivers, mountains or neighbourhoods represent important cultural elements that characterize the participatory, locally sensitive nature of these outputs.

The second meeting with the focus group was aimed at gaining knowledge about the nine targeted plants. A template was drawn on nine white boards to ensure that the same characteristics were included for each plant: physical characteristics, reproductive features, environment, harvesting methods, uses and cultural importance. Working in pairs, the participants were asked to choose a plant they use frequently, and to draw or write about them. They decided that women would pick first, and some women decided to work together. At the end of the activity, the participants were asked to present their work to the other groups for discussion.

Survey

A household survey was conducted as means of complementing the information gathered during the meetings and enabling me to generalize the findings to the whole community (Appendix D). The purpose of the survey was to collect more detailed information about the uses of the forest and of wild plants within the community. At the same time, the survey was a good way to reach community members who had not participated in the public meetings and to make their voices heard in the research process.

The household survey used a standardized questionnaire written in Spanish in a simple and straightforward manner as opposed to the survey interviews which took place in Ngöbere. It began with questions related to the household's demography and followed with general questions on the individuals' perceptions regarding the importance of the mature forest. The questionnaire furthermore included questions that focussed on the practices of harvesting wild plants, and finally questions specifically targeting the harvest, abundance and use of the nine selected plants.

Archival research

While my field methods were primarily based on local knowledge at a community level, my analysis aimed at incorporating the broader social and structural context in which the community exists. To this end, archival research was conducted in national institutes, nongovernmental organisations and at the STRI. Aerial photography was obtained from the Instituto Geográfico Nacional Tommy Guardia. Topographic maps and national census data were acquired through the Contraloría General de la República de Panamá. ACUN provided books on the Ngöbe language and the regulations of the Comarca Ngöbe-Buglé. These included Law 10 and the Executive Order 194 from which the comarca was created. Finally, other key documents, such as the those from the Proyecto Agroforestal Ngöbe, were obtained through CEASPA and STRI. The information gathered in these documents enabled me to better understand the geography of the area, and to develop a more robust analysis of the data collected in the community.

All together, these methods allowed for a deep understanding of the local use of wild plants and the links that exist between cultural identities and broader socio-politico-economic factors. Given that some people were willing to participate in group activities,

while others preferred one on one interactions, using a wide range of methods enabled me to reach a wide range of people. The following section explains how the data generated in the field was compiled and analysed.

3.4 Analytical techniques: Reflection, compilation, processing and analysis

The participatory nature of my methodological approach meant that each research activity brought new knowledge and important insights that influenced my understanding of the local forest use and management practices. In-field reflection on the data and on the general research process shaped the way the research was carried out and formed part of the analysis.

The formal part of the data analysis was comprised of forest plant description and classification, and the interpretation of patterns in their use. Analysis of the data on local forest use and conservation incorporated both quantitative techniques and qualitative techniques.

Before starting the analysis, the quantitative data that was generated in the field was transferred to the computer. The survey results were transcribed and compiled using a spreadsheet. Descriptive statistics were used to draw conclusions about the whole community, given that the majority of households were surveyed. The comments associated with each question on the survey were transcribed and coded to determine the frequency by which elements were mentioned by participants. The quantitative data related to useful plants and acquired during the second community workshop were also compiled in a spreadsheet. The raw data were then coded into categories and classified according to, for example, the gender that selected the plant, or the plant life form.

I did not transcribe certain qualitative data, such as maps, photography and field notes in order to conserve the integrity of their content. Instead, their content was used to produce written descriptions. The pictures were reviewed often, classified and annotated. Field notes were read many times and memos and ideas relating to their content were inserted. Their content was classified and only those sections relevant to the themes studied were transcribed.

After the transcription of the raw data was completed, the data were then reorganized and the information related to specific themes was compiled. For example, data on conservation priorities for plants was found in the description of various types of raw data, including the community workshops, the survey and field notes. Recurring patterns were then identified and key concepts were compared. For example, categories of gender and age were compared with categories of frequency of harvest. This step included drawing links between the community conservation priorities and the ecological characteristics of the harvested areas. This analysis allowed me to disclose hidden patterns in the differentiated use of the plants. It further revealed, for example, the importance of wild harvests for the community, local conservation priorities for plants and their perception and management of the forest.

Since the research was conducted on the premise that quantitative and qualitative methods are both equally valid ways to collect data about the phenomenon in question, discrepancies, which could reveal interesting underlying phenomena, were dealt with on a case-by-case basis. Using qualitative and quantitative methods together allowed me to gain a fuller understanding of the meaning and use of the forest than any one method by itself. For example, whereas comparing the number of useful plants listed by men and

women can reveal a gender dimension of plant use, informal interviews can bring further insights on the subtleties of the different roles of men and women in the use of these same plants.

Along with the interpretation of the data, the social setting, which includes the current living conditions and way of life in the community, was examined (see Chapter IV). This was essential in situating the analysis, and in comparing this research with other studies. Further analysis consisted of comparing, contrasting and linking the data collected in the community with the data found through archival research and in the academic literature.

Sketch maps from the community workshop and focus group were used to better make sense of the social and geographical aspects of forest management. Specifically, they revealed the important nuances that exist between community members in how they conceptualize their territory and in the location of harvesting areas. For example, it showed clearly that women spend more time in the vicinity of the community, and as a result harvest wild plants in more disturbed environments. On the contrary, men spend more time in mature forest parcels located further from the village, and this is where they harvest wild plants more frequently. Similarly, the maps showed that men have a better knowledge than women regarding the broad territory of the community, and understand their community as being delimited by rivers and neighbouring communities. Furthermore, these maps revealed patterns of forest tenure, showing for example the difference in parcel sizes and in the relationship between distance and intensity of use. These are all elements that contributed to the creation of a clear picture of how the community uses and manages wild plants from mature forests.

Concluding Remarks

This chapter has sought to show how my research used a participatory, multi-method approach. Compiling and assembling the various data sources allowed for the production of a comprehensive overview of the management and use of the community's forest resources, but also brought challenges and limitations. The methodology was challenging insofar as it necessitated sustained involvement with the community in question.

Limitations and challenges in the field

Conducting research in rural indigenous settings in a foreign country inevitably brings about various challenges. Language barriers, health issues and accessibility of the field site were the main difficulties I experienced.

Language was the primary limitation while completing this research, as I was relying on a translator about 50% of the time to understand Ngöbere. While this limitation could raise questions regarding the consistency and validity of findings, careful data collection, the use of triangulation, and informal discussions with my research facilitator on certain topics helped to ensure an adequate level of accuracy.

Apart from language, health issues were a major unforeseen limitation. A recurrent case of tonsillitis, often complicated by bronchitis and flu, delayed my trips to the community. In addition, access to the field site was at times difficult. Although the community was located at the end of a road, heavy rainfall often washed the road out. Crossing the 25km separating the community from the closest public transport point required a seven-hour walk on mountain ridges, and was sometimes done overnight as the chance of rain was lower. Notwithstanding the challenges encountered in the field, all the

activities related to the research went well, from acquiring regulatory approvals, selecting a field site and realizing all data collection activities.

Benefits of the research methodology

The methodology selected in the design of this project offered various benefits. It valorized the research subjects' knowledge and involvement in forest conservation, and helped outside institutions, currently STRI and CEASPA but hopefully others in future, gain a fuller understanding of the community's opinions, lifestyles and knowledge. This research centered around the importance of preserving and passing on the community's local knowledge, especially as it relates to useful wild plants. Through active participation in data collection and discussion of preliminary findings, the opinions and involvement of women, youth and elders were valorized. This special attention helped to foster their interest in the subject, and to promote the importance of their opinions and participation. As such, the activities demonstrated sensitivity to power relationships and raised awareness of the importance of social equity, a theme that was also present during informal conversations throughout the field research.

Furthermore, this methodology helped begin a dialogue on local conservation issues and strengthen the relationships between the community and partner organizations. Good communication amongst the participants and myself helped to build trust and to create stronger partnerships between the partner organizations, researchers and the local community. Upon completion of this project, my findings will be shared with the partner organizations and the local community. This methodological framework – including its participatory aspect, the complementary methods, and the analysis – helped shape the results and findings that will be discussed in the following chapters.

Chapter IV: Situating the Research: Daily Life in Ratón

How a community uses and interacts with its forest is highly complex, and is influenced by numerous historical, social and ecological factors. Any analysis of indigenous forest use must therefore take into account the broader context of the area; it must encompass both the colonial legacy that has led to the contemporary institutional disparities that exist as well as the current socio-economic challenges that the community faces in its daily activities. In addition, it must acknowledge that the geographical and ecological characteristics of the area influence the diversity of plants available to the community.

This chapter begins by presenting the national context in which the community of Ratón is embedded. It then turns its attention to the study area's geography, exploring its challenges and advantages. Next, it presents an overview of the daily life of the residents of the community and shows how the socio-economic characteristics of the community influence its forest use.

4.1 Historic and Contemporary Injustices

In the 16th century, the Spanish invasion into what is now the Republic of Panama pushed indigenous communities to retreat into remote areas. Because of the geographical isolation that followed, it was possible for the Ngöbe people to minimize their contact with outsiders until late in the 20th century (Bort & Young 1985). However, during this period, the Panamanian government put into place programs aimed at “civilizing” the indigenous populations living in remote areas. They were taught Spanish, were forbidden from using their traditional clothing and their rituals were outlawed (Chapin 2000).

Bort and Young (1985) have described in detail the rapid economic and political changes that Ngöbe society went through in the 20th century. According to the authors, rapid population growth, from approx. 16,000 in 1930 to approx. 54,000 in 1980, increased pressure on the land supply, in turn making food and forest resources more scarce. As a result, families began selling small products and resorting to temporary wage labour to complement their subsistence activities. This was occurring at the same time as significant development projects (a pipeline, two hydroelectric dams and copper mine explorations) were politicizing the Ngöbe society. In the 1960s, for example, Ngöbe community members began to organize through the Mama Chi religious and political movement and call for self-governance.

The election in 1984 of a Ngöbe candidate in provincial elections paved the way for the recognition of a semi-autonomous indigenous territory in the area. The Comarca⁴ Ngöbe-Buglé was established for the Ngöbe and Buglé people in 1997, in accordance with the Law 10 of March 7th 1997, and is legislated by the “Carta Orgánica Administrativa de la Comarca Ngöbe-Buglé”, in accordance with the Executive Order 194 of August 25th 1999 (ACUN 2003). In addition to delimiting the territory, the Charter recognizes the right to indigenous autonomy, stipulating that:

By this Charter are recognized the right of indigenous autonomy and self management to the Ngöbe-Buglé people in permanent and harmonious cooperation with the government bodies of this region, trying to maintain the shape and cosmology of the cultural life, environmental balance and biodiversity in which the Ngöbe-Buglé people are evolving (ACUN 2003:33).

⁴ The term “comarca” refers to the semi-autonomous indigenous territories. The Panamanian comarcas were created for different indigenous groups between 1938 and 1997. They vary in their political structure and their relative power within the country; some are designated at the provincial level while others are at the district level (Chapin 2000).

⁵ All translations in the text are by the author.

The Charter reflects the traditional norms and practices pertaining to various areas such as land tenure, culture and education. The land granted, though, represents only about half of what the Ngöbe people claim as their traditional territory (Wickstrom 2003, Young 1971). Furthermore, the vast majority of the land granted to the comarca is not considered suitable for agricultural exploitation, with poor soils and steep slopes (Young 1971). Despite important advances in territorial rights, there still exist many problems with the governance of the comarca, and the indigenous population is not necessarily empowered or truly capable of protecting its interests (Horton 2006). This is especially evident when we consider the significant economic and institutional disparities that still exist in the country.

Economic gap

While the Republic of Panama has achieved a relatively high standard of living (World Bank 1999), there is still a wide gap in wealth distribution; Panama ranks among the worst countries in achieving equity (UNDP 2007), with indigenous populations⁶ being especially disadvantaged. According to the World Bank (1999), poverty is spread throughout Panama, but with higher levels among indigenous communities. Even though they account for only 8% of the national population, indigenous people represent 19% of the poor and 35% of the extremely poor (World Bank 1999). The national illiteracy rate of 8.1% (UNDP 2007) also hides an important disparity. While urban areas show a 3.3% illiteracy rate, rural areas show 15% and in indigenous communities this rate reaches 44.3% (Hooker 2005).

⁶ There are seven groups in Panama: the Kuna, Embera, Wounaan, Ngöbé, Buglé, Teribe and Bri-Bri.

The levels of poverty in the Comarca Ngöbe-Buglé are extreme, with 99% of the population living without electricity and 70% without running water. The infant malnutrition rate reaches 52% and there are high occurrences of vaccine-preventable diseases such as tuberculosis, measles, chickenpox and poliomyelitis (GTZ 2001). The indigenous communities living in remote areas, such as Ratón, depend on the forest for food, medicine and house construction materials (GTZ 2001, Smith 2003, Young 1971).

These high levels of poverty and illiteracy amongst indigenous communities reflect a complex reality. These communities' reliance on land resources such as forest products to meet basic needs does not bring measurable income for national data. At the same time the traditional lifestyle of indigenous communities can isolate them from the market economy and often creates a situation in which formal education is not a priority.

Mining threats

Despite the recognition of traditional territorial rights, the protection that the comarca status provides remains weak in certain respects. The Panamanian government retains the right to develop the comarca's natural resources to the benefit of the nation (Elton 1997). Seventy percent of the comarcas' territories fall under mining concessions (Elton 1997). The people of Ratón are especially affected by this reality as they have found themselves at the center of a multinational mining conflict. A large copper deposit was found in this very region in the 1970s, for which the Panamanian government approved exploration activities without consulting the Ngöbe population (Wickstrom 2003). Unsurprisingly, this spawned controversy (Gjording 1991) and significantly influenced the way the Ngöbe people think about encroachment from outsiders on their territory. Most people in Ratón are firmly opposed to this mining development and the

impacts it would have on their community. Fear of dislocation, especially, has been a central focus of the community ever since the mining exploration started. In addition, community members have expressed concerns over environmental contamination, especially relating to water, and destruction of the local forest fauna and flora, including the plants which are the focus of this research. A resident of Ratón made a critical comment regarding the potential benefits that mining exploitation in the comarca would have for the local indigenous population:

The poor continue to be even poorer; this is the development of the rich. It's like saying that the expansion of the Panama Canal helps the development of the indigenous people. It is an increase of the economic gap between rich and poor (Local resident, Nov. 19, 2010).

This resident, though, and most other members of the community, also recognize that the mining company has brought important infrastructural improvements to Ratón in the past. For example, the mining company built a road, a school and a health center in the community.

The persistent inequality and lower standards of living that indigenous people face today can be traced to the history of colonization and subsequent neglect by the government. The impact that the threat of mining has on the local relationship with the mature forest is subtle and difficult to measure, but nonetheless important. On the one hand, the threat of mining and dislocation has prompted the community to unite politically and to open itself to support from organizations such as the UNDP and the Rainforest Alliance (Wickstrom 2003). On the other hand, though, there is a palpable resistance felt in the community in the face of outsiders' presence in the area, and a strong interest in self-governance at the comarca level. Together, these effects both

promote and restrict the potential for cooperation with outside organizations.

As such, it is important to respect and recognize the right that the indigenous people of Panama have to the land when designing conservation strategies. They have fought for the creation of semi-autonomous territories and, as with all indigenous people of the Americas, they continue to suffer the effects of colonisation. They were pushed into remote areas, where they have developed ways to manage their environment in order to continue to derive their livelihood. Furthermore, they are still facing important institutional disparities which, among other effects, reduce in a significant way their chances of gaining formal education. Appreciating the historic and contemporary injustices that are shaping the indigenous people's relationship with the land helps foster a better understanding of their use and conservation of the forest.

4.2 The Diverse Geography of Ratón

The community of Ratón is located about 50km north of San Felix, in the Central Cordillera (Figure 2). The geography of the area brings both challenges and opportunities to its inhabitants. On the one hand, the area is characterized by a rugged topography; the village itself ranges from 1200-1800m in elevation above sea level, and the managed mature forests extend above 2000m. The small hamlets are relatively dispersed; some are built on the top of the hills, others on hillsides with very steep slopes. The climate is also colder and windier than that at lower elevations, which restricts the types of crops that can be cultivated. Following the Koppen classification, the climate is classified as tropical moist montane (Contraloria 2010), and has a mean annual temperature of 17.5°C (Panama 2007). The soils have low fertility and annual precipitations can rise above 3000 mm. The rain continues throughout the year, though the rainy season – August to



Figure 2. View of the community and the steep grass-covered hills (facing Westward), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

December – gets the most precipitation (Panama 2007). During the periods of heavy rainfall, the community members' movement is restricted by the high velocity of the small creeks; in addition, landslides on both cultivated and forested hillsides are common. The landscape and climate therefore create serious constraints regarding what the community can grow; these factors force community members to build their houses and cultivate land in areas prone to landslides.

On the other hand, the cold and rainy climate provides many benefits, including a year-round supply of fresh water. Furthermore, these diverse environments make available a wide array of useful plants and animals, which make up an important part of the local culture. The community's surroundings are made of a mosaic of different

environments. Although the community is officially located on the Pacific side of the continental divide, the people harvest wild plants and practice agroforestry throughout the surrounding forested areas on both sides.

On the Pacific side, savanna environments predominate (Beard 1953). The predominantly grass-covered hills are characterized by steep slopes (Figure 2), high exposure to wind and lower humidity than on the Atlantic side. Forests of various successional stages are also found in valleys or along streams. Patches of younger secondary forest can be found throughout the village and its surroundings. The secondary forests of the area are generally composed of a mix of natural and domesticated species, such as orange trees or banana and coffee plants. Dwarf regrowth vegetation is also found in a small number of areas at mid-elevation. Mature forests only occur above the village along the ridge of the central cordillera and rarely extend more than 200 meters down from the continental divide, but are more extensive on the northern side of the cordillera.

On the Atlantic side, large areas of rainforest flourish in the humid climate. While these rainforests are thought to be rich in biodiversity, not much is known about their ecological composition. In the vicinity of the community, the topography is also characterized by steep slopes and is heavily forested. The coverage is a mix of mature rainforest, younger secondary forest and regrowth vegetation. Dwarf forest patches can also be found on steep slopes with high exposure to wind. This diversity of habitats is thought to have a high level of plant endemism (Caceres Gonzalez et al. 2011). The multitude of used or abandoned trails throughout virtually all of the mature forests in the area is reflective of the long human presence (Gordon 1982).

These highly diverse environments also give rise to an abundance of animals,

providing ample wild game for the community. Birds are hunted frequently, yet remain very abundant within the village. According to local people, small and medium sized mammals are also present in the vicinity of the community, including collared peccaries and white-tailed deer. The prevalence of these animals in the surrounding forests has been explained by the low hunting rates coupled with local land use practices, “practices which make many animals more abundant than they would be under strictly natural conditions” (Gordon 1982:150). Community members also mentioned the presence of wild cats in the surrounding forests, such as jaguars, which have been killed in the past as a means of protecting domestic animals.

As such, even though the climatic and geographical conditions of the area are harsh, there is a rich diversity of environments, plants and animals. The community today derives most of its livelihood from the land, and this close relationship with the surrounding environment is essential to its socio-economic and cultural lifestyle.

4.3 Daily Life in Ratón

According to the national censuses, the community of Ratón has been growing (INEC 2010). The population was 222 in 2000, and in just ten years it increased to 335. This appears to have been primarily through natural increase rather than in-migration, as less than 4% of current residents were not born in Ratón. Compared to other indigenous villages located closer to the borders of the Comarca Ngöbe-Buglé, Ratón could be considered a traditional community. The whole community self-identifies as Ngöbe and speaks Ngöbere. Unlike in other villages closer to larger towns, many houses in Ratón are made in the traditional fashion – modest structures with low walls made of slender poles and conical thatched roofs. Other households with greater economic means have

rectangular houses made with wooden boards and a zinc roof. All houses in the community have dirt floors. Women and girls wear a traditional colorful dress, called *nagua*, and men wear pants and t-shirts. There are also some modern elements in the local way of life, including formal schooling, governmental subsidies and small shops. Some commercial goods have long replaced home-made ones; community members, for instance, use plastic bowls instead of gourds and cotton instead of bark cloth for dresses. An old mining road connecting the community to San Felix facilitates the movement of bulky goods. Nevertheless, the community relies primarily on the land and the forest to meet most of its needs, and kinship plays a central role in its social organization; most exchanges are based on traditional reciprocity.

Local livelihoods

The local livelihood of the residents of Ratón is primarily based on subsistence activities (Figure 3). They produce or harvest from the wild most of what they consume, and sell their surplus to make small cash incomes. Wage labor, government assistance and the use of cash in general are limited within the community.

Food production

The vast majority of households in Ratón practice subsistence agriculture and some form of animal husbandry. Each household has a “treegarden” which plays an important role in livelihoods. The area surrounding each house is carefully managed, with a small open area of short grass surrounded by a variety of useful plants and trees. The gardens’ structure varies between households in size and composition. Both domesticated and wild plants provide fruits, vegetables, medicinal plants, fuel wood and timber.



Figure 3. A house structure entirely made with local materials and surrounded by food crops, Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Some people grow crops in the area adjacent to their houses, while others have agroforestry plots further away. Trees and crops are mixed to provide shade and to make greater use of available space, both horizontally and vertically. These areas also provide food and habitat for domesticated animals, such as hens, and for wild animals, such as birds and rodents.

Given the high reliance on agriculture, the local diet varies according to the season. The principal crops produced are maize (*Zea mays*), beans (*Phaseolus vulgaris*), bananas (*Musa* spp.), oranges (*Citrus sinensis*), coffee (*Coffea* spp.) and otoi (Araceae family). Due to the cooler highland climate, rice (*Oriza sativa*), sugarcane (*Saccharum* spp.) and the larger varieties of banana or plantain (*Musa* spp.) do not grow well in the area.

In addition to food crops, Ngöbe households in Ratón also raise domesticated animals for household consumption and sale, mainly chickens but also ducks, pigs and cows. The consumption of dairy products, eggs and meat, however, is highly limited. Milking cows is seldom done, as it requires significant effort. Pastures are generally located in the periphery of the village, and require visits both at the beginning and end of the day to feed younger individuals. Similarly, even though chickens are raised locally, their egg production varies according to the availability of food, such as corn and wild seeds, which fluctuate throughout the year.

Only a limited number of the residents own bovines (22%) and these animals are seldom killed for local consumption. In fact, the Ngöbe started raising cattle in the comarca on a small scale only sometime toward the end of the 1800s (Young 1971). The number of cattle that a household has contributes significantly to its wealth and status. Cattle are highly advantageous, as they require very low care and can be sold whenever cash is needed (Coomes et al. 2008, Young 1971). They are an important cultural and economic asset for local people, and are understood more as an asset than a regular source of income. As a result, eating domesticated meat, eggs or milk is considered locally as a luxury, and is reserved for special occasions.

The food that people in the community produce is complemented by wild harvests and items bought with money from the sale of small amounts of cash crops or modest governmental assistance payments (Figure 4). Food harvested in the forest includes edible plants (palm hearts, fruits, ferns, etc.) and wild game (birds, rodents, medium sized mammals, etc.). Purchased items include rice, salt, sugar and vegetable oils, and small agricultural surpluses include corn and eggs sold by other community members.

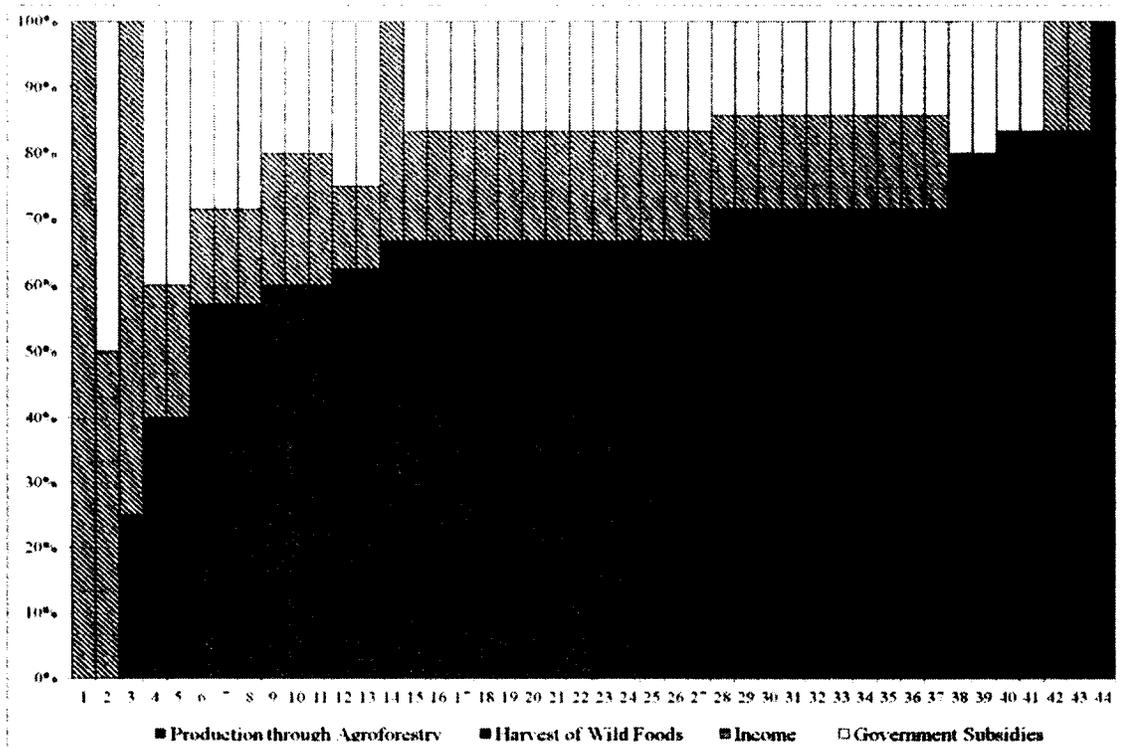


Figure 4. Comparison of households’ production, harvest and purchase of food, reported by residents of Ratón, Comarca Ngöbe-Buglé, Panama, 2010 (n=44).

Cash Economies

Overall, the use of cash in Ratón is not very significant. While there are several different sources of cash income available to the village residents, they are all modest and don’t allow for significant savings. The limited transportation infrastructure and services renders paying jobs and markets for local products difficult to access for local people. The few literate adults, having been able to find formal salaried employment in other towns, commute through the long and rugged terrain to visit their family in Ratón every week or month. Although there is no data on the percentage of temporal outmigration for Ratón, the residents explained that many families, including women and children, work on coffee or banana plantations in Bocas del Toro province or in Costa Rica. Seasonal

agricultural work enables indigenous households to gain a salary, which they can invest in education, food security and health. This salary, though, is also linked with the increased consumption of alcohol and a reduction in adherence to local customs in other communities (CONAPI 2006). In Ratón, the respondents expressed concerns regarding the isolation of the family members of temporal workers left by themselves in the community.

The local economy is based on small cash incomes, subsistence activities and barter. Only a small proportion of the community has a formal source of income or wage labour (12%) (Table 3). Those who do have a formal income get it either from working as shop owners or as government employees, such as nurses and teachers. The survey results revealed that most paid positions (67%) are occupied by people either from other Ngöbe communities or non-Ngöbe people.

This lack of formal employment is evidenced by the fact that the vast majority of the current population rely on other, non-formal sources of income for their cash needs (88%). This group is much more reliant on the natural resources within the community for their subsistence needs and interestingly, this is the same percentage of non formally-employed households that was identified by INEC (2010). When one accounts for informal income sources, however, the number of people without any source of income falls to 14% (Table 3).

People also produce small amounts of cash crops – mainly coffee, corn and beans. Coffee is the most commonly reported source of agricultural income for both men and women (37%), and corn follows as the second most important cash crop (14%). Many local people expressed concern about the isolation of their community, as they cannot

access markets for their small agricultural surpluses, such as coffee, fruits and corn.

Numerous people are also involved in animal husbandry, raising cows and chickens.

Table 3. Comparison of the sources of income reported by men and women in a community-wide survey in Ratón, Comarca Ngöbe-Buglé, Panama 2010.

Income sources	Men (n:21)		Women (n:28)		Total (n:49)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Sale of unprocessed coffee	7	33.3	11	39.3	18	36.7
Sale of meat/cattle	7	33.3	4	14.3	11	22.4
Sale of handicrafts	0	0.0	9	32.1	9	18.4
Sale of maize	3	14.3	4	14.3	7	14.3
Sale of chickens	1	4.8	6	21.4	7	14.3
Shop	2	9.5	2	7.1	4	8.2
Sale of beans	2	9.5	1	3.6	3	6.1
Wage Labour	2	9.5	0	0.0	2	4.1
Other	1	4.8	1	3.6	2	4.1
No cash income	3	14.3	4	14.3	7	14.3

With regards to gender, the sources of income primarily associated with men are the sale of coffee, cattle ranching and official employment, such as employment as a teacher or nurse. In comparison, women generated income primarily through the sale of coffee, handicrafts and raising chickens. Finally, it should be noted that the numbers presented in this table do not account for remittances or governmental subsidies. The former are difficult to account for and reportedly rare, and the latter are not considered as a source of cash income, as they are paid as credits that can only be exchanged for certain goods.

Living conditions

Out of 59 houses in Ratón, 37 have access to the rudimentary community potable water system (through pipes from a small spring-fed reservoir), with the other houses only having access to water through less dependable small wells or nearby creeks. In terms of sanitation, the majority of houses, 38 out of 59, do not have latrines (INEC 2010). Most garbage is burned, and non-flammable items such as cans are buried. Plastic bags and other petroleum-based items are often used to start cooking fires, especially during the rainy season when most wood is damp. The vast majority of people cook using fire in a kitchen that is either attached the main house, or built as a separate structure, using wood as fuel. The community has few small shops, which rely mainly on the arrival of goods delivered by four-wheel trucks every week or so. Supplies include non-perishable food items, school supplies and batteries for radios and other electronics. The community has one public pay telephone. There is no formal way of saving money for hard times, and accessing financial institutions is almost impossible. The limited access to commercial goods prevents local people from using alternative products to ease the pressure on nearby forests, especially trees used as construction materials and firewood.

Social organization

The social organization of the community is complex, comprising various familial and religious groups and associations. Kin groups serve as the primary basis of social organization in Ratón. The community is composed of various small familial hamlets in which households may be multigenerational, composed of both nuclear and extended family members. Monogamy and polygamy, including sororate marriages, are both practiced today. Children are required to help in daily tasks, including cleaning, preparing

meals, caring for younger siblings and working in the field. The community is thus linked by tight familial bonds and individuals rely heavily on each other for help with daily activities and during hard times. It is frequent, for example, that people rely on their kin to help build houses or clear fields. Furthermore, when catastrophes such as landslides happen, numerous people join efforts to clear the road. During these work parties, called *juntas*, men typically work at the task while women are in charge of cooking on site (see Young 1971 for a detailed organization of the Ngöbe society in the 1960s).

There are two community leaders in Ratón. The traditional *cacique* (i.e., “chief”) is an elder who was active in the fight for the recognition of Ngöbe land rights and the creation of the comarca. The local political representative is a male teacher from another community. Men are also in charge of local associations, such as the community aqueduct, the parent committee and the association of coffee producers. A few women are part of the Ngöbe Women’s Association based in San Felix, and work together to produce beans and raise chickens for sale. To date, there is no formal or informal association regarding forest conservation or the production of wild useful plants.

In terms of religious organizations, the majority of local people consider themselves Christians. There are churches in the village, including the Mama Chi church, a Ngöbe branch of Christianity which promotes Ngöbe self-governance and is generally wary of interventions by outsiders (Bort & Young 1985, Young 1971). Drinking alcoholic beverages, prohibited by the local Christian traditions, does not seem to be a habit amongst the local people. Along with Christian beliefs surrounding things like burial customs, local people hold many ancient beliefs. For example, one person I interviewed said that a pregnant woman cannot cook or eat inside a house that is under

construction until it is completely done.

In terms of power relationships, it is difficult not to notice the complex familial histories that seem to bind the actions of many local people. Unfortunately, unravelling these relationships would require a more lengthy research period. Nevertheless, it can be noted that elders, large land owners, people involved in the community's associations and those with formal employment command a large amount of respect. Some women are well respected, but men seem to be more active in the local political arena. This male predominance is reflected in the control of mature forests, as the passage of land ownership usually favours male children.

Access to education and health services

The accessibility of education and health services for local people is restricted within and outside the community. In the community, there is a health center and a school. The majority of local people expressed appreciation for these facilities, as many surrounding communities have them as well. The health center is well maintained overall and the fact that the nurse is Ngöbe and now lives in the community are together very positive elements. Nevertheless, numerous local people expressed concerns about the low supply of medication and about the quality of services provided. The nurse is said to show personal preferences in his practice and to moralize patients. In addition, the fact that he is a man seems to have caused some women to shun the clinic for women's health issues. Furthermore, at least some community members expressed to me trusting traditional practices more than western medicine. As a result, even if there is a health clinic located in the village, many people rely on medicinal plants rather than on western medicines.

For the local school, the main concerns regard the high level of teacher absenteeism and racism. The vast majority of teachers in Ratón are Latinos from distant towns. Since commuting requires an entire day, there is a high level of teacher absenteeism and almost all teachers complain about the work conditions, with some even showing signs of depression. Furthermore, the sharp ethnic contrast between the teachers and community members brings friction. According to local people and my own observations, racism is not uncommon and many teachers forbid children from speaking Ngöbere in their presence. As a result, the school is not able to offer the basic bilingual, bicultural education that is required within the comarca (ACUN 2003), and some parents told me they were hesitant to send their children to school. To get a high school education teenagers are obliged to attend boarding schools, which imposes high costs on the family for room and board. However, some parents mentioned that education may allow their children to have easier lives, and more importantly will allow the community to better defend its interests in front of large development projects in the future.

Despite the presence of schools, illiteracy amongst adults remains high in the area of Ratón. According to the 2010 census (INEC 2010) an average of 77% of the predominantly indigenous population of the Nole Duima⁷ district can read and write. About 24% of the adult population have no formal education, 16% have achieved a grade six level and less than 2% have completed secondary education or higher. Given that Ratón is amongst the most remotely located communities of the district, the literacy rate and education levels are likely lower than this. As one resident commented, the fact that the majority of the community does not have an elementary education influences the way

⁷ There is no governmental data at the community level.

in which they learn new concepts. According to him, they learn by example – not by reflecting on theory or charts, but rather by realizing how things work by themselves. Outsiders' influence on local ways of doing is therefore likely to be limited, as the typical two or three day workshop is generally insufficient to fully demonstrate any significant concept.

The effects of education on local cultural attitudes are unclear. On the one hand, some scholars argue that education of indigenous people could lower forest clearance thus reducing pressure on natural resources (Godoy & Contreras 2001). On the other hand, it is thought that schooling may diminish the amount of traditional knowledge that is passed on (Godoy et al. 2005), and thus compromise the long-term management of mature forests.

The residents' access to better education and health services found outside the community is limited by inadequate transportation and communication. While there is public transport that reaches the community during most of the year, it is highly limited and unreliable. The bad condition of the old mining road that reaches the community prevents cars from coming anywhere close by. Commuting in and out of Ratón is mainly done by foot or horse. To cross the 25km separating the community from the closest town of Hato Chami, it takes an average of seven hours. Challenges associated with this situation are illustrated by the example of a woman who hoped to visit a health center. She left Ratón by foot at midnight and reached Hato Chami in the morning, only to find out that the doctor was absent for the day. She therefore had to return to Ratón, weaker and without having seen a doctor, to take care of her children after a total hike of 16 hours on rugged terrain.

Outside of transportation, cultural and personal preferences also influence the choice between western and traditional medicines and services. For example, there is a religious center, the Centro de Capacitación y Formación Nuestra Señora del Camino located in San Felix, which offers free stays for pregnant women and their partners, in addition to offering health workshops and services in Ngöbere. Nevertheless, numerous women expressed a preference for giving birth at home with traditional medicines and the help of their kin. As a result of these challenges, the choices for people in need of severe or specialized care is difficult; either they stay in their home surrounded by their kins and using traditional practices, or they travel to distant hospitals where they would be isolated from their family, uncertain if/when they would be able to return and unconvinced by the reliability of western treatments.

These findings are in line with those of Waters (2010), who identified three main barriers to indigenous access to education and health services in Panama: transport, negative perceptions of services and non-respect for indigenous language and cultural traditions. While these barriers were found in relation to accessing education and health services, they are also likely to have an impact on the community's involvement with other outsider organizations, such as forest conservation agencies.

Government programs

The federal government of Panama has recently started assistance programs to help relieve families from extreme poverty and to achieve better levels of education and better health. In Ratón, the vast majority of households – at least 88% – receive governmental support from one or more of three programs.

Firstly, families living in conditions of extreme poverty are eligible for support

through the Family Food Allowance (“Bonos familiares para alimentos”). This program was launched in 2005 by SENAPAN (“Secretaría Nacional para el Plan Alimentario Nutricional de Panamá”) and is part of the program entitled Opportunities Network (“Red de Oportunidades”) (SENAPAN 2010). Families receive vouchers of \$50 (all amounts reported are in USD) per month exchangeable for food or basic items such as soap. To be eligible, families must adhere to specific requirements which are monitored using a family card managed by mothers (Nutrinet 2010). The program requirements stipulate that all school-aged children must attend school and have regular health exams.

Secondly, the program entitled “100 at 70” (“100 a los 70”) administered by MIDES (“Ministerio de Desarrollo Social de Panamá”), has been providing since 2009 a monthly allocation of \$100 to elders who are 70 years and older who do not have pensions (MIDES 2011). The third program is a universal fellowship (“Beca Universal”) of \$20 monthly for public school students attending elementary or secondary schools with good standing. The fellowship is delivered to fathers and the program is administered by IFARHU (“Formación y Aprovechamiento de Recursos Humanos”) together with MEDUCA (“Ministerio de Educación”). It was launched in 2010 (HoraCero 2010).

These programs, especially the conditional cash transfers, have been commended in Latin America and Panama for their success in improving child health outcomes, school attendance, and in improving women’s status in the case of transfers made directly to women (Valencia Lomeli 2008). Whereas these benefits are certainly felt in Ratón, this research revealed that numerous local people are concerned about the implementation of the programs.

Firstly, transportation is an issue and has rendered implementing the programs difficult. Given that these programs are based in distant towns, Ratón residents are required to register at offices located in San Felix, which means losing an entire day in commuting to receive their subsidies – a \$20 benefit in the case of the universal fellowship. Furthermore, planning the future use of this governmental support is very difficult given the pressing needs in the community and lack of cash budgeting experience. Little attention is paid on the part of the government regarding how to maximize the impact of subsidies on the local economy (Handa & Davis 2006). One Ratón resident explained that the community members are in need of knowledge and training about the “organization and planning necessary to make this money go far” (Local resident, Nov. 19 2010). In the same way, other people expressed that they do not have the habit of saving cash for later uses. For example, some people tend to accumulate debt at their local shop during the periods between the irregular payments, which they are not able to fully reimburse with the stipend. Some explained that when the payments finally arrive, there is a wave of activity in the community. Some people then buy luxury items such as watches and toys with money, or condensed milk and juices with coupons, instead of keeping these subsidies for long-term use or as an emergency fund for food shortages. Some people with an outstanding account in one shop may try to find these items in another shop. As a result, these subsidies bring the potential for increasing conflict and modifying people’s relationships within the community.

Overall, while governmental aid helps to mitigate the effects of poverty, it is not enough to slow the households’ land requirements for crops or cattle. These programs do not target the broader structural problems that perpetuate inequality in the country. For

example, more years of schooling may not result in higher incomes in the absence of improved accessibility of employment opportunities in the area (Valencia Lomeli 2008). Broader national reforms of institutions are required to ensure a fair inclusion of indigenous people in social and economic programs (Valencia Lomeli 2008). Without targeting these underlying inequalities, changes in the dependence on forest resources are unlikely. In short, however well intentioned these investments in long-term human capital development are, their effects on poverty reduction are complex, and it is unknown how they will impact the residents of Ratón's use and management of forests in the long run.

Concluding remarks

The inhabitants of the mountainous region of the Comarca Ngöbe-Buglé such as those living in Ratón live in close relation with the land, and rely on each other to fulfill their essential needs. The continuity of traditional food, dress and general systems of conduct despite the Spanish presence in the country demonstrates the significance of identity and self-determination for the community. Despite this attachment to culture, a community like Ratón faces various challenges. The community lives in extreme poverty, with limited access to basic needs such as potable water and sanitation. The harsh climate and rugged terrain are not forgiving; cold weather restricts the variety of crops that can be cultivated and heavy rain falls and frequent landslides render commuting difficult. The population is also isolated from potential jobs, services and markets offered in other towns. The use of cash is limited, and traditional reciprocity is important. External help, such as governmental assistance, has become available in the past decade, but according to the people with whom I spoke, this support remains insufficient to have a noticeable impact on the local dependency on wild resources.

The recent changes in demographics, infrastructure and services may influence the community's forest use. My observations in the community corroborate the view that increasing population puts pressure on the natural environment surrounding indigenous communities, as described by Godoy and Bawa (1993). Given that the livelihoods in Ratón are based largely on agriculture, the increase in population has resulted in a corresponding increase in the need for agricultural space. This is especially prevalent when one looks at cattle ranching, which is slowly becoming more common in the area; this practice requires vast tracts of land and thus can put pressure on forests. Both Young (1971) and Gordon (1982) have identified cattle ranching as a key element in the change in forest use in Ngöbe settlements on the lower elevations of the Pacific and Atlantic sides, respectively. The increase in cattle ranching will thus likely continue to be a leading cause in mature forest cover loss as the community grows.

Furthermore, my observations suggest that the improvement of infrastructure, namely the road, school and health clinic, has encouraged people to stay closer to the village center. Compared to the traditional small hamlets, this denser settlement pattern places increased pressure on the village's surroundings, and is likely to be linked with the depletion of useful wild plants.

The improved infrastructure has also resulted in a slight increase in the use of cash and commercial goods. The link between higher incomes and the harvest of wild plants in indigenous communities is not clearly understood. While some works (Godoy 1993) indicate that as a household's income increases, the economic importance of wild harvest declines, others suggest that this increase does not automatically lead to a specialization in the harvesting activities (Godoy et al. 1995) or to a lower reliance on

forest products (Coomes et al. 2004). These findings are important to consider, as they indicate that the reliance on natural resources does not necessarily correlate with household incomes.

This discussion provides the necessary context for the next section, which focuses on the community's resource use and management practices. Understanding the structural factors that shape the interaction between people and their surroundings is necessary if we wish to engage in a meaningful discussion of the sustainability, success and efficacy of resource management.

Chapter V – People and the Forest: Forest Importance, Management and Tenure

This chapter examines the community's use of the forest. Furthermore, it engages with how the community's interactions with the forest are shaped by customary access and resource rights. The chapter begins by exploring the complex local forest tenure system and the resource access regimes that affect the harvest of wild plants. Following this, it examines the key forest practices that take place under the canopy. The next section turns its attention to an overview of the importance of the forest for local people in terms of resources, services, cultural identity and spirituality. Finally, the last section of this chapter analyzes the impacts of these local interactions with the forest, trying to make sense of local deforestation and the depletion of forest wildlife. In doing so, the possible underlying causes of this depletion are examined, as well as their implications for forest conservation. This chapter draws primarily on data from the household survey, informal interviews and participant observation.

5.1 Importance of the Forest for the Community

Numerous indigenous communities throughout the tropics depend on forest resources to meet their basic needs (Balée & Gély 1989, Coomes & Burt 1997, Michon et al. 2007, Toledo 1995). These environments are well known to provide a great diversity of products, including food and construction materials, as well as vital environmental services, such as clean water. To illustrate this strong people-forest relationship and to exemplify how the forest fulfills the basic needs of local people, Michon and colleagues (2007) use the expression “domestic forests.” Looking at the importance of the forests in the lives of the residents of Ratón is therefore crucial if we want to better understand the

subtleties of their relationship with this environment, especially how plant use and conservation strategies are carried out.

Extensive tracts of mature forest can be found about 2.5 hours walk from the village (Figure 5), and small fragments are found nearby. The residents of Ratón were asked about the overall importance of the mature forest for their community, and the results show that while most people depend primarily on subsistence agriculture, the forest is indeed very important to them. The vast majority of respondents (84%) consider the mature forest as “very important”, as opposed to only 14% who feel the forest is “relatively important”. Only one person (2%) said that the forest is “not really important”, explaining that the community is increasingly relying on plants found in other habitats and on commercial goods. This section explores the various reasons – ranging from material needs to cultural identity – which were mentioned as reasons why the community values the mature forest.

Forest resources

The provision of resources was the prime reason for which respondents gave high importance to the mature forest. This habitat encompasses a rich and diverse flora and fauna, which local people use to meet a variety of household needs. Plants constitute the main resource type, followed by game animals.

Gathering wild plants

The forest is very important for local people due to the wild plant products it provides them. The vast majority of the community (92%) harvests wild plants to some degree from a variety of different areas, including mature forests and other



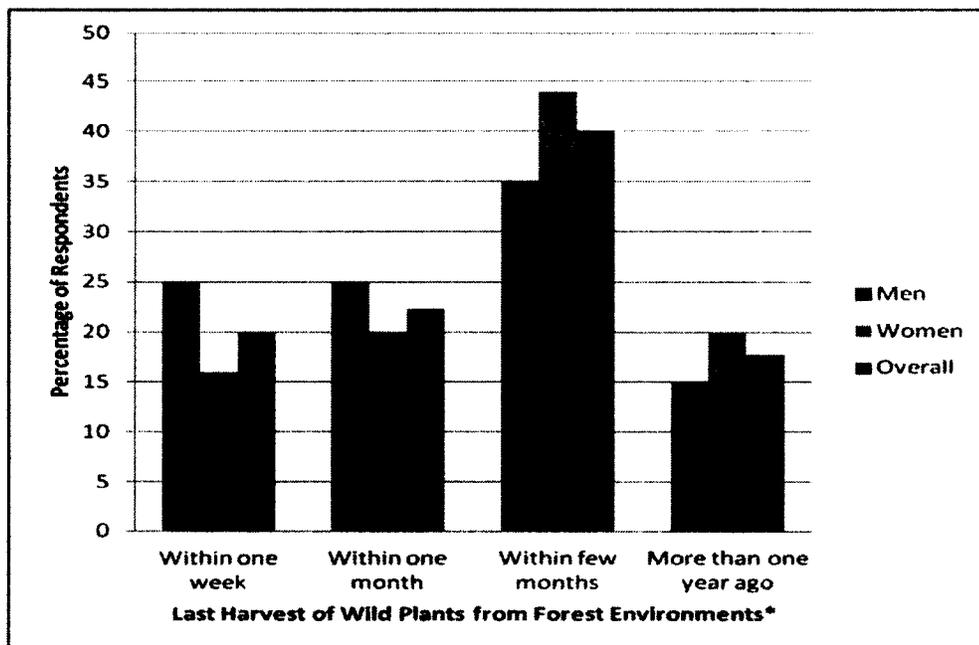
Figure 5. The dense mature forests are found 2.5 hours (walking distance) north of the village centre, Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

habitats. The other respondents (8%), although they did not report collecting plants themselves, indicated that they still benefit from this practice, as wild plants are widely used in virtually all households for food, construction materials, handicrafts, medicines and ceremonies. Also, the respondents who did not report harvesting plants themselves had either recently moved to the community or were formally employed and thus had a different economic relationship with the forest.

Given that the frequency of harvesting plants varies throughout the year, the respondents were asked when their most recent harvest of wild plants in forest environments was (Figure 6). Overall, amongst the 45 respondents who reported collecting wild plant products, the vast majority, 82%, said they had harvested them within the past year. The most frequent answer, for both men and women, was “within a

few months”. Breaking the results down by gender, the data suggests that men may harvest wild forest plants more frequently than women, at least at certain times of the year. The results presented here represent a snapshot, and given the gendered difference in wild plant use and the seasonal availability of different plant products, the frequencies of harvesting likely vary throughout the year.

Mature forest is the environment in which most useful wild plants are collected (65% of respondents mentioned it). Local people also harvest wild plants from other areas, including from secondary forests (49%), along paths and roads (12%), from agricultural fallows (8%) and from the savannah areas (4%). How the community uses wild plants is dealt with in greater detail in the next chapter (see Chapter IV).



* The original question included precise categories for weeks and months, but the local investigators preferred using simpler categories, although less precise, as they would be easier to answer for the respondents.

Figure 6. The most recent harvest of wild plants from forest environments, Ratón, Comarca Ngöbe-Buglé, Panama, 2010 (n=45).

Hunting

Mature forests provide habitat for many animals, and wild game constitutes a valuable resource for many households in the community. Wild meat is highly valued as a local delicacy. Birds are hunted using hand-made sling-shots, and larger animals are caught using rifles or bows and arrows. Most animals considered edible are pursued whenever they are encountered. Hunting is a male-dominated activity; none of the women reported practicing it, even occasionally. Hunting is not, however, practiced by all men, with only 10 out of 21 male respondents indicating that they hunt. Most men hunt with a slingshot (7/10) and thus do not typically hunt large animals; the others hunt either with a shotgun (2/10) or with a bow and arrows (1/10). According to local people, only a few large mammals are present in the immediate vicinity of the community. Birds, including humming birds, are abundant near the village and – hunted by young boys – they seem to be by far the most frequent animal catch, constituting a minor, but appreciated, food source. In the recent past, the community members also hunted a type of frog in the village. The cause of its recent disappearance is unknown, but it is likely due to a fungus infection rather than overhunting, as similar declines in amphibian populations have been witnessed in Panama (Lips 1999). Gordon (1982) also mentions edible forest frogs in his research with the Ngöbe communities in the northern part of the comarca.

Rocks and Mushrooms

While not reported in the household questionnaire, participant observation activities revealed that other resources found in forest areas are used, although likely on a much more limited scale. For example, I witnessed on one occasion the use of a specific

type of rock for sharpening machetes, and one kind of edible mushroom was mentioned by local people as a delicacy.

Forest services

Numerous people living in Ratón explained to me, during the workshops and informal interviews, that the mature forest is very important to them because of the services it provides. For example, one person explained that the forest maintains air quality and “purifies the environment” (Local resident, November 2010). Numerous others mentioned that the forest provides the community with a reliable supply of fresh water in the small streams that pass near people’s homes. Numerous respondents also explained that cutting down the mature forest would dry out the rivers and the water supply, which would affect not only their community but also other communities downstream. Other respondents explained that the forest cover stabilizes the soil. In this mountainous region, landslides commonly occur on steep slopes, and, as a local person explained, without the root structure of trees to hold soil in place, landslides would be much more frequent (Local resident, November 2010).

These comments on the importance of the forest reveal a high level of understanding regarding the connections between the forest and hydrology, and of the forest’s role in preventing erosion and landslides. A service not mentioned by the respondents but witnessed through observation is the fact that the forest provides protection against high winds.

Cultural identity and spirituality

A few people clearly mentioned that living close to the mature forest and depending on it was an integral part of their culture and was important to their identity as

Ngöbe people. Furthermore, many plant and animal products from the forest are used for traditional ornaments and spiritual protection. In addition, local myths and legends feature forest animals, such as jaguars. Other respondents said that they “need to take care of the trees” (Local resident, November 2010), demonstrating the recognition of a responsibility to protect the forest. Since this research was conducted by a non-Ngöbe person and relied on the help of translators, these results are limited and do not depict the complex cultural and spiritual connections that local people have with the surrounding forests and forested landscapes. Nevertheless, from the above-mentioned practices and traditions, it can be said that the forest is a source of cultural identity and spirituality for numerous local people.

The survey results show that the mature forest still plays a very important role in the lives of the residents of the highlands of the comarca. Although socio-economic changes in the past decades have led to the substitution of many forest products with commercial goods (Gordon 1982, Young 1971), and although the mature forest in Ratón is located at a distance that precludes daily trips for numerous people, the community is still highly dependent on the mature forest’s resources and services to meet its basic needs. The forest activities that local people carry out, including hunting and harvesting plants, are gendered, which confirms previous studies in the region (Gordon 1982, Young 1971). These activities are further shaped by the local customary tenure system, which grants land and access rights to the community members according to specific customary rules.

5.2 Under the Canopy: Indigenous Forest Management

Customary forest tenure and management practices play important roles in the sustainable use of forest resources, and many countries have started to recognize these rights along with the territorial claims of forest dwelling communities (White & Martin 2002). The majority of forest-related practices and activities take place under the forest canopy and as a result are not detectable from satellite imagery. These practices can be misunderstood by conservation or government agencies (Fairhead & Leach 1995). Nevertheless, numerous studies have demonstrated that indigenous communities engage in diverse forest management practices that are highly place specific (Balée & Gély 1989, Dounias & Hladik 1996, Michon et al. 2007, Wiersum 2004), and that these practices are important in terms of sustaining both the local livelihood and a diversity of wildlife (Schroth et al. 2004). Forest management aims at improving the productivity of a forest area by favoring elements such as useful forest species. To this end, socially oriented measures, such as restricting use rights, and biologically oriented practices, such as selective clearing, are used (Wiersum 2004).

Local forest tenure

Indigenous tenure regimes are composed of customary rules, which are rarely written down and in which kinship and gender play important roles (Howard & Nabanoga 2007). Often, the access to trees and plants also differs from land ownership (Howard & Nabanoga 2007, Rocheleau & Edmunds 1997). The complex social customs and the diversity of habitats and plant life forms create diverse rights of use and access to resources, which are often overlapping (Rocheleau & Edmunds 1997). As such, this

discussion on the local forest ownership should be considered tentative.

Forest ownership

Land in Ratón is legislated by the comarca's charter, called the *Carta Orgánica* (see Chapter IV), which details the land tenure regulations. It is important to note that while the community of Ratón is located within the Nidrini Region of the comarca, the local people's forest areas extend beyond the continental divide into the region of Ñokribo, which means that they are under different regional authorities. Within the comarca, all land is legally considered common or collective property and private ownership is prohibited (ACUN 2003). The use and enjoyment of the land – including forested lands – is done through what is called a right of possession (ACUN 2003). This right can be either individual or familial, and can be passed on. People in Ratón recognize these rights of possession over mature forest as exclusive. This practice is widespread, as 73% of respondents (including both men and women) reported owning parcels of mature forest.

While this exclusivity may seem to be contradicting the charter's prohibition of private ownership, the exclusive rights of possession are not the same as private property, even if locally people refer to "owners" of forest parcels. For example, while forest areas are considered to be owned, people are free to walk through them and people traveling overnight are welcome to use provisional shelters found in forest areas. Furthermore, as one local person explained to me, the owner has the right of possession over a given forest parcel as long as s/he continues to use it. Leaving a forest parcel unattended for a few years could result in somebody else taking up residence on it and as a result establishing ownership. Finally, it is important to note that no parcel can be sold to a non-

Ngöbe person, and the owner cannot receive a mortgage loan through any financial institution. The vast majority of land parcels are therefore acquired through inheritance.

The forest tenure system of the Ngöbe communities of the central mountain is tied to their social organization (see Young 1971 for more details). The management of mature forest is a gendered activity; while women do acquire land through inheritance and as a result own parcels of mature forest, it is in practice their husbands who manage them. Forest parcels can also be informally sold or exchanged. In Ratón, the forest parcels' distribution is characterized by a patchwork pattern. Many residents have rights over multiple parcels, mainly acquired through inheritance. People do not have precise measurements of their parcels in hectares, but around 16% of respondents affirmed having a "large amount" of mature forest. The majority of respondents (57%), however, reported having only a small amount of mature forest within their agricultural parcels, and about one quarter (27%) did not claim ownership or exclusive rights over mature forest areas. The results of the sketch mapping sessions, in particular, revealed that the distribution of control over most of the mature forest is concentrated in few peoples' hands and that no forested land is owned by the community as a whole; the families who settled the area still own the majority of the forest. It is uncertain how long these rules have existed, but they predate the establishment of the comarca in 1997.

Access to forest resources

In addition to the ownership of forest areas, there are customary rules that shape access to forest resources. These rules are also highly related to the community's social organization and kinship (see Young 1971). In Ratón, harvesting and hunting on other people's parcels is allowed or tolerated at various levels, depending primarily upon three

main factors: kinship, the abundance of the resource and, for plants specifically, whether or not the species is destroyed when it is harvested. For example, as several informants explained to me, family members, friends and other kin group members are allowed freely onto a forest parcel, whereas other people may require permission. Also, forest parcel owners become concerned when they believe that visitors from other communities have been harvesting resources from the areas that they claim rights over. The harvest of commonly found wild, edible plant products seems to be generally accepted. On the contrary, trees and palms that are highly valued, such as *mrä* and *juogo* (see Chapter VI), are understood as privately owned and cutting them down without permission is not tolerated.

Local forest management

Communities living in the highlands of the comarca carry out many activities on the mature forest parcels they control, including agricultural plantings – in particular, coffee – and cattle ranching. These longstanding agroforestry practices that date back in the region to sometime before 1900 (Young 1971) require careful management of the forest to ensure continuous long-term benefits. In Ratón, agricultural plantings occur for the most part in the secondary forests, but cattle are increasingly grazing within mature forests.

There are three broad categories of forest management practices that I documented in Ratón's mature forests: clearing the understory, thinning out the forest through selective cuts, and setting aside areas of forest as "reserves". These management practices make possible the activities taking place in mature forests, such as cattle ranching and the harvest of wildlife. Together, these management practices, as well as the

activities that they make possible, have different levels of impact on the floristic and faunal composition of the forest. These impacts are discussed below.

Clearing the understory

Clearing the understory of mature forest areas with a machete is a very common practice. Informal interviews revealed that esthetic and functional preferences are a primary reason behind this practice. For several local people, a cleared understory is esthetically more attractive than an un-cleared one, irrespective of the forest's successional stage. Others explained that clearing part of the understory makes walking around easier, enables a more efficient identification and monitoring of valuable plants and allows wild game and venomous snakes to be seen from a greater distance, which aides in both hunting and safety. This practice also promotes the growth of useful plants, such as edible plants, which are spared during clearing. Clearing the understory is done by the "owners" of forest areas, and also by people without these rights who are permitted to harvest wild plants and game from these areas by the owners. About 33% of the respondents who harvest wild plants (15/45), both men and women, indicate that they clear the understory of part or all of the forest parcel when harvesting plants.

Thinning out the mature forest

Selective thinning is done in Ratón to foster the growth of selected trees and palms or to create space for agriculture or cattle ranching. It is mainly done through selective cutting, which consists of a careful selection of which trees and palms to keep and which to cut down. Valuable trees and palms are left standing when the forest is thinned so that they can be saved for later use. Examples include *juogo* (a palm), *mrã* and *zoguanda* (both trees), which are used for construction materials and household goods

(see Chapter VI). Many different species are spared – particularly the numerous fuelwood species, which deserve further study. When thinning a forested area, trees and palms are cut down using manual tools – axes and saws primarily – and according to one local person the burning of the fallen biomass is not commonly practiced in Ratón.

Most agricultural areas are found outside mature forests. There is, however, population pressure on the environment surrounding the village that may drive people to seek space in mature forests for agricultural use. Regardless, thinning of the mature forests to create space for cattle ranching is currently occurring. This practice enables the owner to increase a parcel's production by combining the valuable forest resources with livestock, two important economic status symbols. Selective cutting of the forest is done to ease the animals' movement, while at the same time keeping all valuable species including native fodder. By conserving the tree cover, this practice sustains a significant diversity of native flora and fauna compared to other forms of cattle ranching (Rice & Greenberg 2004). However, cattle ranching poses the risk of significantly impeding the reproduction of trees as the animals might feed on the trees' seedlings. Furthermore, remaining trees are not always able to survive and replace themselves under the new environmental conditions (Williams-Linera 1990). Significant thinning out of the forest might therefore lead to forest degradation and eventual deforestation. One local person, for example, showed me that after having cut down most of the trees of a mature forest area, the remaining ones began to die. This person lamented the loss of these trees, as they were a rare and valuable species.

These practices – clearing the understory and thinning out the mature forest – are referred to as “working” the forest and the amount of time that somebody spends working

in the forest influences his or her reputation in the community. A man who “works” his forest effectively is very well respected.

Informal forest reserves

Setting aside areas of forest as “reserves” is not especially common in Ratón, but nonetheless is an important practice that has potential as a building block for broader conservation strategies. Certain people have preserved specific harvest sites for useful wild plants. Two men in the community reported maintaining forest “reserves” to provide suitable habitat for *juogo* palms, whose leaves are used as thatched roof material. One of them also maintains a forest patch almost intact for *tugue ningro*, a woody vine used for lashing.

Informal interviews also revealed that two members of the village own mature forest “reserves” for the services they provide. The first one, located near the entrance of the community, is a small hill formation featuring very steep slopes. As the owner explained, this forested area, not suitable for agriculture, serves as protection against erosion, as heavy rainfall could wash the soil and block the road passing just below it. The second mature forest reserve is located outside the community limits. In this case, the main motive of the owner for maintaining the forest is to protect the rich biodiversity and develop ecotourism. Even if the main reason that people set aside a mature forest patch is not for biodiversity but rather for the useful plants they shelter or for the services they provide, these local initiatives could make for a promising area to learn about community-led conservation amongst the Ngõbe communities.

Agroforestry practices in other environments

A variety of agroforestry practices also exist in other environments, providing

habitat connectivity for some of the plant and animal species living in mature forests. Within the village, trees are incorporated into pastures for livestock, so horses and cattle can benefit from their shade. Surrounding almost every house is a high concentration of useful trees planted with perennial and annual crops, both native and domesticated. These “treegardens” or “homegardens” are highly diverse and primarily composed of plants used for food or medicine, characteristics that have also been observed in indigenous peoples’ gardens of Costa Rica (Zaldivar et al. 2002).

There are also numerous patches of secondary regrowth forests between houses. The crops of bananas or coffee are generally incorporated into secondary forests. Both of these forested environments, the regrowth patches and the secondary forest, provide fuelwood and a variety of useful wild plants for community members. Finally, there is at least one plantation of useful trees within the village.

Scholars are increasingly recognizing that these agroforestry practices offer a wide array of habitats for wildlife (Schroth et al. 2004). As such, the “informal” forest tenure and management practices of the Ngöbe have a significant influence on the floristic composition and long-term survival of the relatively narrow band of mature forest along the central cordillera.

In the mature forest patches found in the area around Ratón, management primarily consists of the controlled use and conservation of forest resources. Practices such as clearing the understory and thinning out the forest through selective cuts have beneficial economic, ecological, social and safety implications for the local people. As Wiersum (2004) argued, although the plant species composition has been changed to meet local needs, the native vegetation is largely conserved. Except in the case of forest-

livestock integration, the managed mature forest structure closely resembles the so-called “natural” forests. Unfortunately, overuse of these practices can also lead to the loss of forest areas and thus of suitable habitat for plants that people rely on to meet many of their basic needs. Many local people in fact expressed concern about the impacts of excessive thinning on the resilience of mature forests. These concerns reflect the importance that the community places on the forest for both cultural and economic reasons.

5.3 Change in Forest Cover

Changing plant composition under the canopy is a normal process in any domesticated forest (Michon et al. 2007). Deforestation, defined as a “complete or almost complete removal of tree cover and conversion of forested land to other uses as a result of human activities” (Ghazoul & Evans 2001:23), however, is a concern for both conservationists and local people. According to governmental data, the forest cover of the comarca decreased of 12% during the 1992-2000 period (ANAM 2006, Parker et al. 2004).

Comparing national and local views of forest cover change

Comparing the information from national documents to the responses of local residents can help to expose the changes in vegetation occurring in a given area (Fairhead & Leach 1995, Lykke 2000). Furthermore, ensuring that local people support the general discourse of national and conservation agencies around deforestation is necessary for the development of appropriate policy guidelines (Fairhead & Leach 1995).

Around Ratón, I observed a landscape comprised of numerous habitats, including forests patches of various successional stages and size. The majority of respondents

(78%) said that the forest cover had decreased around Ratón within their lifetime. Deforestation can be seen in the area surrounding the community and a small number of people identified areas that have been deforested within the past 50 years (Figure 7). Conversely, other respondents said that the forest had not changed in extent (10%), or that it had increased within their lifetime (12%).

The National Environmental Authority (ANAM) assessed the change in forest cover for the period 1992-2000 using satellite imagery (ANAM 2011). Their work indicates a significant reduction in forest cover in the vicinity of Ratón (Figure 8). However, correlating with the discourse of the community members, the imagery also reveals that the forest has been regenerating in some areas, and that mature forest patches are found within the community area.

Together these results show that although a diminution in forest cover occurred in the past decades, there are areas where the forest has been successfully regenerating. Furthermore, aside from small forest fragments found mainly in ravines, the respondents agreed that the mature forest is currently located at about a 2.5 hours walk from the village. As such, the perspective of local people is generally consistent with the national agency description of forest cover change, at least in this context.

Distance and intensity of practices

The distance between the forest and the center of the community affects the local use of resources. As one respondent commented, the distance to the mature forest precludes frequent trips for many people and, as a result, some people are turning to other options to meet some of their needs, such as using savanna grass instead of palm leaves as roof material, or the purchase of commercial goods that replace forest products.



Figure 7. An area along the continental divide that according to local informants was heavily forested fifty years ago, Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

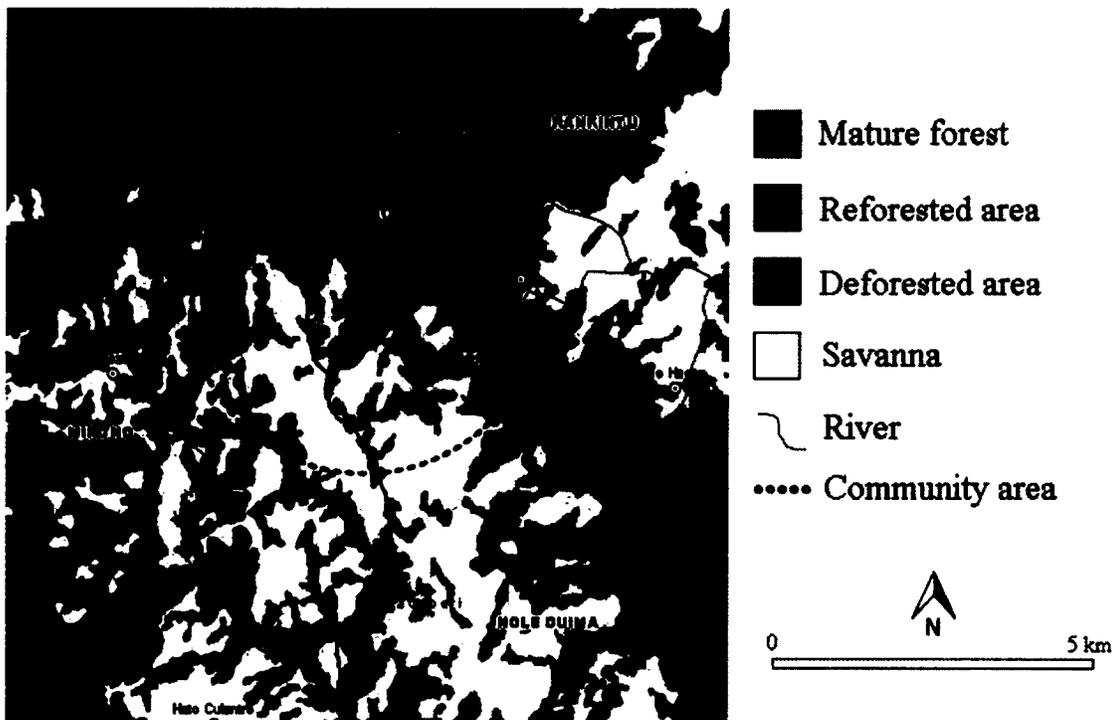


Figure 8. National Environmental Authority's assessment of change in forest cover for the period 1992-2000 showing the area around Ratón (ANAM 2011).

Furthermore, the distance separating the forest from the community influences the intensity of forest management practices, and as a result, the degree to which the forest is modified. Informal interviews revealed that parcels located closer to home or with easier access were visited and “worked” more often and managed with more care. On the other hand, forest located eight hours walk away may have been left for months without a visit. This sporadic management, though, renders the distant mature forest more vulnerable to encroachment from outsiders, who may harvest valuable plants without permission and without the long-term vision that the land’s owner may have.

Proximate vs. underlying causes of forest cover change

It is well acknowledged that changes in forest cover, including deforestation, are multifaceted and vary highly from one region to another (Appiah et al. 2009, Ghazoul & Evans 2001, Geist & Lambin 2002, Laurance 1999, Vanclay 2005). In the comarca’s highlands, Gordon (1982) and Young (1971) identified decades ago that population growth and cattle ranching are important reasons behind deforestation. The need for agricultural and cattle ranching space still play an important role today. The division and passing of familial plots to subsequent generations means that the inherited areas are becoming smaller and smaller. As a result, when the forest plots become too small to support the growing population, previously unused forested areas are needed. Similarly, the space used for cattle ranching either leads to deforestation or leaves a smaller amount of land for growing. In addition, livestock husbandry in forest areas impedes the regeneration of the mature forest, and based on my observations may not be as productive as people expect.

Cattle are thought of as a form of monetary asset for many local people, as they do not have any access to bank accounts. The lack of economic options locally leads numerous people to prioritize their immediate needs over the long-term environmental services that the forest brings them. Yet, it is important to understand that poverty and population growth are also the drivers behind the increasing need for cattle and agriculture. Evidently, the relationship between poverty and resource use is complex.

When looking at the population pressure on the forest, the land tenure system is important to take into account. On the one hand, this system allows the person controlling a given forest parcel to carry out long-term planning, and some people do indeed have managed forest conservation areas. On the other hand, even if the community disagrees with a person's clearing of mature forest, there is, to date, no system in place to stop this from happening or allow for forest protection at the community level. Furthermore, the unequal access to forest parcels means that families with small plots may not be able to follow sustainable practices given their land shortage, which can lead to deforestation.

Population growth and poverty are, however, themselves only the resulting consequences of the colonial forces that pushed the Ngöbe people away from the productive lowlands and of the state's policies that continue to marginalize indigenous groups. These factors have given rise to the contemporary conditions in which forest clearance can seem like a logical step.

As such, the role of local people in mitigating the reduction in forest cover is very important, and their sustainable practices should be acknowledged and encouraged. This being said, most of the broader underlying forces causing deforestation are out of the community's direct control. Improving local governance, promoting sustainable forest

practices, education and opportunities for employment are therefore crucial in helping the community slow the degradation of forest on which they depend (Vanclay 2005).

Concluding Remarks

Studying how indigenous people use and value the forest environment can help us reach a better understanding of the local conservation priorities and challenges, as well as identify promising conservation strategies. This knowledge enables one to articulate the needs of the community and to reveal potential avenues for future resource management.

The research presented here shows that in Ratón more than 90% of the community harvests wild plants for both sustenance and construction purposes, and that the mature forests found in the region are the primary sources of wild products. Similarly, nearly half of the men in the community hunt in mature forests at least occasionally. In addition to relying on the forest's resources to meet their everyday needs, local people appreciate the services it provides, such as clean air, clean water and slope stability, and regard it as a source of identity and spirituality. These findings highlight the multiple benefits that stem from protecting forests. In addition, they highlight the incentives that local people have to manage the forest in a sustainable way.

Assessing local people's knowledge of change in forest cover was necessary to ensure that the national narrative on this subject was supported by local experience. This correlation between the national data and the local people's knowledge reinforces the relevance of using local people's knowledge for understanding environmental processes and using this knowledge to develop conservation strategies (Dalle & Potvin 2004, Donovan & Puri 2004, Lauer & Aswani 2008, Michon et al. 2007, Posey 1985, Smith 2008).

Furthermore, the research findings suggest that the majority of the community is aware of and concerned about the loss of forest cover, which implies that the way to prevent further change in forest cover does not lie in environmental conservation education per se, but requires discussing the constraints within which people make their decisions related to the forest. This study revealed that the distribution of the mature forest between the community members is skewed – 16% of residents own a large amount, 57% a small amount and 27% do not own any – and that forest management varies highly amongst community members. Some people manage their land as to conserve the services that the forest offers, others to ensure the availability of specific resources, or a combination of thereof. Each household is therefore using the practices of forest management according to its own interests and within its own limitations. Looking at individual household behaviors in local forest use and conservation practices would therefore be useful in explaining the factors motivating or hindering specific forest conservation practices.

Despite the socioeconomic challenges that promote deforestation, promising opportunities for conservation have been identified. Agroforestry practices have the potential to contribute to the preservation of wildlife habitats, and as such enhance conservation (Schroth et al. 2004). Also, there are specific forested areas both in and outside of the community that are kept almost intact. This is usually done to preserve either the services or the resources that the forested area provides. Management practices such as these should be especially promoted, given that they reflect both the local reliance on mature forests and the conservation of the forest itself.

Chapter VI – Use and Conservation of Forest Plants

Indigenous people living in neotropical forests rely on a wide range of plants (Balée & Gély 1989, Coomes & Burt 1997, Gordon 1982, Michon et al. 2007, Toledo 1995, Young 1971). However, the specific ways in which the Ngöbe communities living today in the mountainous areas of Panama manage wild plants from mature forests remain poorly understood. This chapter presents the research findings regarding the local use and management of wild plants by the Ngöbe people living in Ratón. The data are based on focus groups, household surveys, informal interviews and guided harvest trips. The chapter first examines the large number of useful wild plants found in mature forests in terms of plant types and what they are used for. The chapter then undertakes a closer examination of nine plant species selected by local people as conservation priorities, providing a profile of each that describes its habitat, use and management, in addition to the concerns of the community and the prospects for long-term sustainable use. Following this, attention is paid to the gendered differences of wild plant use and management, followed by an analysis of the differences that exist between households with different economic and land assets. This analysis helps to better explain the variations in uses, the community's concerns and the variations in different people's dependencies on wild plants. Finally, the chapter examines harvest patterns, including both spatial patterns as well as the frequency of harvesting for different types of plants, before moving to a discussion of broader plant management strategies and their effectiveness. Taking into account the barriers and limitations hindering the effectiveness of local management practices, the chapter offers broad guidance regarding how indigenous communities in forest environments along with outside organizations and

agencies can develop or improve their conservation strategies.

The findings of this chapter reveal that the mature forest and its resources are important for the community's lifestyle and well-being. It also indicates, though, that reliance on plants varies between households depending on their assets and preferences. While there are important differences in the gendered use of plants, there are also common concerns shared by both men and women, which underline the importance of including both men and women's insights in conservation discussions. The research further reveals that a wide array of wild plant management practices occur; examples include restricting access to plants, banning detrimental practices that harm reproductive capacity and the management of overstory light. Local management practices have the potential to make possible the continued, sustainable use of most species over the long term.

6.1 The Uses of Wild Plants

While the livelihoods of most Ngöbe families in Ratón rely on subsistence agriculture, the community as a whole makes use of dozens of wild plants to meet its different needs. In the three-hour workshop focused on useful wild plants, the 29 people present listed 66 species⁸. Given that people tend to mention important species first (Lykke 2000), whether they are used frequently or not, the listing of plants can provide hints regarding the variation in plant use (Dovie et al. 2008). There may be other species that people may not have recalled during the focus group, but it is likely that all the most important wild plants have been included.

⁸ Because the focus of this research is on the local use of plants, their local, or folkloric, names are used in the text.

Habitats in which useful wild plants are found

The area surrounding Ratón is comprised of a mix of savannah, fallows and various successional stages of forests. Useful plants are found in all of these habitats; some plants are found in a single habitat, and others in more than one (Table 4). Mature forests, both old growth and secondary, host an especially high number of wild plants that are valuable to local people. Unfortunately, deforestation rates have been very high in the past decades. The comarca lost 12% of its forest cover during the 1992-2000 period (ANAM 2006, Parker et al. 2004), an alarming problem of concern to people in Ratón. During that period, deforestation was concentrated in the Ñokribo region and was primarily due to the need for agricultural space and the extraction of timber for commercial use (ANAM 2006). Given that the extent of mature forests is declining so rapidly, mature forests are of higher concern than other types of habitat at this point.

Table 4. Environments in which useful wild plants are encountered, Ratón, Comarca Ngöbe-Buglé, Panama 2010.

Environments	Number of wild plant species	Percentage of total
Old growth forest only	30	45
Mature forests	11	17
Secondary forest only	17	26
Secondary forest and fallows	1	2
Fallows	4	6
Savannah	3	5
Total	66	100

Principal uses of wild plant species found in mature forests

Amongst the useful wild plants found in mature forests around Ratón, a large proportion of the species are used for construction and food, and to a lesser extent for handicrafts, housewares and ceremonial or ritual purposes (Figure 9). A single species

can provide a range of products, using the different plants' parts (leaves, trunk, wood, branches, roots, flowers) or a single part for different purposes (Dovie et al. 2008). As such, a single species can have multiple uses. Furthermore, as Phillips and Gentry (1993) point out based on their observations in indigenous communities of Peru, some needs require one specific plant – for example, plants used for a particular ceremony – whereas in other cases several different species can be used to fulfil the same need – for example, plants used in construction or to make household items.

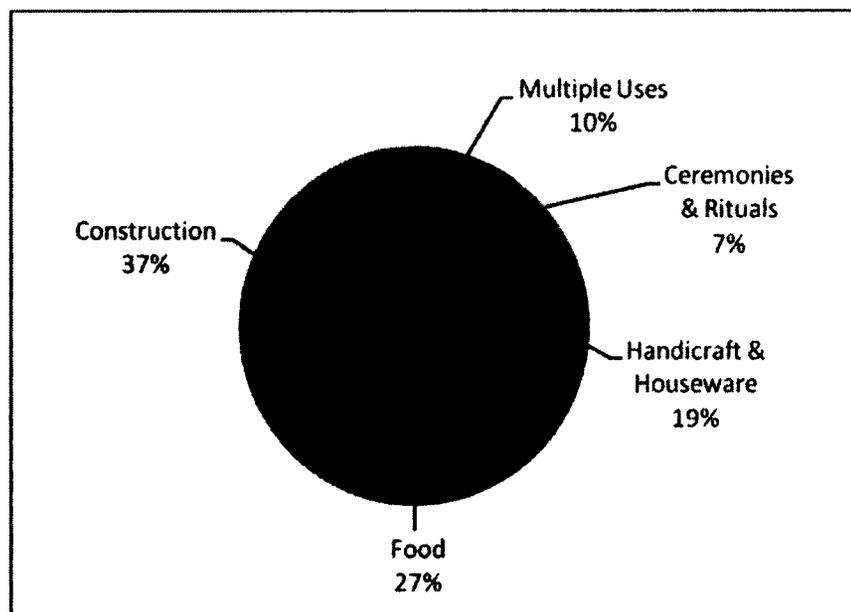


Figure 9. Principal uses of wild plants found in mature forests, Ratón, Comarca Ngöbe-Buglé, Panama, 2010 (n=66).

Construction materials

The very strong winds common in the area requires that houses be made of very solid and durable materials, which are most commonly mature forest plants. A traditional Ngöbe house in a mountainous region such as this one is a hut with a wood structure and a thatched roof made of palm leaves (Figure 10). Lianas are also used to make rope to attach the various pieces together.



Figure 10. Traditional Ngöbe house of the mountainous region, Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

The past decade has seen an increase in the total number of houses and a slight change in the types of housing material used in Ratón (Table 5). According to national census data (INEC 2010), the number of houses rose from 35 in the year 2000 to 59 in 2010. The use of thatch, the traditional material used, has remained predominant overall. Although the number of houses with a thatch roof has increased, their proportion in relation to the total number of houses has decreased. More roofs are made of metal or wood than a decade ago. On the one hand, the increase in corrugated metal roofs indicates that a certain number of households are doing well economically, as the residents reported that it cost between \$300USD and \$500USD to cover a small roof with metal sheets. On the other hand, the continued trend of using wood for roofing indicates

that other households are facing difficult conditions; wood is not considered a prime roofing material locally, and is likely to be used only in the case of a shortage of both palm leaves and cash. The numbers presented in the table, however, do not account for many houses that are made out of more than one type of roofing material, but rather reflect the primary material used.

Many residents pointed out during the research that the nearby forest ecosystems are increasingly under pressure, and cannot supply enough material to offset the growing need for construction materials. A high proportion of respondents (41%) mentioned not knowing when they would be able to change their thatch roof, as the material is in increasingly short supply. Many houses' roofs are leaking, and many houses' posts are also made of lesser-quality wood, which does not last as long due to rot or insect damage. Securing a long-term supply of wild plants useful for construction is therefore a crucial issue.

Table 5. Comparison of roof materials for the 2000-2010 period, Ratón, Comarca Ngöbe-Buglé, Panama 2010 (INEC 2010).

Roof Materials	2000		2010	
	Number of houses	Percentage of total houses	Number of houses	Percentage of total houses
Thatch or Grass	24	68.6	34	57.6
Metal	11	31.4	20	33.9
Wood	0	0	5	8.5
Total	35	100	59	100

Wild plant foods

The relatively cool climate and relatively poor soils also restrict the range of crops which can be cultivated, and local people complement their locally grown crops and store

bought foods by hunting and harvesting wild plants. Edible wild plants include palm heart, fruits, vines and ferns, for which consumption varies throughout the year depending on factors such as the plants' life cycle and the yield of agricultural crops. Along with the edible plants, local people listed a wild mushroom, suggesting that fungi are seen to belong to the same category as plants in the local taxonomy. Whereas wild plants represent an important portion of the local diet, there is no information regarding the nutritional content of most edible species; this concern was mentioned by a small number of local people.

Handicrafts, housewares and ritual items

The people of Ratón use a variety of wild plants while making handicrafts and housewares. Brooms, hats, baskets, clothing, bags, umbrellas, bowls, plates and bed platforms are amongst the numerous daily items made from these materials. Wild plants are also used in ceremonies and rituals, for purposes such as repelling bad spirits. As such, useful wild plants found in mature forests are very important in the lives of the residents of Ratón.

Life forms of useful wild plant species found in mature forests

Mature forests are the habitat of a broad range of useful plant types, including life forms ranging from grasses to trees and including vines, palms and ferns that provide a similarly wide range of useful products. Among the inventory of useful plants, trees are the most common type of plant (Table 6). The community uses them primarily for construction materials, their trunks being used for the posts and beams of houses, as well as the short walls that are made from their branches. Hardwoods are also used to make housewares such as chairs, bed platforms or axe handles. Trees are also a source of

fabric. The bark of the *nomogrie* tree⁹, for example, is rendered soft as a result of being repeatedly struck with a machete; it is used to make underclothing. The bark of the *zoguanda* tree (*Trema micrantha*) is used to make bedrolls, large pieces laid directly on the ground or on a raised bed platform. Smaller pieces of the bark are braided into rope. Some forest trees also provide edible fruit, such as the “wild avocado”. Dye used to colour handicrafts is extracted from the fruits of *cremai*.

Table 6. Useful plants found in mature forests according to their types across use categories, Ratón, Comarca Ngöbe-Buglé, Panama 2010 (n=41).

Plants Types	House Construction	Food	Handicraft/ Houseware	Ceremonies & Rituals	Multiple Uses	Total	
						Number	%
<i>Woody Plants</i>							
Tree	10	1	7	2	1	21	51
Shrub	1	2	1	1	1	6	15
Liana ¹	2	0	0	0	2	4	10
<i>Non-Woody Plants</i>							
Palm	2	2	0	0	0	4	10
Climber ²	0	3	0	0	0	3	7
Herbaceous	0	2	0	0	0	2	5
Fern	0	1	0	0	0	1	2
Total Number	15	11	8	3	4	41	100
Percent	37	27	20	7	10	100	

1. Woody vine. 2. Thin-stemmed, herbaceous vine.

In addition to trees, six types of shrubs found in mature forests provide food, house construction materials and materials used to make handicrafts and ritual objects. The young leaves of *sögatoro* and *ngubruon* are edible, whereas the leaves of *cuiguion* and *uròn* provide dyes for handicrafts. The bark of *jogue* is used to repel spirits around

⁹ Herbarium samples were only taken for key species. Other plants to date have not been scientifically identified.

houses, while the bark of *cogrogradu* can be used for lashing roof beams. Four types of woody vines, or lianas, are also dried and used for lashing or to make woven baskets, depending on their size.

The community also relies on non-woody plants from mature forests for various purposes (Table 6). Two types of palms provide a culturally important source of food. The heart of *mitdra* (*Prestoea acuminata*) and the male fruits of *ñurun* (*Chamaedorea tepejilote*) are both considered a food of choice in the area. The young leaves and tendrils of *kä*, *ka teguea* (*Sechium venosum*) and *ngrögä* – three types of herbaceous vines, or climbers – are frequently eaten as greens. Two other types of herbaceous plants and one type of fern also provide a wild source of food. The fruits of *kimo*, the young leaves of *mutdü gri* and especially the furled fronds of *ka oguo* (Pteridophyta group), are highly appreciated. Mature forest palms are also a source of construction material. *Juogo* (*Geonoma undata* subsp. *edulis*) leaves, and in a lesser extent *jüoga* leaves, are used for thatching. Bounded in bundles of about a dozen fronds, they are attached to the wood roof frame to create a waterproof roof which resists high winds and heavy rainfall year after year.

6.2 Wild Plants of Particular Concern to Local People

Amongst the long list of useful wild plants, some plants are more important than others for the community, and some appear to be declining rapidly in abundance. Of the 41 useful forest plants identified, a smaller number were selected by the research participants for more detailed study. Men and women, in two separate groups, were asked to select the five plant species that they are most concerned about. Participants were

instructed to choose forest species that are particularly important for the community, which are of concern because of declining availability and which might benefit from some type of special management or protection. Remarkably, there was only one plant species that was chosen by both the men and the women, resulting in a total of nine plants that became the subject of more detailed investigation (Table 7). The following section presents a profile of each of these nine plants, based on information gathered from local knowledge, personal observations and biological literature. For each plant, the plant morphology, distribution, habitat and phenology are provided, and its local use, access and management in Ratón are described. In addition, the local concerns and prospects for sustainable use are discussed.

1) *Juogo - Geonoma undata, subspecies edulis*

Plant selected by: both men and women

Primary use(s): roof material

Other names: pamaca (Gua), capuca (Hon)

Description, distribution, habitat and phenology

Juogo has been described by Henderson (2011) as follows. This understory palm can reach 15m in height, but has been observed up to 7m tall by the residents of Ratón (Figure 11). The solitary stem is brownish and measures up to 6.5cm in diameter, with leaf scars up to 5.7cm apart and without spines. The green leaves can reach 2.65m in length and hold 19-65 pairs of leaflets, which are 45-80cm long. The mature leaves are the principal product used by the Ngöbe people of the area. *Juogo* is monoecious with an inflorescence of up to 50cm long and whitish flowers that are about 4mm long. The single-seeded green fruits are ovoid (4.5-15mm), and turn reddish black as they mature.

Table 7. Ethnobotanical characteristics of the nine plants selected as priorities for further examination, Ratón, Comarca Ngöbe-Buglé, Panama 2010.

Local Ngöbe Name	Local Spanish Name	Binominal Name / Taxon	Plant Type	Use Category	Parts Used	Principal Use
<i>Species selected by both male and female groups</i>						
juogo	penca	<i>Geonoma undata</i> subsp. <i>edulis</i>	palm	construction	mature leaves	roof material
<i>Species selected by men</i>						
ka oguö	calalu	Pteridophyta group	fern	food	young leaves	edible, eaten cooked
mitdra	palmito	<i>Prestoea acuminata</i>	palm	food	palm heart	edible, eaten raw or cooked
mrä	cigua	Lauraceae family	tree	construction	wood	house post
ngri grie	palo de carne	<i>Roupala montana</i>	tree	construction	wood	house post
<i>Species selected by women</i>						
ka teguea	iraka dulce	<i>Sechium venosum</i>	vine	food	young leaves	edible, eaten cooked
ñürün	bodá	<i>Chamaedorea tepejilote</i>	palm	food	male inflorescence	edible, eaten cooked
tugue nigro	bejuco	Araceae family	liana	household items	aerial roots	basket & rope
zoguanda	palo zaino	<i>Trema micrantha</i>	tree	household items	bark	sleeping pad & rope

The *juogo* palm is found mainly from southern Mexico to Panama in lowlands and montane rainforest at elevations between 850-2400m, but it is also found in the Lesser Antilles and the northern Andean regions of South America (Henderson 2011). In Ratón, *juogo* palms are found in the understory of mature, primary forests, and Ngöbe informants indicated (and I also observed) that fruiting occurs primarily during the rainy months of November and December. There are indications that the palm has a widely dispersed distribution in the mature forests in the region, but clusters of this palm are found in managed forests.

Local use, access and management in Ratón

Mature leaves of *juogo* are the prime material used for thatch for houses and other structures, as all households employ it either for their primary or secondary house's roof (Figure 11). Leaves of at least 1 m in length are cut and left to dry out until they have turned from green to a chocolate colour, which takes about three weeks. This is said to prevent damaging leaf-bug infestations. The leaves are then bound together on the ground and attached to the roof structure, which is almost always conical in shape. According to one local resident of Ratón, it takes from 1,000 to 2,000 leaves to thatch a large, traditional house. It is one of the few forest products that are bought and sold within the community. The leaves are bartered or sold locally for \$0.10 per three leaves, which means that the cost of a larger roof would range between \$100 and \$200. According to the survey, about 30% of households in the community buys palm leaves for part or all of their main residence. In general, whereas men are in charge of cutting the leaves and building the houses, women are involved in collecting and carrying them from the forest.



Figure 11. A young *juogo* palm (*Geonoma undata* subsp. *edulis*) (a), from which the mature leaves are a prime thatching material (b), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Roughly three quarters (78%) of households said that the roof of their principal residence is made with *juogo* thatch, whereas the remainder uses corrugated metal sheets. Another 33% indicated having a second thatched roof structure. At the time of the research, the average age of the thatched roofs was eight years, with the oldest ones reaching 20 years. More than half of the respondents with thatch roofs (53%) said that they did not know exactly when they would change the roof material, but that it depended in part on “when they could get the palm leaves” (Local resident, November 2010).

My research indicates that *juogo* is the most actively managed wild plant in Ratón, in terms of the effort invested in maintaining or enhancing its population. Access to *juogo* is highly restricted and limited to the household having control over the plant’s

forest parcel, which restricts collective use and reduces overall harvest rates. Out of the 49 respondents surveyed, nine said that they have a reserve of *juogo* palms within a forest parcel. Today, to limit the impacts of the harvest on individual palms, the palm is not cut down, and a minimum of about one year passes between harvests of a particular individual. Furthermore, when harvesting fronds, a minimum of one mature leaf and all young leaves (less than 1 m in length) are left on each plant for future use. To stimulate the palm growth and the leaf regeneration, a good proportion of the naturally occurring forest plants surrounding the palms are cleared, which significantly improves the light penetration to the understory where the palm grows. While *juogo* occurs naturally in old growth forests, it also survives transplantation into mature secondary forests, a practice done by a small number of people in the community. People who transplant seedlings told me that they do not survive when planted in an unshaded, unforested environment. The detailed, most favorable conditions for growth and reproduction remain unknown.

Although *juogo* leaves could be harvested year round, they are generally harvested during the rainy months, because the strong winds during the summer render the construction of roofs difficult. According to local tradition, the leaves are only harvested during a new moon. As such, seasonal conditions and local traditions tend to restrict the harvesting season to several short windows of a few weeks.

Concerns of the community and prospects for the future

Despite the management practiced in the community, the vast majority of local people in Ratón express concerns regarding the decreasing availability of *juogo* thatch in the vicinity of their village. This is probably due to a combination of deforestation and

the increased demand associated with a growing population. Today, only a few people have forest parcels with a reserve of *juogo* palms. There is high demand for *juogo* leaves, which are needed in large numbers for thatching. At the same time, the community has seen a reduction in the extent of mature forest habitat that the palm requires. In addition, unauthorized harvesting by people from neighboring communities is mentioned as another significant factor contributing to the reduction in the availability of *juogo* thatch, as these people tend to cut down the whole tree when harvesting the leaves.

The active management strategies implemented by the residents of Ratón, which include minimum time between harvests, light management and restricted access, have undeniably improved the availability of this essential palm in the wild. Extending these already existing conservation measures to a broader scale and monitoring harvest levels could improve the abundance and long-term supply of this resource. In Ratón, as in many indigenous communities in the neotropics, palm leaves are an essential construction material. Their declining availability acts as a limiting factor in the capacity of numerous residents in Ratón to build adequate and comfortable shelter.

2) *Ka oguö*

Plant selected by: men
Primary use(s): food, eaten cooked
Other names: unknown

Description, distribution, habitat and phenology

To date, the *ka oguö* fern remains unidentified at the species level due to the difficulty in collecting and analyzing spores. In the study area I observed that this fern measures between 1-1.5m tall at maturity, or full leaf development. I noticed the presence

of soft whitish hair on the stem of young plants, and spines on fully developed ferns. Various stages of development were encountered during my stay during the rainy season but no spores or reproductive fronds were observed. Similarly, the local informants mentioned having never noticed them, which suggests that they may be difficult to detect. The *ka oguö* fern thrives in semi-shaded areas in the proximity of water, and grows on the forest floor in large patches. It is found in openings and on the edges of mature forest, but also in fallows.

Local use, access and management in Ratón

The young, tightly curled frond of the *ka oguö* fern, or “fiddlehead” (Figure 12), is eaten cooked, either boiled in stew or fried. Harvested by 88% of households, this fern constitutes an essential food for the community. One respondent explained that it “is very important because it is [their] own food and because it is a nutritional plant for the entire family” (Focus group participant, November 2010). This is also a highly appreciated food, with one person even saying that he likes it better than meat, one of the most rare and highly valued foods.

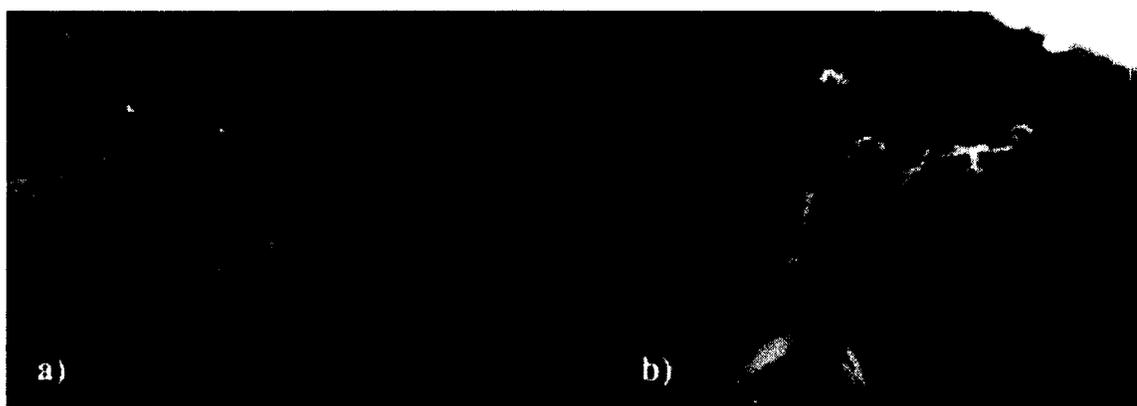


Figure 12. A mature frond (a) and a freshly harvested edible young plant (b) of the of the *ka oguö* fern (Pteridophyta group), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

The plant is not sold locally, but is exchanged or offered as a gift. The *ka uguō* fern is harvested by hand at specific harvesting sites where the plant is found in patches of a large number of plants. Although this plant was selected by men and not by women as a priority for conservation, women reported harvesting the plant at similar rates (see Figure 20). Either the young undeveloped plant is harvested on the ground, or the end part of the almost-mature leaves are cut, both while showing whitish hair. It can be harvested year round, and roughly half of the households reported harvesting it at least once a month. Access to the *ka uguō* fern is generally open, there are no active management practices affecting it, and permission is not required to collect it.

Concerns of the community and prospects for the future

The *ka uguō* fern is very important for the Ngöbe residents of Ratón, as it is a source of food that is available year-round. As a result, the plant's population faces constant demand, which may exceed the carrying capacity of its population depending on the fern's reproductive rates, which are not known. The impact of the harvest would further vary depending on the reproductive strategy of the fern, which remains unknown. In addition to reproducing through spores, some types of fern can grow from spreading of the existing root system or from the proliferation of the tips of their leaves. With this diversified reproductive strategy, the population could withstand higher harvesting pressure.

Furthermore, it is not known how many fiddlehead tops can be harvested per plant without affecting the plant's survival. Harvesting the entire young plant may cause its elimination if the root system cannot resprout and, depending on how frequently this occurs, may have a severe impact on the population. On the other hand, harvesting only

the tip of a fully-grown frond will have a considerably lower impact on the population, as the adult fern can survive this type of harvest. As such, the harvest of the fern's tips should be encouraged over the harvest of the entire young fern, in order to ensure the stability of the population.

In addition to harvest pressures, local informants explained that the *ka oguö* fern is facing a reduction in its habitat in the village surroundings. The fern is negatively impacted by the increasing presence of cattle in the regrowth areas of the mature forests, as the animals trample the young plants and prevent their growth.

3) *Mitdra - Prestoea acuminata*

Plant selected by: men

Primary use(s): food, eaten raw or cooked

Other names: palmito (Pan), tinguiso (Ecu), sierra palm (Puerto Rico)

Description, distribution, habitat and phenology

Mitdra has been described by Henderson and Galeano (1996) as follows. It is a 3 to 15m tall palm showing high variation in its physical characteristics. The stem can be solitary or clustered and may have a cone of roots at its base. I only witnessed solitary stems without aerial roots in the Ratón area. The stem is brownish to grayish with leaf scars, no spines and is 4-20cm in diameter. The green leaves measure from 1 to 2.5m in length and hold 30 to 60 pairs of leaflets, which can reach 1.2m long. The *Mitdra* inflorescences reach 60cm long, and become reddish at maturity of the fruits. The whitish flowers are 2.5-6mm long. The globose fruits are single-seeded, green becoming black at maturity and measuring about 1cm in diameter.

According to Henderson and Galeano (1996), *Prestoea acuminata* ranges from

southern Mexico to northern and western South America, including Central America and the Caribbean. In Panama and Central America, the variety *P. acuminata* var. *acuminata* is the most widespread form, common in forested mountainous regions. It is found above 1000m in altitude in regions of high rainfall in scattered patches and usually on steep slopes. In Ratón, the *mitdra* palm only occurs in mature forests at higher elevations (i.e., above 1600m), and is highly dispersed. In general, one adult is found with numerous juveniles nearby. My informants did not know about the phenology of the *mitdra* palm, but I observed during my stay that inflorescences and mature fruits were both present in November.

Local use, access and management in Ratón

Mitdra is an important wild forest food, although it is harvested less frequently than other species (see Figure 20). The terminal bud of *mitdra*, also known as apical meristem or palm heart, is consumed cooked, either boiled or roasted. When working in the forest, traveling or hunting, *mitdra* is also eaten raw. *Mitdra* is offered as gift, but it is not sold locally, and does not seem to have monetary value.

The local harvesting strategy of *mitdra* is primarily opportunistic, which means that there are no specific harvesting sites visited on a special trip. This is primarily due to the fact that no more than one adult *mitdra* is found in an area and that there is a single harvest of palm heart per palm, as it does not survive the harvest. The palms are encountered while working in the forest, traveling or while harvesting other plants. As a result, *mitdra* palm hearts are harvested by more men than women (see Figure 20).

The palm is first cut down using a machete in order to reach the part about 2m below the palm crown. The outer fibers of the stem are then removed, and the fresh,

white terminal bud inside it is extracted (Figure 13). The palm heart of *mitdra* can be harvested year round, but the plant needs to be at least two meters in height. When the plant is higher than two meters, the edible leaf bud does not grow significantly larger.



Figure 13. A man harvesting a palm heart from the *mitdra* palm (*Prestoea acuminata*), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Any *mitdra* adult palm and the juveniles found in proximity are kept when clearing the understory of an area for later use. The plants around them are cleared in order to improve the light availability and to lessen environmental competition. Weeding around the seedlings and juveniles following the harvest of the adult is not necessarily done. Local residents further explained that the palm does not survive transplantation in secondary forests or in other environments. Overall, given that the *mitdra* palm is locally rare, difficult to propagate, and is found only in remote areas of the primary forest, active management of its population is limited.

Concerns of the community and prospects for the future

All of the informants expressed concerns about the rapid diminution of *mitdra* in the primary forests of the community. According to the survey, 92% of respondents believe that the plant is declining and the rest don't know how its abundance may have changed. The reduction in extent of the primary forest is an important cause, but I observed that a lack of awareness about the palm reproductive biology might have misled some of the harvesting techniques, and as such, may have been preventing the population from replenishing. All informants mentioned that they do not know how the *mitdra* palm reproduces, what happens to the numerous seedlings after the adult is cut down, or why only a single adult palm is found in a given area. Some experimentation has occurred but no transplantation attempt has been successful to date. A local resident suggested that the concentration of juveniles in the proximity of an adult palm might be explained by vegetative reproduction, like banana plants.

The knowledge of the palm biological reproduction in the literature is also limited (Ervik & Feil 1997). Nevertheless, one study suggests that *Prestoea* reproduction is primarily done through seeds (Ervik & Feil 1997), and another study on the subspecies *P. acuminata* var. *montana* demonstrated that they "do not sprout and cannot be rooted by ordinary means" (Lugo, Francis & Frangi 1998), which indicates that the vegetative reproduction of *mitdra* is unlikely. However, a subspecies of the *Prestoea acuminata* palms, widespread in the Ecuadorian Andes, has clustering stems. For this variety, cutting one or even few stems does not induce the death of the clump (Svenning & Balslev 1998). Nevertheless, in the Ratón area there has been no indication of clustering stems or the ability of part of the palm to survive the harvest.

Furthermore, the reproductive rate of *mitdra* may be affected by a large minimum reproductive height and a low dispersal capacity. A recent study on the factors affecting the distribution of mountainous palms in Ecuador suggests that *P. acuminata* is dispersed by mammals or birds (Svenning et al. 2009). According to the author, this method of dispersion tends to lead to a short dispersal distance, especially when compared to wind-dispersed seeds. This dispersal limitation could explain the proximity of numerous seedlings as well as the scarcity of the palm in the forest. Another study stated that the *P. acuminata* of Ecuador has a minimum reproductive height of 3m and suggests that it has a slower growth rate than other palm species (Svenning 1998). While the *mitdra* palms in Ratón have been seen with inflorescences on palms smaller than 3m tall, this fact highlights that the harvest may be done when the palm has only had a small number of reproductive seasons. A slow growth rate means that the palm's population necessitates a longer time period to recover, which further decreases the rate of sustainable harvest. As such, a reduction of its habitat, a low reproductive rate, a short dispersal distance, and the impact of the harvest on the individual plant and on its reproduction seem to be the key factors in the observed diminishing population of *mitdra*.

A study on *P. acuminata* var. *montana* found that light availability strongly influences the seedling's and juvenile's growth, as well as improve the reproductive rate of adults (Lugo, Francis & Frangi 1998). The practice of weeding the adult palms, which is already in place in Ratón, should be pursued to promote the survival of juveniles, and a continuous weeding of *mitdra* seedlings and juveniles following the harvest of adults should be encouraged as it has the potential to improve their growth. Care should be taken to prevent the trampling of young palms by cattle in areas where this is a potential

risk. Furthermore, increasing the minimum size of harvest to be larger than the minimum reproductive age, which remains to be determined, should increase the *mitdra* reproductive rate. These measures, along with the protection of its habitat, would help the palm's population to recover. More research is needed to understand the palm's requirements for sprouting and transplantation. *Mitdra* is an important forest food, as it is one of the few that can be eaten raw.

4) *Mrä* - Lauraceae family

Plant selected by: men
Primary use(s): house post
Other names: unknown

Description, distribution, habitat and phenology

The identification of the *mrä* plant is still pending; to date we know that it belongs to the Lauraceae family, a large family of trees and shrubs, which Perez (2011a) describes as follows. The leaves are simple and generally alternate, with entire margins. The inflorescences can be arranged in spikes or raceme, either axillary or terminal. The small flowers can be unisexual or bisexual. The fruit can be a berry or a drupe, and usually have a cup-shaped persisting cap.

In Ratón, local residents distinguish between three types of *mrä*, after the color of their fibers: *mrä sübrüre* (yellow), *mrä ngwe* (white) and *mrä tain* (red). These variations may indicate that we are dealing with three varieties of a single species, or three distinct species. Local informants explained that the *mrä* trees can reach 30m in height (Figure 14), and that small acorn-shaped green fruits are present from October to December. They further state that the *mrä* trees grow primarily in mature forests, but are also found

occasionally in younger secondary forests.

Local use, access and management in Ratón

Mrä trees provide a prime construction material for the residents of the area (Figure 14). According to the survey results, it is the main tree used to make house posts, used by 88% of the respondents. The heartwood is especially solid and can withstand rot better than other species when placed in humid soil. The tree, which must be at least 1.5m in circumference, is cut down and sculpted to the right shape, before being put in place, partly buried. According to local informants these posts can last for many decades. In contrast with other species, *mrä* trees are recognized as being owned privately by individuals, and few people (4/49) mentioned having a reserve of these trees on their forested parcels. The post or tree can be purchased for \$10-15, but this is not a common practice, as only a small number of people mentioned having bought them in the past (8/49). There was no mention of transplantation in Ratón, but the trees are left standing when clearing a forested area for agricultural purposes. Men are the ones in charge of cutting *mrä* trees down and building houses.

Concerns of the community and prospects for the future

Local residents are concerned about the reduced availability of *mrä* trees in the area. The vast majority of the respondents (88%) said that the abundance of this tree has recently diminished; the remaining 12% did not know. Deforestation together with the constant demand and regular harvest of this species for its timber is thought to have led to a relative depletion of the population around the village. To date, there are no customary conservation measures in place to ensure its long-term survival. Little is known about the extent to which *mrä* populations can be improved through either manual reproduction or

the transplantation of seedlings. As a result, the identification and protection of seedlings and juveniles should be promoted.



Figure 14. An adult *mrä* tree (Lauraceae family) growing in the village (a), which is one of the preferred species for making house posts (b), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

5) *Ngri grie - Roupala montana*

Plant selected by: men

Primary use(s): house post

Other names: palo de carne, carne asada (Pan)

Description, distribution, habitat and phenology

Ngri grie (Roupala montana) has been described by Perez (2011b) as follows. It is a medium-size tree, measuring between 5-20m in height and 10-50cm in diameter (Figure 15). The trunk is straight and grayish-brown. Leaves are always alternate and thick, but vary in form. Juvenile trees tend to have compound leaves measuring 3-15cm, with 5-12 opposite or alternate leaflets of lanceolate shape with a pointy tip. Adult trees

tend to have simple leaves measuring 5-12 cm long by 4-10cm wide, egg-shaped with pointy end. A given tree may also feature both types of leaves on branches that are close to one another. The yellow flowers are arranged on a spike-shaped inflorescence growing at the junction between the stem and the petiole. The green fruits measure 3cm long, hold two winged seeds and turn black when mature. The flowers and fruits are present from January to July. According to Chizmar and colleagues (2009), the *ngrie grie* tree ranges from Mexico to Brazil. In Panama, this species is common at low and medium elevations in secondary forests, and grows as a small tree or shrub in dry, open areas on the Pacific slope (Perez 2011b). In Ratón, this tree grows primarily in mature forests, but is also found in younger secondary forests. Its name, literally “meat stick/wood” comes from the dark-red color of the inner bark and from the strong smell emanating from the leaves and small branches when broken (Figure 15).

Local use, access and management in Ratón

The timber extracted from the *ngrie grie* tree is highly valued by the residents of Ratón. It is considered one of the most durable species, but only 67% of the respondents currently utilize it. It is used to make the main pillars in houses, as well as a broad range of other items, such as axe handles and fence posts. Trees measuring at least 1.5m in diameter are cut down and sculpted by men. The *ngrie grie* trees are owned by individuals and can be purchased for \$10-\$15, regardless of the size of the tree. Out of the 49 respondents, one mentioned having reserved a section of his land for the tree and eight mentioned having bought it. In terms of management practices, the trees are left standing when community members clear a forest patch, but according to the informants no other methods are used to enhance its reproduction in Ratón.



Figure 15. A *ngrie grie* tree (*Roupala montana*, “meat wood”) (a) with a close up of its leaves and the dark red color which gives it its name (b), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Concerns of the community and prospects for the future

The reduced availability of the *ngrie grie* tree in the area is of concern for the majority of the residents (88%). As with other species, depletion is likely a result of the combined effect of the decreasing extent of the primary forest and the constant demand for its timber. Apparently no active conservation measures have been implemented to date, and the potential for manual reproduction and transplantation remain unknown. The early identification and protection of seedlings may be the single most important measure in improving the *ngrie grie* tree population in the area.

6) *Ka teguea* - *Sechium venosum*

Plant selected by: women

Primary use(s): food, eaten cooked

Other names: unknown

Description, distribution, habitat and phenology

Ka teguea is described as a climbing plant (Tropicos 2011). *Ka teguea* is in the same genus as chayote, both belonging to the Cucurbitaceae family (Lira 1996), and was previously known as *Frantzia venosum* (Lira & Chiang 1992). The *ka teguea* stem is simple, thick and woody at the base and becomes herbaceous, highly branched, thin and crisp toward the apex (Figure 16). The green, heart-shaped leaves are 6-16 cm long and almost as wide, with symmetrical teeth on the margin. The tendrils have 3-5 branches, and the root formation is unknown. The plant sometimes has small hair on the stem, tendrils or leaves. The flowers are yellow-green, the females are solitary and the males are clustered on a raceme-shaped inflorescence measuring 10-26 mm long. The small fruits (approx. 3 mm) are green turning to brownish as they mature.

The plant grows in evergreen forests of Costa Rica and Panama at elevations up to 1,650m (Lira & Chiang 1992, Tropicos 2011). In Ratón, it grows in semi-shaded areas of mature forests, along streams, roads or in gaps. According to the literature (Tropicos 2011), the flowers and fruits can be found throughout the year. I observed flowers during the rainy seasons, from September through November, but no fruits.

Local use, access and management in Ratón

The young part of *ka teguea* is widely eaten as greens by Ngöbe households in the area (82% of survey respondents). Its year-round availability renders this plant an important food source. The tender part at the apex, including young leaves and tendrils, is

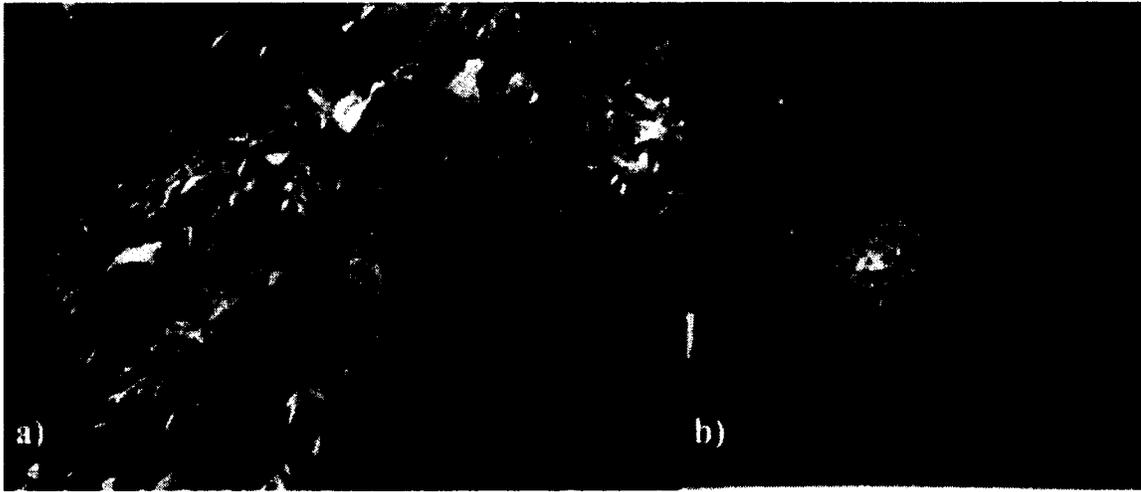


Figure 16. A patch of the *ka teguea* (*Sechium venosum*) edible vine (a), and its freshly harvested young leaves (b), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

boiled in soups, added to rice or cooked with meat. *Ka teguea*, which was selected as a species of concern by women, is generally harvested by women at least once per month at specific harvest sites (see Figure 20). The plant is not sold locally, but is exchanged and offered as a gift. Access to *ka teguea* is generally open, and permission is not required to collect it from forest areas of other people. The edible and soft part of the plant is usually cut using a machete; either the plant is cut right below mature leaves – a piece about 40 cm long (Figure 16) – or the young terminal part of the plant is cut with all individual young leaves. To limit the impact of the harvest on the plant, the stem is not cut beyond the mature leaves or further than 1m from the end. According to local informants, cutting it further would prevent the plant from regenerating and would likely result in its death. Aside from this practice, no other active management practices are done in Ratón.

Concerns of the community and prospects for the future

The population of *ka teguea* is considered to be declining by the majority of

residents who were surveyed (92%). This important edible plant is under pressure from a constant, year-round harvest. Although there are no customary conservation measures in place to date, the residents mentioned harvesting it only if there is “enough”, which suggests a sense of awareness about the plant’s harvesting capacity and recognition of the need to leave some plants for future reproduction. The impact of the harvest on the plant’s reproduction and survival remain unknown, but the informants believe that the plant survives if its stem is not cut further than 1m from the end. This plant is not considered threatened by a loss of habitat, as it grows in mature forest openings.

7) *Ñürün - Chamaedorea tepejilote*

Plant selected by: women

Primary use(s): food, eaten cooked

Other names: bodá (Pan), palmito dulce (CR), pacaya, tepejilote (Mex)

Description, distribution, habitat and phenology

Henderson and colleagues (1995) and STRI (2011a) together offer a complementary description of the *ñürün* palm. *Ñürün* is an understory palm reaching 7m tall. Its green stem, generally solitary, is about 5cm in diameter, without spines, with leaf scars along it and roots at the very base. The green leaves reach 2.5m in length and can hold up to 25 pairs of leaflets. The latter are 40 to 60 cm long and narrow abruptly toward the end, becoming pointy. *Ñürün* is dioecious with one to three spear-shaped inflorescences of various stages. These grow up to 40cm in length, become bright orange and erects when the fruits mature. Both male and female inflorescences have a similar cluster of white flowers up to 5mm long. The female flowers, though, are markedly thicker, more erect and less densely crowded than male ones. The green fruits are oblong, less than 2cm long and turning black at maturity.

Ñürün ranges from southern Mexico to Colombia up to 1600m in elevation, but is generally uncommon. In Panama, it is known in tropical moist forests and premontane wet forests throughout the country. Flowers appear mostly from the late rainy season to the early dry season, and fruits mature primarily from the late dry season to the late rainy season. In Ratón, *ñürün* is found in the shade of mature forests, particularly along streams or in forest openings. A small number of adult palms are often found together, with many juveniles close by.

Local use, access and management in Ratón

The male inflorescence buds are a highly appreciated food in Ratón. The white part of the inflorescence is taken off the hard shell and is either roasted or boiled by women. It is eaten like a vegetable generally in combination with cooked green bananas. A study of the nutritional content of *ñürün* indicates that it is a good source of vitamins and minerals, especially iron and vitamin C (Castillo et al. 1994). *Ñürün* edible inflorescences are commonly offered as gifts or exchanged within the community. They can also be sold locally at a price of \$1 for 7-12 inflorescences and up to \$0.25 each in towns such as San Felix.

Ñürün is harvested in the wild by the vast majority of the residents of Ratón (84%). Although it was selected as a priority by women, it appears to be harvested somewhat more commonly among men than women (see Figure 20). Its access is restricted to the household who controls the parcel of forest in which it is found. The harvest season ranges from September to February. The male inflorescences are cut by hand or using the machete just before they open (almost ripe) or once they have already opened (ripe) (Figure 17). There is no reported minimum size for harvest other than when

the inflorescence seems almost ripe. Some residents of Ratón mentioned that the palm could be transplanted to secondary forests, but not to unforested environments. No weeding is done around the plant, as the palm is found in areas with relatively good light, such as along creeks, on steep slopes or in canopy openings.



Figure 17. A man harvesting an edible inflorescence from a *ñürün* palm (*Chamaedorea tepejilote*) along a creek, Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Concerns of the community and prospects for the future

In the past, the residents of Ratón use to consume the female palm's heart (terminal bud), which lead to the death of the palm. Concerns for the reproduction of the

dioecious species has led the residents to suspend the harvest of female plants in order to ensure a long term supply of the edible male inflorescences. Today, the vast majority of people in Ratón express concerns regarding the scarcity of *ñürün* in the forests found in the vicinity of their village. However, the academic literature indicates that *ñürün* is generally uncommon in tropical moist forests, more so above 1600m in elevation (Henderson et al. 1995, STRI 2010a). It should therefore not be expected to find this type of palm occurring naturally in high density in the forested environments surrounding Ratón, as the elevation there ranges from 1400m to above 2000m.

Local residents also expressed concerns about a diminution in the availability of *ñürün*, which they attributed to a reduction in the extent of its habitat, the mature forest. From my observations, depletion may also be related to the harvesting practices, which may lower the reproductive rates of the palm. In fact, the collection of the male inflorescence before it opens (unripe) is frequent, which indicates that it is harvested before the fertilization of the female flowers can occur.

The informal ban on the consumption of female palm hearts in Ratón demonstrates that the residents are aware of the impact of harvest on wild plant populations, and that they are able to implement effective conservation strategies. Further active management practices, such as improved light management and weeding of juveniles to reduce environmental competition, could also improve *ñürün* population status over the long term in the wild. In addition, setting a minimum developmental stage of the inflorescence for harvest could limit the impact of the harvest on the palm's reproductive rate. Harvesting the male inflorescence when it is opening (ripe) would improve the chances that some of the pollen has the time to fertilize the nearby female. It

remains unclear whether human-assisted fertilization would be an effective measure, but this could be tested under experimental conditions.

In various countries such as Guatemala, Nicaragua and Mexico, similar varieties of the palm are cultivated for food or for their ornamental leaves (Castillo et al. 1994). As a result, there is a strong probability that the plant could survive if the seedlings were transplanted to the village and subsequently cultivated. Furthermore, a San Felix-based study is currently examining ways to improve the cultivation of the male *nürün* through in vitro multiplication (IDIAP 2010).

8) *Tugue nigro* - Araceae family

Plant selected by: women

Primary use(s): basket & rope for lashing

Other names: unknown

Description, distribution, habitat and phenology

The identification of the *tugue nigro* is still pending; currently, all that is known is that it belongs to the Araceae family, a large family of flowering plants. Several of its characteristics, however, were documented during field research. *Tugue nigro* is a woody epiphyte vine. The strong but flexible roots hanging from the canopy all the way to the ground do not have latex. The woody and solid branches can reach 2cm in diameter. The large dark-green blades have the distinctive holes of the *Monstera* genus (Figure 18), and the ones collected during my stay measured 28-48 cm long by 23-40 cm broad. The large inflorescence is accompanied by a bright red spathe. The *tugue nigro* vine grows at the edge and in gaps of dense mature forests, living in trees at least 8m from the ground. It grows in patches; many plants were found in a single site or a single tree. Given the

pending identification, its distribution and phenology are currently unknown. In Ratón the plant was flowering in November, during the rainy season.



Figure 18. The leaves of a *tugue nigro* vine (Araceae family) (a), and its aerial roots hanging down from the canopy (b), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Local use, access and management in Ratón

The long roots of the *tugue nigro* vine that hang from the trees (Figure 18), referred to as “tallos” in Spanish (i.e., stems), are used by 73% of the community’s residents. The strength and flexibility of the aerial roots make it a prime construction and handicraft material. It is used as a rope, especially in building houses, but also in making carrying baskets. This plant product is available year-round, and is generally harvested by men, who are traditionally in charge of construction and basket weaving. The aerial roots of the vine are cut close to the ground using a machete and vigorously pulled out from the tree. The transformation of *tugue nigro* into rope consists first in peeling out the outside

part of the stem, and then in enrolling and soaking the whitish inside fiber in a large quantity of water. The residents explained that the plant is not harvested on a regular basis, but rather when it is needed, for example when building a new house.

The *tugue nigro* vine survives the harvest and its reproductive capacity is thought to be unaffected by it. As such, it is likely that the plant's population is not severely affected by the harvest itself. There is no active management of the *tugue nigro* vine in Ratón, which may be due to the fact that the plant lives high in the tree canopy and is inaccessible. Some residents have designated harvest sites in which they preserve the trees to provide both support and shade for this species, fostering its growth and regeneration. The harvest of the plant is restricted to the forest parcel owner, but access is commonly granted to extended family members. While there is no economic value associated with the *tugue nigro* vine itself, the baskets can be exchanged, offered as gifts or sold for a few dollars. The rope made from this vine is generally exchanged or offered, but is not widely sold given the availability of plastic rope for sale in Ratón.

Concerns of the community and prospects for the future

There are concerns within the community of a decreasing availability of the *tugue nigro* vine in the forests of Ratón, as was mentioned by 86% of the survey respondents. The reductions in mature forests coupled with the high demand for the rope, an indispensable material in house construction, have resulted in a depletion of the plant in the surrounding forests according to local residents. The relative inaccessibility of the plant, however, prevents the implementation of active management practices. Given the difficulties associated with seed collection, propagation by stem cuttings would be more appropriate. For the plant to be useful, though, the aerial roots need to be very long, thus

necessitating a very old and tall plant. As such, protecting harvesting sites remains the primary way of managing this type of woody vine. The continuity of existing harvest sites and the creation of new ones are crucial to ensure a long-term recovery of the population of the *tugue nigro* vine.

9) *Zoguanda - Trema micrantha*

Plant selected by: women

Primary use(s): sleeping pad and rope for lashing

Other names: ixpepe (Mex), zurrumbo (Col), tortolero (Ecu), needletree (USA)

Description, distribution, habitat and phenology

Zoguanda has been described as a medium-sized monoecious tree, ranging from 5 to 20m tall (STRI 2011b). The thin bark has a light brown color with prominent lenticels (Figure 19), and the inner bark is beige. The oblong leaves are simple and alternating, measuring 5-15 cm long by 2-5cm wide, with serrate to subentire margins. The inflorescences, growing at the junction between the stem and petiole, grow up to 1.5cm long. The small flowers are 5-parted, with similar males and females ranging from greenish to whitish in color. The green fruits turn red at maturity and are ovoid, measuring 3-4mm long. The flowers and fruits appear principally in the rainy season. In Ratón, flowers were observed in November, the late rainy season. The *zoguanda* tree ranges from the United States to Argentina and grows occasionally at the edge of clearings and rarely in dense forests. In Panama, it is a common species, present in mature secondary forests and in disturbed areas of low and medium elevations featuring humid and very humid climates (Perez 2011c). Similarly, the tree grows in mature forest gaps and openings surrounding Ratón, as well as in clearings. According to Perez

(2011c), the species shows important morphologic variations depending on in which habitat it grows. He explains that the same species of *zoguanda* tree can reach 20m in height in mature forests, whereas it rarely grows more than 5m tall in open areas, environments in which it also develops smaller leaves and begins its reproduction at a younger age. According to CONABIO (2011), this tree has a rapid growth rate and a life span of about 30 years.

Local use, access and management in Ratón

The inner bark of the *zoguanda* tree provides a resistant fabric, which is used as sleeping pad and to make rope by the Ngöbe inhabitants of the area. According to the survey, 71% of the residents currently use this species. The bark is peeled from a tree of at least 1.5m of circumference. The outside part of the bark is removed to keep the inner bark. It is then softened through repeated cutting with a machete, a task generally carried out by women (Figure 19). The resulting fiber is relatively soft, flexible and strong. The large pieces of fabric are placed on the sleeping area, either directly on the ground or on a raised wooden platform, primarily to reduce humidity coming from the ground. A sleeping pad made out of *zoguanda* can be sold for \$7, and only a small number of respondents (7/49) answered having bought theirs. Smaller pieces of the bark are cut in strips and braided to make rope. The wood of the tree can be used to carve small objects or as firewood, as long as it is located close enough to home to carry it. The majority of respondents have at least one *zoguanda* tree on their parcel (67%), either in mature secondary forests or in other habitats. The tree is left standing when clearing an area, but no one I spoke with reported collecting seeds or transplanting seedlings. The bark of the *zoguanda* tree can be harvested when the tree's circumference reaches about 1.5m, which

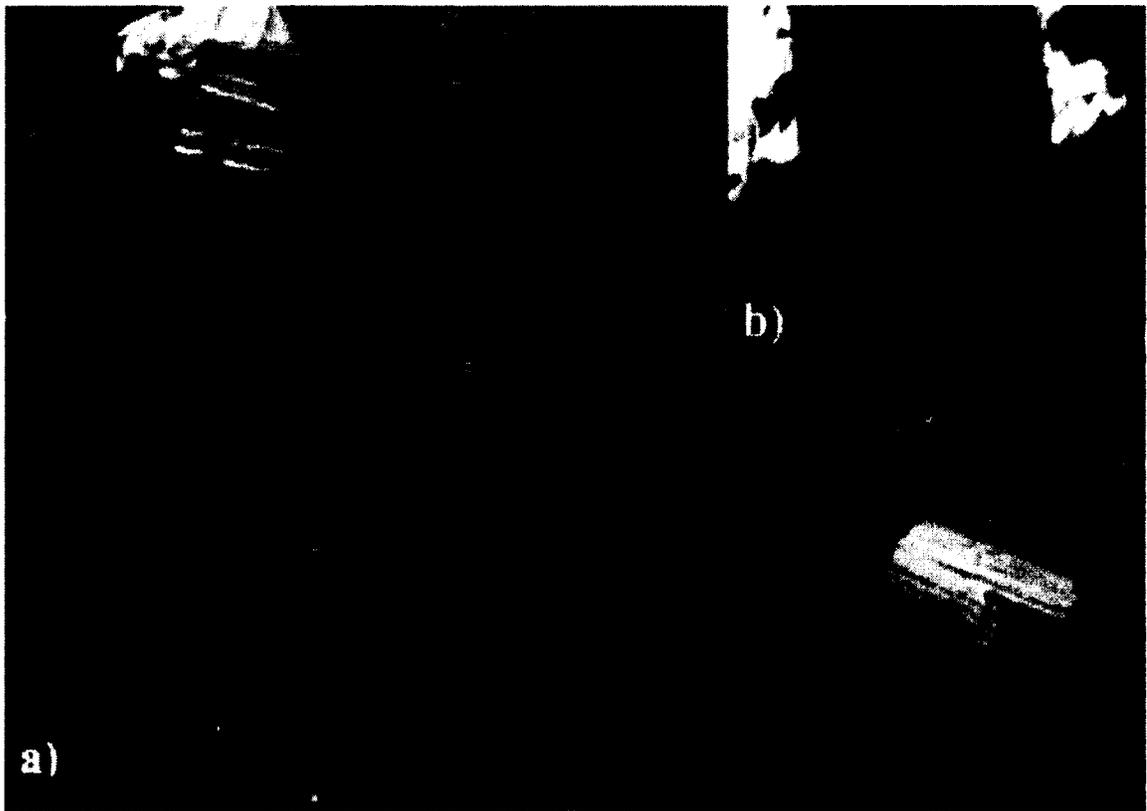


Figure 19. A woman explaining how to make a sleeping pad (a) out of the inner bark of a *zoguanda* tree (*Trema micrantha*) (b), Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

takes about 10 years. Each tree can only be harvested once, as it does not survive the harvest. The use of the *zoguanda* tree bark is therefore destructive and restricted to its owner, generally the household claiming ownership of the given land parcel.

Concerns of the community and prospects for the future

The vast majority of the residents of Ratón (90%) expressed concerns about a diminishing occurrence of the *zoguanda* tree in their area, and the others didn't know how the abundance had changed in the past. It became clear during the focus groups that the species is valued because of its practical importance and because it is considered to be a Ngöbe traditional plant. The harvest of the *zoguanda* bark undeniably leads to the death of the individual tree, but at the time of the harvest a mature tree has likely had several

reproductive years, assuming the appropriate ecological conditions were met. Given that this tree grows in mature forest clearings, the loss of mature forests does not necessarily result in the elimination of suitable habitat. Given its rapid growth, short life span and good adaptation capacity, the species indeed presents great potential for reforestation (CONABIO 2011).

One resident mentioned that some of their *zoguanda* trees had died in a field cleared a few months earlier before having reached their expected size. In other areas, the tree's leaves are known to be susceptible to fungi and insects (CONABIO 2011). Furthermore, although this species thrives in open areas, the effects of drastic canopy removal on adult trees in this type of environment remain to be studied. Research on the causes of death for this tree could help inform its management and prevent further losses.

Another area deserving attention is the threat originating from the introduction of cattle in areas suitable for the germination of the *zoguanda* seeds. As with other tree species, cattle may be severely damaging the seedlings and young trees by trampling on them, which in turn could have negative repercussions on the *zoguanda* population. The protection of seedlings with physical barriers may therefore be the single most important step in improving the *zoguanda* tree population in the area.

6.3 Differentiated Use of Wild Plants from Mature Forests

The use of wild plants from mature rain forests is known to vary according to gender (Kainer & Duryea 1992, Rocheleau & Edmunds 1997, Wayland 2001) and between households (Coomes 2004, Coomes et al. 2004, Godoy et al. 1995). Examining the differences in use within the community can help in developing a more rigorous

understanding of how the concerns for wild plants differ between genders and between households. Understanding these differences is useful if one wants to incorporate a diversity of voices into the development of conservation priorities.

Differentiated use and concerns: The gender dimension

Within the community, men and women have different daily activities, which influence their use of and concerns for wild plants. Men spend considerably more time in mature forests than women, they are generally the ones in charge of managing mature forest areas. But women also harvest mature forest plants, mainly in the small patches of suitable forest habitat found closer to the village; in addition, they are involved in the transformation or the use of nearly all mature forests plants that are harvested by men.

The gender dimension of plant use is best illustrated through an examination of how men and women prioritized plants differently. When examining the plants considered of special concern by men and women (see Table 7), we observe that they chose almost completely different sets of plants, with the exception of *juogo* that both groups selected. While the uses of three of the species selected by each gender are similar – thatching and food – the two other species chosen are different. Following the gendered division of labour, women selected two plants primarily used in making handicrafts whereas men selected two plants useful in making house post, reflecting their different responsibilities. As such, both groups chose species according to their own understanding of utility, which is shaped by their daily activities.

Similarities and differences are also revealed when one compares the full species lists developed by both genders. In our three-hour workshop, men (14 participants) and women (12 participants) independently listed a similar number of useful wild plants from

mature forests (Table 8). There was a lot of overlap between the lists, as at least half the plants listed were identified by both groups, but at the same time about one third of the plants were uniquely listed by either men or women. There was no significant difference in the proportion of plants listed under each category of use.

All but one of the nine targeted species were identified by both groups during the overall listing of useful plants, which underlines their importance for the community members. The one plant in question, the edible *ka teguea*, was not listed by women even if their group chose it as a conservation priority. This omission is likely due to a transcription error.

Table 8. Gendered distribution of knowledge of useful plants across four use categories, Ratón, Comarca Ngöbe-Buglé, Panama 2010.

Category of Use	Listed by Women only	Listed by Men only	Listed by Both men and women	Unknown*	Total Plants listed
Construction	2	4	6	3	15
Edible	0	2	8	1	11
Handicrafts / Housewares	2	0	3	3	8
Ceremonies & Rituals	1	1	0	1	3
Multiple Uses	1	0	3	0	4
Total	6	7	20	8	41

* The gender who identified these plants was not recorded

Despite these similarities, there are also differences in the forest plants listed by men and women. While 20 species were listed by both groups, six plants were listed by women only, and seven were listed by men only. Men identified more plants under the construction and food categories, while their female counterparts listed a slightly higher number under the handicraft and housewares category. For example, men identified a lesser-known palm, *jüoga*, from which the leaves can be used as thatch material, and a

type of shrub, *cogroguadu*, which provides bark that can be used to make rope for construction. Women, on the other hand, listed *cremai*, a tree from which dye can be derived and can be used in making handicrafts, and *kö guatda*, a woody vine from which baskets or rope are made. Furthermore, out of the six plants only listed by women, five were trees.

These findings therefore indicate that men and women are both knowledgeable about a wide range of mature forest plants. The fact that both men and women identified useful plants outside of their “gender sphere” reveals that plant knowledge is shared within the community and that men and women have different roles in the collection, transformation and use of wild plant products.

Overall, the findings indicate that men’s and women’s use of and concerns for useful plants show both similarities and differences. The findings thus underline the importance of getting insights from both groups, even when researching areas which seem to belong to one or the other traditional gender speciality.

Differentiated reliance on useful plants based on household assets

Most households in Ratón cannot afford to buy more than the most basic commercial goods (e.g., salt, machetes, clothes). As a result, they rely primarily on the harvest of forest plants to meet a variety of needs, such as construction materials. There are, however, variations in the dependence on wild plants depending on each household land, economic and familial assets (Coomes et al. 2004). As discussed in the previous chapters, there are significant variations between households regarding their subsistence strategies, especially their access to income (cash or subsidies) and to mature forest resources (see for example Figure 4 and Table 3 in Chapter IV). Furthermore, the extent

of the familial network of a household has an impact on the potential for barter and the support in terms of traditional familial reciprocity. All together, the assets influence the household reliance on forest resources.

The land tenure system is an important dimension of overall wealth and a critical factor that determines access to wild plants. In Ratón, it is a source of both challenges in terms of equitable distribution within the community, as well as prospects for the conservation of wild plants. Whereas some households have control over large areas of mature forests, most have only small fragments within their farmlands, and some do not have any. The households having control over large forest areas can plan for the sustainable, long-term use of the plants, because they, or their descendents, will be able to receive the benefits of the efforts that they put into plant management. However, as they keep plants for their own consumption, they also restrict the other households' access to them. As a result, most residents of Ratón rely on their kin to give them access to essential useful plants, and do not have much control over their management. The same can be said for the community as a whole. At present, conservation primarily occurs at the family or individual levels. Furthermore, some families are large and well-established, while others have only recently arrived and have a limited number of close relatives in the area. One household, for example, had experienced difficulty in obtaining a small parcel of land for subsistence agriculture, let alone additional reserves of mature forest. Typically, the larger the network of a household, the better its chances are to gain access to useful wild plants and other reciprocal benefits.

Because access to assets such as land and cash differs so much within the community, the effect of a reduction in the availability of useful wild plants will not be

felt uniformly. The households with large forest parcels, with formal employment and which are considered asset-rich, are less likely to suffer. For the asset-poor households, there are fewer options when their access to forest products changes. Not only do they not have cash to mitigate any lack of forest access, but they are also less able to rely on their families for support. Useful plants are likely to represent the only source of essential materials, such as construction materials, and if these are not available then these households face increased difficulty. At the same time, these are the households that have the least control over the future of mature forests and the wild plants resources that are found in them.

Research on the use of wild plants and on the fate of mature forests should therefore try to include the perspectives and priorities of households with different combinations of assets.

6.4 Patterns of Harvest of Useful Wild Plants

There was a wide consensus within the community regarding the fact that plant availabilities near the village were reduced in past decades. Examining where and how often people harvest plants can help us in understanding the level of influence that factors such as land tenure and gender have on the use of different plants.

Harvesting strategies

There are two broad harvest strategies that can be noted in Ratón. Firstly, some plants are collected through special, directed harvest trips; people travel to specific sites where the plants are known to be found. This strategy is used when harvesting large plants, such as trees, or plants growing in patches. For example, *juogo* is found in patches in reserves specifically created for this tall palm. Harvesting and transporting the palm

requires time and energy, which necessitates planning the trip in advance. Most construction materials are acquired through this type of harvest. The edible *ka oguö* fern is another example, as this small plant grows in patches in concentrated areas.

Other plants are harvested primarily through opportunistic gathering – when plants are encountered while doing other activities. These harvests happen when travelling along paths or while doing other activities in the forest, such as clearing, hunting or harvesting other plants. Although this type of harvesting is called opportunistic, it is noteworthy that through the frequent use of the paths, forests and useful plants, the residents have become intimately familiar with the area and often have a good idea of where to find even some of the scarcest plants. Both genders use a combination of these two strategies, sometimes during the same trip.

Locations of harvesting zones

Mapping the spatial patterns of the wild plant harvests would require a lot of time and effort, as noted by Roth (2009). Given that male and female residents of Ratón perform different daily activities, harvesting patterns and favourite harvesting sites are likely to vary widely between individuals and between genders. Furthermore, the physical environment, seasonality and land tenure influence the patterns of harvest of wild plants. The findings nevertheless give an idea of the general location of harvesting zones.

The results of the sketch mapping sessions in particular reveal that the majority of harvesting sites are located on the northern side of the continental divide, about two to five km from the village as the crow flies, which is a long walk from the village given the rugged topography. Fragments of mature forest are also found just outside of the village,

which host a few edible plants of concern – *ñürün*, *ka teguea*, *ka uguö* and *tugue ningro*. In addition, scattered within agricultural areas and within the village area are some individual *mrä* and *ngri grie* trees. These may well be examples of trees that had previously existed in mature forest and were spared during clearing, and are now found in the non-native environments that have replaced the cleared forests – young secondary forests, fallows or cultivated areas. According to two local informants, while some trees were strong and healthy, others showed signs that these habitats are not suitable and will not survive much longer. Their reproductive capacity in these new environments remains unknown. Despite this, the continuing presence of some of the most important useful wild plants within a half-hour walk of the village suggests that the impacts of overharvesting have been limited. It may also be the case though that current harvest levels have not been occurring long enough to deplete these resources.

As such, although the distant mature forest is controlled by only a handful of people, this serves as an important harvesting area for a great number of residents. The small and fragmented mature forests patches closer to the village are also important harvesting zones, and their persistence indicates that the protection of wild plant habitats within the village is possible. Examining the clearance and regeneration of the small forest patches closer to the village over time could provide a better understanding of why people engage in certain management practices and help in identifying new conservation strategies.

Reported frequency of harvest

In addition to location, various factors influence the frequency of harvest for wild plants. Of the plants that are regularly needed – four edible plants in this case – the

harvest is done on a fairly regular basis (Figure 20), and variations in use of the different species are easy to distinguish. Two plants are available year-round, the *ka teguea* vine and the *ka uguö* fern. These plants are harvested on a weekly basis, by a similar number of men and women, but in the case of the *ka teguea* especially, harvest is done more frequently by women. When I asked a male resident passing in front of a patch of *ka teguea* why he did not harvest some for the evening meal he replied that it was “the role of women” (Local informant, November 2010). This statement highlights the importance of gender roles in the harvest of some plants. The two other edible plants, *nürün* and *mitdra*, are only available at certain times of the year, and are found dispersed in relatively more remote areas. They are, as a result, harvested less frequently and by a higher number of men than women. Men, because of their responsibility to manage mature forest parcels use more distant areas more frequently.

The residents reported that they do not harvest the five other non-edible plants selected as conservation priorities on a regular basis, but rather do so depending on household needs and the availability of the plant. These plants, namely *juogo*, *mrä*, *zoguanda*, *ngrie grie* and *tugue ningro*, are used in construction and to make housewares, and their products can last a very long time. Thatch made of *juogo* leaves, for example, can last up to ten years whereas *mrä* and *ngrie grie* house posts can last decades before needing to be replaced. Furthermore, the access to these plants is highly restricted, and they are only harvested when they either reach the right size, or when the few people who control them decide to do so.

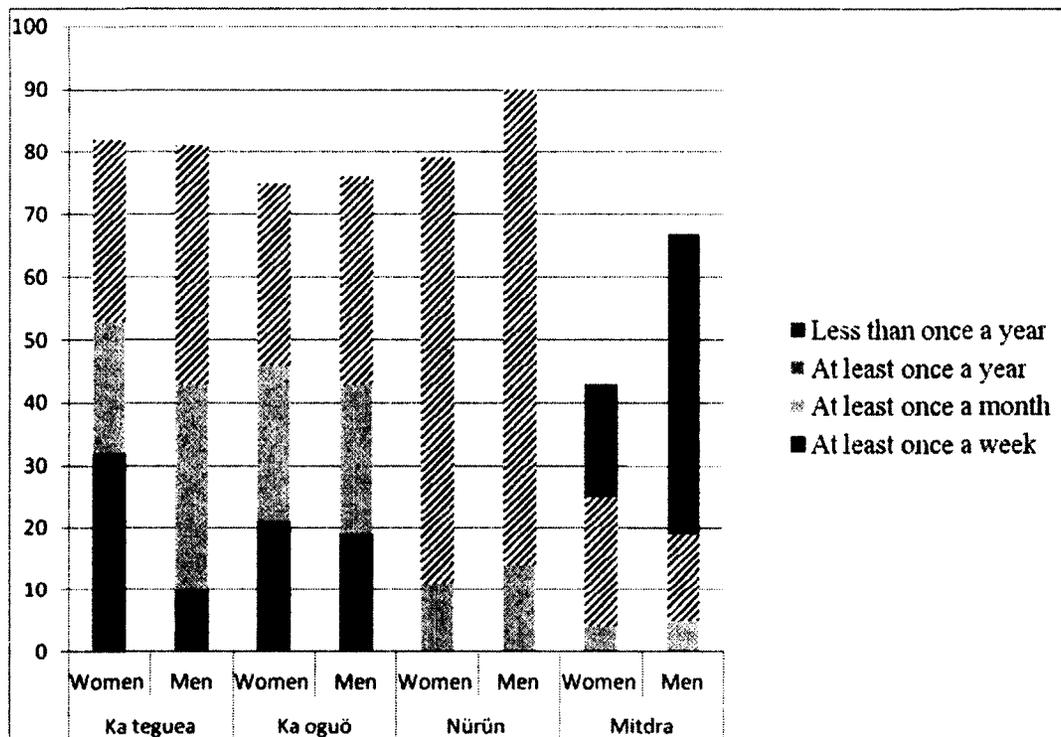


Figure 20. Frequency of harvest of four edible plants of concern, expressed in percentage, reported by 28 women and 21 men in Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

This examination of harvest frequencies, which have a significant impact on wild plant populations, indicates that for open access and fast growing plants that are needed on a regular basis such as edible plants, seasonality, distance, distribution and gender influence how often plants are gathered. These factors are not as significant when discussing slower growing plants that are not needed on a regular basis and for which access is restricted, such as trees used in construction. In these cases, land tenure is a more significant factor. To understand how harvest frequency and location affect the plants, it is necessary to examine the types of management undertaken to reduce the impact of these harvests.

6.5 Local Management of Useful Wild Plants

Exploring how local people manage mature forest plants can bring important insights regarding the community's relationship with the forest. Such an analysis can further expose sources of both challenges and opportunities for forest conservation.

Diverse plant management practices

Regarding the management of useful plants, in particular the nine plants selected by local residents as priority species, I noted two broad and related categories of cultural practices that together affect the abundance of wild plant populations: socially-oriented and biologically-oriented practices (Table 9).

Firstly, the residents have rules and customs that restrict the access to and use of valuable plants; these restrictions often have significant conservation implications. These cultural practices stem from the land tenure system, which, although not a plant management practice per se, is highly influential regarding the way in which resources are managed in the community. Forests in the comarca are communally-owned, but the control of a given forest parcel belongs to a specific individual or household. The access to plants within a parcel is granted to other people based mainly on familial bonds and depends on the plant type and its degree of rarity; small and relatively common plants have more open access, whereas scarce trees and palms such as *juogo* are privately owned, and their use is highly restricted. This type of land tenure allows a household with long-term management goals to preserve the habitat of a useful plant as a harvesting site.

Secondly, the residents of Ratón have informal rules regarding the appropriate management of the plant's biology. Some of these practices aim at fostering the growth of useful plants – practices such as light management, weeding and transplantation. Other

practices and rules are designed to reduce the impact of the harvest on the valuable plants' populations. For example, there are informal, customary rules regarding the frequency of harvest and the size or amount of resources that can be harvested from the forest at once. Another example of the way the residents of Ratón effectively minimize their impact on the plants they harvest is through the prohibition of detrimental practices. In the past, they used to eat the heart of the female *ñürün* palm, which killed it. This practice hindered the reproduction of the palm and reduced the availability of both the palm heart and the edible male inflorescences. Whereas this practice is still occurring in other areas of the comarca, the residents of Ratón have stopped eating the female *ñürün* in order to help protect the long-term supply of the edible male inflorescences.

Table 9. Examples of local management practices, Ratón, Comarca Ngöbe-Buglé, Panama, 2010.

Socially-oriented	Biologically-oriented
Restricted access to plants	Overstory light management
Creation of private reserves	Transplantation
	Limited frequency of harvests
	Ban on detrimental practices

The case of the *juogo* palm is ideal to illustrate the way both socially and biologically oriented management practices are used in Ratón. The mature leaves of *juogo* are the prime material used for thatching houses, and the palm is probably the most actively managed wild plant in Ratón. Access to the palm is restricted to the owner, who probably has a specific, well-maintained harvesting site. The palm seedlings are identified early on and are weeded regularly. The residents also improve the light availability in the understory for the growing palms by manually clearing a good proportion of the plants that would normally shade them. To limit the impacts of the

harvest of the leaves, a minimum of one mature leaf and all young leaves (less than 1 m in length) are left on each palm at all times. A minimum of about one year must also occur between harvests. Through these practices, the residents promote the growth of the palm population and at the same time lessen the impact of the harvest on it.

It is clear that the residents of Ratón use a variety of management practices to promote the survival and reproduction of valuable plants within the mature forest. While it is unclear exactly when some of these practices were adopted, some of them are relatively recent and others are not practiced in other communities, thus demonstrating that not all conservation approaches can necessarily be classified as “traditional”. Research on innovative plant management practices can play a role in promoting the sharing of best practices between communities.

Barriers and limitations to effective management

As this research clearly demonstrates, the residents of Ratón are highly knowledgeable about the uses, habitat requirements and spatial distribution of wild plants, and this knowledge is the basis of a variety of plant management practices. The current management practices, however, are likely not sufficient to insure the long-term survival of the valuable plant populations for most of the key species identified as conservation priorities. The main limitations to the overall sustainability of local management practices stem from interrelated technical and structural issues.

State of the knowledge of plants

Firstly, the knowledge of the use and ecology of wild plants is slowly eroding in the community, as one local informant explained during our discussions. Younger generations are spending less and less time learning about wild plant management, as

they spend more time in school. The influence of Latino lifestyles and tastes is also impacting the interest of youth in forest management. Many young people in the community aspire to become teachers or to find work in towns such as San Felix. Temporary outmigration to work in coffee or banana plantations in Bocas del Toro province or in Costa Rica also provides an alternative to the traditional agricultural livelihood (CONAPI 2006).

Plants located in mature forests are particularly vulnerable to this knowledge loss. These environments are often located further away from where people live, and as a result the youth have less exposure to them (Ladio & Lozada 2004). Even if the plants are not needed as much today, conserving the knowledge of their use and management remains important in the long term; a slow erosion of knowledge may render the community more vulnerable if this knowledge is needed in the future.

Furthermore, the knowledge that local residents have of the useful plants that they use is limited in certain areas. I noted, for instance, that the local informants had difficulty gaining a complete understanding of phenomena not easily visible to the naked eye, such as the reproduction of a fern, a type of knowledge that was arguably not necessary when the plants were more abundant. When they have the knowledge and resources, the residents engage in active management practices which foster the plants' growth and regeneration. However, in many cases, attempts to do things such as transplant seedlings are repeatedly unsuccessful, and the plant management practices remain insufficient to maintain a healthy population. The case of the *mitdra* palm is an apt example, as the harvest kills the palm. A few residents explained to me that they have attempted to transplant the palm's seedlings which are found in proximity of the adult but

none ever survived.

This finding was also pointed out by Bentley (1989), who found that although local farmers were highly knowledgeable about their environments, they did not know as much about the aspects that are difficult to observe, such as parasitic insects and bacteria. His study further suggests that the farmers are able to learn and integrate notions learned from outsiders into their fields “even when that information contradicts previously held notions” (Bentley 1989:30). The resident’s technical limitations therefore point to the potential role of collaboration with other communities or organizations; these partnerships may assist in the transmission of management techniques and even help in organizing experiments seeking to explain the reproduction of different species. The influence of outside organizations or researchers interested in this theme, however, is limited due to the discrepancy between the ways of learning of the residents and the typical teaching approach of outside organizations (see Chapter IV). Participatory projects adapted to the local reality are needed for the success of such learning.

Structural limitations

Secondly, when I asked about the factors that influence the use and management of useful forest plants, local people mentioned a combination of the rapid societal and structural changes that happened in Ratón in the past few decades. For example, the community has seen the construction of a road, a school and a clinic, and the government has started conditional aid programs (see Chapter IV). This increase in infrastructure and services occurred at the same time as continued population growth, which had already been identified by scholars as a force putting increased pressure on the forest ecosystems in this region (Gordon 1982, Young 1971). The availability of services in the village has

also attracted many families to the area, which resulted in a denser settlement pattern. Traditionally, Ngöbe families in mountainous areas like this one live in small hamlets dispersed over a large area.

The improved infrastructure has also made the movement of goods and money in and out of the community easier, which is slowly reshaping the traditional sharing and reciprocity based economy. The increase in cash crops, especially coffee, and of cattle ranching is further aggravating land shortage. All together, these rapid changes have created more need for agricultural space and cattle, increasing pressure on forest ecosystems and the wild plants they shelter. In addition to losing their habitat, the valuable plants are being overharvested in proximity of the village, and are vulnerable to being stepped on or eaten by cattle, as cattle are increasingly ranching within mature forests.

Furthermore, one cannot consider these issues outside of the broader political and economic context in which the community exists. If the residents of Ratón need more agricultural space, this is linked to the limited amount of crops that can grow in the poor soils and harsh climate of the area, an area which they inhabit in large part as a result of the colonial legacy. The reliance on a small amount of less than ideal agricultural space and the rampant poverty that exists are also a result of limited access to education and health services and the lack of employment opportunities in the region. Finally, one must not forget to consider the role of all levels of government in investing in and supporting the development of conservation strategies; without support from the regional and national levels, it is very difficult for communities such as Ratón to effectively implement large scale conservation strategies.

Improving local conservation strategies

In this context, most western-lead conservation measures would not be adequate. Building on measures already existing in the community and on the people's desire to stabilize useful wild plant populations, a few broad actions can be proposed. Firstly, it is recommended that the community get together to decide on potential individual and communal conservation measures for important useful wild plants, such as the ones identified in this study. Discussion, as this research found out, can trigger interest and awareness, as these plants are locally considered very important, both in terms of use and cultural identity. In addition, it is clear from the above analysis that their long-term protection could benefit everyone in the community, especially more marginalized members. Discussions and the sharing of best practices with neighboring communities can also help in improving practices and developing a broader conservation strategy.

Secondly, preserving the natural habitat is a crucial measure for the protection and recovery of useful wild plant populations. Setting reserve areas is a low-cost method already implemented in the community, and has the potential of benefitting more than just the single plant. In addition, it is important to promote and expand the already existing management practices such as the setting of sustainable harvesting frequencies.

Outside organizations can play an important role by finding answers to the local residents' questions regarding biological reproduction and transplantation requirements, or by elucidating the lifecycle of specific plants. Unfortunately little research has been done to date on the key species in question. With the support of outsider researchers or organizations, the community can reach a better understanding of the current population trends of these key species, and on the impacts of its harvesting practices.

Given that these plants are part of the local economy, their increased availability would also improve local livelihoods. The edible plants foster local food security and the useful trees and palms ensure the long-term availability of materials for construction and household goods. As such, the residents of the area would benefit from developing efficient conservation measures in terms of both cultural identity as well as food and material security.

Concluding Remarks

By examining the local use of wild plants found in mature forests, this chapter sought to highlight the importance of these resources for the Ngöbe inhabitants of Ratón. Local residents use these plants for food and construction as well as to make handicrafts, housewares and spiritual items. Gender, economic wealth, the extent of kin network, land tenure and personal preferences shape the complex interaction that the community's residents have with the mature forest's plants.

My findings suggest that the most important direct threats to the plant populations are the reduction of the mature forest and the grazing of cattle within forest parcels. The underlying factors leading to the need for more space must be targeted at the same time as other conservation measure to improve the mature forest cover in the area.

Chapter VII – Discussion and Conclusions

Throughout this work, I have highlighted the nuances and complexity of the relationship between an indigenous community and its surrounding environment. Most previous research on useful wild plants has focused on conducting an inventory of useful plants or on assessing the commercialization or pharmaceutical potential of non-timber forest products (Chauhan, Sharma & Kumar 2001, Coe & Anderson 1996, Joly et al. 1987, Mendelsohn & Balick 1995, Philips 1993, Ros-Tonen 2000, Toledo 1995, Sanz-Biset et al. 2009). In contrast, this research aimed at drawing a picture of the opportunities and constraints that local people face in their use and management of wild plants. In completing this research, I have contributed to the field of political ecology in a meaningful way. Firstly I have stressed the importance of understanding mature forests as an anthropogenic habitat that is influenced by the socio-economic context of its users. Secondly I have highlighted the differences that exist within the community and how these differences affect resource rights. Finally, I have drawn attention to the internal management practices within the community, and have highlighted that mature forest conservation is a political issue which is linked to the self-determination of the indigenous people living in the area. In addition, I have demonstrated how using a participatory framework can reveal important insights regarding forest conservation; without engaging the local population, respecting the knowledge that they have, and actively pursuing their input when designing and executing a project like this, it is difficult to get reliable and robust data.

Shifting our understanding of tropical forest conservation

Using a political ecology framework enables one to challenge the dominant discourse surrounding mature forests and the role of outside organizations in their conservation. Understanding mature forests as anthropogenic or domestically managed, rather than as “pristine” has been crucial for me in making sense of how the local community members view the forest (Michon 2005, Nightingale 2003). Because local management practices include elements such as cutting and deliberately allowing certain patches to regenerate at certain points in time, it is crucial that we understand mature forests as having a dynamic nature; they are never static but rather constantly evolving, often with the help of local people. In addition, it is important to discuss the role of younger secondary forests when looking at forest management and conservation. This study showed that even small patches of trees found within the community provide useful products, and previous studies have highlighted the contribution of this habitat to biodiversity conservation (Chazdon et al. 2009, Harvey et al. 2007). Evidently, we need to broaden our understanding of tropical forest conservation to include not only the dynamic nature of mature forests but also the role of different stages of forests.

Self-determination and outside organizations

In the context of indigenous areas especially, the interests and practices of the indigenous residents should be given priority in forest conservation. These forests belong to the communities that live in and around them; they form part of the local way of life and not respecting them can create negative social impacts (Brockington et al. 2006, Stocks 2005, West et al. 2006). While this research advocates the community’s self-determination in conservation, it also found that actors from outside the community can

bring much needed technical information, help foster conservation discussions and create useful legal protection frameworks. In this context, conservation agencies and regional authorities have been considering working with others to create a protected area that will help to counter external threats such as mining activities (Smith 2010).

While external actors may recognize the importance of involving communities in a conservation strategy (Salafsky & Wollenberg 2000, Smith 2010), they also need to recognize the opportunities and constraints that arise from the socio-economic and political context in which the community exists (Nygren et al. 2006). Outside researchers need to be cognizant of the underlying reasons why there is such pressure on primary forests; their recommendations should be sensitive to the fact that with a growing population comes an increased need for agricultural space. Because of this, they should not attempt to impose their vision of conservation onto the community.

Heterogeneity of use, access and concerns

Studying forest plant use through the lens of political ecology further allowed me to see the important differences that exist within the community. Although the ownership of most of the continuous mature forest is concentrated in the hands of a few families, a significant proportion of the community has access to the forest and harvests the wild plants that grow within it.

Using a gender sensitive approach here showed me that the use of and concerns for plants are different for men and women. Their opinions regarding which plants should be considered a priority showed both similarities and differences. Their respective knowledges reflect that they are both involved in some stage of each plant's harvest, transformation or use. Furthermore, each gender is responsible for the harvest of certain

plants more frequently than the other, and in different areas. As such, this research contributes to the scholarship on the gendered nature of the use of wild plants (Kainer & Duryea 1992, Rocheleau & Edmunds 1997, Wayland 2001), and highlights the need to include the input of both men and women when developing conservation measures.

In addition to gender differences, including a diversity of voices in the research highlighted the fact that there are variations between households regarding the use of and access to wild plants. Building on the approach of Coomes and colleagues (2004) regarding the conception of “wealth”, this research examined the extent to which individual households could be impacted by the reduced availability of useful plants. Resource depletion undeniably affects asset-poor households (i.e., those without forest parcels, formal employment or extensive family ties) significantly more than asset-rich households, as the former also tend to be the ones without access to valuable forest plants. The lack of access to cash income and to forest resources limits the options for these households and may exacerbate their poverty.

As such, using the framework of political ecology combined with gender-sensitive methods provided critical insight into the community structure and customary practices related to wild plant management. The heterogeneity of resource users highlights the need to include the interests of a broad range of stakeholders when studying mature forests. Including both men and women from households with and without forest parcels in decision-making is necessary if one wishes to represent the diversity of interests and develop equitable conservation strategies.

Importance of local knowledge

This study contributes to the literature on the field of local knowledge, particularly ethnobotany, by providing insights into the types of plants that are useful from the point of view of the Ngöbe residents of Ratón and how they are used and managed. Like previous research with similar results (see, for instance Gavin 2009), this study showed that mature forests provide the majority of non-medicinal plant resources used by the community. It further adds to the literature showing how local knowledge can improve understandings of environmental and ecological processes (Dalle & Potvin 2002, Donovan & Puri 2004, Lauer & Asani 2008, Smith 2008).

Most importantly, this study helps better explain the distinctive customary practices of indigenous communities. Through a close examination of the management of a small set of plants, the findings reveal that a wide array of plant management practices currently occur in the community. The most important wild plants are cared for through practices fostering their growth, such as light management, weeding and transplantation. In addition, the community's rules and customs are designed to significantly reduce the detrimental impacts of harvesting. The residents are aware that there are, for most plants, destructive and non-destructive harvest methods, and have restricted detrimental practices used in the past. The informal ban on the consumption of female palm hearts of *ñürün*, especially, demonstrates that the residents of Ratón are able to collectively identify and implement effective conservation strategies.

Taken as a whole, this study highlights the necessity of basing conservation strategies regarding useful wild plants on local priorities. In doing so, it suggests that this type of approach can significantly improve the local quality of life and relieve pressure

on forest ecosystems. Meaningful inclusion of indigenous people in the development of conservation programs is crucial if we wish to foster sustainable and respectful resource management in the future.

Appendices

Appendix A. Cooperation and Research Agreement, August 2010, Ratón, Comarca Ngöbe-Buglé, Panama.

Acuerdo de Cooperación-Investigación

“Uso indígena de recursos forestales: Investigación de las prioridades de conservación en la Comarca Ngöbe-Buglé, Panamá”

Investigación en las comunidades de Ratón y alrededores

El Congreso Regional de Nedrini, representado legalmente por su Presidente, Antonio Amador

Y

El Centro de Estudios y Acción Social Panameño (CEASPA), representado por su director, Jesús

Alemancia

Y

Adèle Michon, estudiante de maestría de la Universidad de Carleton (Canadá) e investigadora del proyecto *“Uso indígena de recursos forestales: Investigación de las prioridades de conservación en la Comarca Ngöbe-Buglé, Panamá”*,

Acuerdan:

Primero: Realizar una investigación conforme a la propuesta *“Uso indígena de recursos forestales: Investigación de las prioridades de conservación en la Comarca Ngöbe-Buglé, Panamá”*.

Segundo: La investigación se realizará de acuerdo a la normativa referente a los recursos naturales en la Carta Orgánica Administrativa de la Comarca Ngöbe-Buglé (Decreto Ejecutivo No. 194 del 25 de agosto de 1999).

Tercero: La investigación se realizará de acuerdo a las normas de acceso al recurso genético vigentes en la República de Panamá (Decreto Ejecutivo No. 25 del 29 de abril del 2009).

Cuarto: Se coleccionarán muestras de plantas para una correcta identificación de las especies de interés, que una vez terminado el estudio serán depositadas en el Herbario de la Universidad de Panamá. Se solicitarán los correspondientes permisos de colecta a la Unidad de Acceso al Recurso Genético (UNARGEN), oficina dependiente de la Autoridad Nacional del Ambiente (ANAM).

Quinto: Los resultados que se generen producto de esta investigación serán compartidos con las comunidades donde se habrá realizado la investigación, en la forma de informes y talleres. Los informes finales en español, serán depositados en la oficina administrativa de la Comarca Ngöbe-

Buglé y en la oficina de CEASPA en la ciudad de Panamá. La tesis completa en inglés reposará en la oficina de CEASPA, en el Centro de Investigación y Desarrollo Internacional de Canadá (IDRC) y en la Universidad de Carleton (Canadá). Los resultados de la investigación podrán ser publicados en revistas científicas especializadas, que no producen beneficios económicos. Se enviará una copia de cada artículo publicado a la oficina administrativa de la Comarca Ngöbe-Buglé, a CEASPA y a la ANAM.

Sexto: Los costos de transporte, alimentación, hospedaje, viáticos y/o honorarios serán cubiertos con los fondos del IDRC, administrados por la investigadora Adèle Michon.

Séptimo: El periodo de duración de esta investigación será de cuatro (4) meses, iniciando en el mes de septiembre de 2010 y finalizando en diciembre de 2010. No se podrá extender el periodo del estudio. Las partes podrán dar por terminada la investigación en cualquier momento, notificando por escrito a las demás contrapartes la causa de dicha finalización.

Octavo: Cualquier otro detalle relacionado con el presente acuerdo y la ejecución de las actividades relacionadas con el mismo, que no hayan sido expresamente regulados en el presente documento serán resueltos entre las partes, en caso de que sea necesario, actuando siempre de buena fe y en el espíritu de cooperación mutua.

Noveno: Asimismo, cualquier conflicto que surja entre las partes relacionado con la interpretación del presente acuerdo o su ejecución, será resuelto entre las mismas mediante conversaciones directas, actuando siempre de buena fe y en el espíritu de cooperación mutua.

Firmado en la Comarca Ngöbe-Buglé
Fecha:

Por el Presidente del Congreso Regional de Nedrini

Antonio Amador
(Cedula)

Por Director del Centro de Estudios y Acción Social Panameño (CEASPA)

Jesús Alemancia
(Cedula)

Por la candidata a la maestría en geografía por la Universidad de Carleton

Adèle Michon, Investigadora del Proyecto
Pasaporte Canadá: WF341782

Appendix B. Free Prior and Informed Consent Declaration, October 21st 2010, Ratón, Comarca Ngöbe-Buglé, Panama (Original version in Spanish).

Consentimiento Libre Informado Previo
de acuerdo al Decreto Ejecutivo No 25 del 29 de abril de 2009,
Capítulo III artículos 23-28

“Uso indígena de recursos forestales: prioridades de conservación en la Comarca Ngöbe-Buglé”
Investigación en las comunidades de Ratón y alrededores
Septiembre 2010 – Agosto 2011

Esta investigación se realiza dentro de un acuerdo de cooperación entre el Congreso Regional de Nedrini, representado legalmente por su Presidente Antonio Amador, el Centro de Estudios y Acción Social Panameño (CEASPA), y Adele Michon, estudiante de maestría de la Universidad de Carleton (Canadá) e investigadora del proyecto. Más detalles se encuentran en el Acuerdo de Investigación y en la Propuesta de Investigación.

El propósito de la investigación es determinar, en la comunidad de Ratón, cuales son los productos forestales usados y las prioridades de conservación de los habitantes.

La investigación se realizara así:

Octubre – Diciembre 2010:

1. Reunión con la comunidad para presentar el proyecto y obtener el CLIP.
2. Reunión para mapear la comunidad con método participativo.
3. Reunión para identificar las especies vegetales que son importantes para la construcción, la artesanía y la alimentación.
4. Selección de especies que necesitan medidas de conservación, tomando en consideración las limitaciones del proyecto (tiempo limitado, estación lluviosa, enfoco forestal).
5. Entrevistas para conocer el uso de cada casa y la importancia de las especies.
6. Entrevistas en cada casa para documentar quien recolecta y usa las especies seleccionadas, y con qué fin. Enfoco sobre las prácticas culturales, condiciones ambientales y los factores socio-econo-políticos relacionados a las especies seleccionadas.
7. Observaciones directas de las recolectas para toma de datos geográficos (toma de coordenadas geográficas con GPS) y biológicos (toma de muestras de plantas).
8. Reunión y discusión con la comunidad sobre la investigación y la conservación.

Mayo 2011:

Divulgación de resultados en forma de talleres de presentación y de escritura de informes para la comunidad, las autoridades comarcales y los representantes de los colaboradores (CEASPA, etc.).

Notas de Interés: Beneficios y Riesgos

Dentro de esta investigación:

- Serán grabadas las entrevistas para garantizar la exactitud, y serán posteriormente transcritas.
- Se tomaron puntos de GPS para documentar información geográfica.
- Se coleccionarán muestras de vegetales para correcta identificación.
- Se tomarán fotografías sobre cuales no se podría identificar personas para documentar información.
- Se tomarán fotografías de personas solo con el acuerdo de aquellas personas, y se usarán solo con el acuerdo de aquellas personas. Fotografías de personas serán compartidas con aquellas personas.

Este proyecto se realiza con participación voluntaria. No hay riesgos o beneficios directos para los participantes en esta investigación. Las entrevistas no serán pagadas. Los participantes en las reuniones no serán pagados, pero recibirán una comida. Esta investigación no produce o producirá en el futuro beneficios económicos para la investigadora.

Confidencialidad

Si usted(es) acepta(n) participar, su información será guardada estrictamente confidencial. Su(s) nombre(s) nunca será(n) mencionado(s) en la investigación, y ninguna información que podría revelar su(s) identidad(es) será empleada. Grabaciones y notas serán guardadas como confidenciales durante la investigación y destruidas al final.

Consentimiento Informado

Usted(es) puede(n) decidir de no participar en este estudio. Si usted(es) acepta(n) de participar, puede(n) retirarse en cualquier momento sin afectar sus relaciones con el Congreso Regional de Nedrini, con el CEASPA, o con la investigadora.

Para más Información

Si desea(n) retirarse o tiene(n) preguntas sobre cualquier aspecto de la investigación, por favor contacta:

En español: Adèle Michon (Investigadora) Teléfono: (507) 6546.5061

Correo electrónico: amichon@connect.carleton.ca

En Ngöbere: Ramón Pineda (Coordinador local) Teléfono: (507) 6667.6407

Certificación de Participación

El participante debe entender el propósito del Consentimiento Libre Informado Previo. El tuvo la oportunidad de hacer preguntas con respeto a este estudio y a sus derechos como participante. El acepto de participar en este estudio como participante de investigación.

Appendix C. Free Prior and Informed Consent Declaration, October 21st 2010, Ratón, Comarca Ngöbe-Buglé, Panama (English translation).

Free Prior and Informed Consent
According to Executive Decree 25 of April 29th 2009,
Chapter III Articles 23-28

"Indigenous use of forest resources: Conservation priorities in the Comarca Ngöbe-Buglé"
Research project in the community of Ratón
September 2010 – August 2011

This research is conducted within a Cooperation Agreement between the Congreso Regional de Nedrini, legally represented by its President Antonio Amador, the Centro de Estudios y Acción Social Panameño (CEASPA) and Adèle Michon, master's student at Carleton University (Canada) and researcher in the project. More details can be found in the Research Agreement and the Research Proposal.

The purpose of this research is to determine, in the community of Ratón, which forest products are used and what the forest conservation priorities of the inhabitants are.

The research will be conducted as follows:

October – December 2010:

1. Meeting with the community to explain the project and gain free prior and informed consent.
2. Meeting to map the community using a participatory approach.
3. Meeting to identify the plant species that are locally important in construction, crafts and food.
4. Selection of species that require conservation measures, taking into consideration the limitations of the project (limited time, rainy season, focused on forestry).
5. Interviews to determine the plant use of each household and the importance of each plant species.
6. Interviews with each household to document who collects and uses the selected species and for what purpose. Focus on cultural practices, environmental conditions and the socio-economic issues related to the selected species.
7. Direct observations of the collections for the purposes of collecting geographical data (GPS coordinates) and biological data (plant samples).
8. Meeting and discussions with the community about research and conservation.

May 2011:

Dissemination of results in the form of presentations and written reports for the community, Comarca authorities and other partners.

Points of Interest: Benefits and Risks

Within this research:

- Interviews will be recorded to ensure their accuracy and will later be transcribed.
- GPS points will be taken to document geographic information.
- Samples of plants will be collected for scientific identification.
- Photographs in which people will not be identifiable will be taken for documentation purposes.
- Photographs of people will be taken only with their agreement, and will be used only with their agreement. Photographs of people will be shared with them.

This project is taking place on the basis of voluntary participation. There are no risks and no direct benefits anticipated as a result of this study. Interview subjects will not be paid. The meeting participants will not be paid but will receive a meal. This research does not produce and will not produce in the future any economic benefits for the researcher.

Confidentiality

If you agree to participate, your information will be kept strictly confidential. Your name will not be mentioned in the research outputs and no information that could reveal your identity will be used. Recordings and notes will be kept confidential throughout the research process and destroyed upon completion of the project.

Informed Consent

You may decide not to participate in the study. If you agree to participate, you may withdraw your consent at any time without affecting your relationship with the Congreso Regional de Nedrini, CEASPA or the researcher.

Further Information

If you wish to withdraw your consent or have questions about any aspect of the research at any time during the research process, please contact:

In Spanish:	Adèle Michon (Researcher) Phone: (507) 6546.5061 Email: amichon@connect.carleton.ca
In Ngöbere:	Ramón Pineda (Local Coordinator) Phone: (507) 6667.6407

Participant certification

To participate in this project, each participant must understand the purpose and contents of this free prior and informed consent declaration. S/he has had the opportunity to ask questions about the study and about her/his rights as a participant. S/he agrees to take part in this study as a research participant.

Appendix D. List of useful wild plants, with details on their uses, users, life forms, habitat, status and prioritization for conservation, collected during the Second Community Workshop, October 23-24 2010, Ratón, Comarca Ngöbe-Buglé, Panama.

Nombre Ngöbere	Nombre Español	Tipo de planta	Parte que se usa	Categoría de Uso	Uso Principal	Quien la usa y colecta	Estado de Conservación	Tipo de Medio Ambiente
Ban	ceabulla	mata	frutas	Rituales, Cultural	barba	hombres	escaso	BII
Biü o Bün	Inga (guabo)	árbol	fruto	Plantas Comestibles	comestible	familia	escaso	BII
Bom	Cabuya	mata	hojas	Artesanía	chácara	familia	escaso	Sabana
Brore o Blore	Flores	mata	corteza	Rituales, Cultural	baño	familia	escaso	BII
Brüra	Pito	árbol	madera	Construcción	cerca de casa	familia	escaso	BII
Bügüzaly o Bugosali	Ortiga gigantes	arbusto	hojas	Plantas Comestibles	comestible	familia	escaso	BII
Cigui	-	árbol	madera	Construcción	horcones	familia	escaso	BII
Cogroguadu	Cortesía	arbusto	corteza	Construcción	amarre	familia	escaso	BI y BII
Cremai	Jagua	árbol	fruto	Artesanía	pintura	familia	escaso	BI, BII bajo
Cuiguion	-	arbusto	hojas	Artesanía	pintura	familia	escaso	BI, BII bajo
Dobo grie	-	árbol	madera	Construcción	viga, solen	familia	escaso	BII
Dora	-	arbusto	fruto	Plantas Comestibles	comestible	familia	escaso	BII
Dubuin	-	bejuco	hojas	Rituales, Cultural	aislante de espíritu malo	familia	escaso	Rastrojo
Dugua o duga o duca	aguacate silvestre	árbol	fruto	Plantas Comestibles	comestible	familia	escaso	BI
Gkogro o Kógra	Bejuco	liana	Bejuco	Construcción	amarre	familia	escaso	BI
Guarain	salamora	mata	fruto	Plantas Comestibles	comestible y chicha	familia	común	BII
Güida ngobó	Ají brujito	mata	fruta y hojas	Rituales, Cultural	aislante de espíritu malo	familia	escaso	Rastrojo

Jabona o Yabona	-	árbol	madera	Construcción	viga, solen	familia	escaso	BII
Jogue	-	arbusto	fruta y hojas	Rituales, Cultural	aislante de espíritu malo	familia	escaso	BI
Jom	Sangrilló	árbol	madera	Construcción	cerca de casa	familia	escaso	BII
Judö o Mitdra	Palmito	palma	Cogollo	Plantas Comestibles	comestible	familia	escaso	BI
Jüoga	Palma gira	palma	hojas	Construcción	techo	familia	escaso	BI bajo
Juogo	Penca	palma	hojas	Construcción	techo	familia	escaso	BI
Kä	Iraca	bejuco	hojas	Plantas Comestibles	comestible	familia	escaso	BI
Ka Oguò	Calalú	helecho	parte tierna de hoja	Plantas Comestibles	comestible	familia	escaso	BI, BII
Ka tekwea o Ka Teguea	bejuco	bejuco	hojas	Plantas Comestibles	comestible	familia	escaso	BI, BII
Kaguina	-	árbol	madera	Construcción	cerca	familia	escaso	BI
Keben	durmiera	mata (rastren)	matas	Rituales, Cultural	baño	familia	escaso	Sabana
Keòn gro o Cuan Ngra	-	mata	matas	Rituales, Cultural	trampas para mal espíritu	familia	abundancia	BII, Rastrojo
Ketdä	Mamacillo	árbol	madera	Construcción	cerca y horcones, viga	familia	escaso	BII
Kiga guatda	Ficus	árbol	corteza y gamba	Artesanía	uso Múltiple, fogonero, batea	familia	escaso	BI, BII
Kimo	-	mata	fruto y ápices	Plantas Comestibles	comestible	familia	escaso	BI
Ko Cuguon	bejuco	liana	liana	Múltiple: Artesanía y Construcción	canasta y amarre	familia	escaso	BI, BII
Kö Guatda o Kogro guatda	bejuco	liana	bejuco	Múltiple: Construcción y Artesanía	amarre y canasta	familia	escaso	BI
Krigrie o Ngri Grie	Palo de carne	árbol	madera	Construcción	horcones	familia	escaso	BI
Krin o Krün	Balsa	árbol	madera	Artesanía	silla, asiento	familia	común	BI, BII

Krögä o Ngrega	bejuco	bejuco	hojas	Plantas Comestibles	comestible	familia	común	BI
Krun	Balso	árbol	madera o palo	Rituales, Cultural	cruz y guardián	familia	común	BI, BII
Kuän o kuön	Hoja de zorrillo	mata	hojas	Rituales, Cultural	aislante de espíritu malo	familia	escaso	Rastrojo
Male	-	árbol	madera	Construcción	cerca	familia	escaso	BI
Mígui	Sabana	paja	La mata completa	Construcción	techo	familia	escaso	Sabana
Mira o Mirä	-	árbol	madera	Construcción	cerca	familia	escaso	BI
Mrä	Cigua	árbol	madera	Construcción	horcones	familia	escaso	BI
Mrena	Palomar	árbol	madera	Construcción	cerca	familia	escaso	BII
Mrubriö	Mastranto	mata	hojas	Rituales, Cultural	aislante de espíritu malo	familia	escaso	Rastrojo
Munegä	Chichica	heliconia	cogollo	Plantas Comestibles	comestible	familia	común	BII
Mutdü Gri	Matas de jabalí	mata	hojas de ápices	Plantas Comestibles	comestible	familia	escaso	BI
Naguada	-	árbol	corteza	Construcción	fogonera	familia	escaso	BI
Ngubruon o Jubruon	-	arbusto	ápices y hojas	Plantas Comestibles	comestible	familia	escaso	BI
Noiugöy o Noin Koa o Nanköe	-	bejuco	bejuco	Rituales, Cultural	para amarrar los poseidos y espíritu malo	familia	escaso	BII
Nomogrie	-	árbol	corteza	Artesanía	ropa interior	familia	escaso	BI
Nurman	-	árbol	madera	Construcción	horcones	familia	escaso	BI
Ñürün	Boda (palmito)	palma	fruto	Plantas Comestibles	comestible	familia	común	BI, BII
Quetda	Roble	árbol	madera	Artesanía	mecedor, pilón, cabo	familia	escaso	BI
Rugä o Rüga guatda	cedro	árbol	corteza y rama (ritual) y madera (cons)	Múltiple: Construcción y Rituales, Cultural	aislante (ritual) y cerca de casa (cons)	familia	escaso	BII

Rurian guatda	-	árbol	corteza	Artesanía	tapa rabo	hombres	escaso	BI
Sabo	-	árbol	madera	Construcción	horcones	familia	escaso	BI
Subri	jengibre	mata	tuberculo	Artesanía	pintura	familia	escaso	BII bajo
Tara o sögatora	-	arbusto	ápices y hojas	Plantas Comestibles	comestible	familia	común	BI, BII
Tugue Grie	-	árbol	madera	Construcción	viga	familia	escaso	BI
Tugue Nigro o tuguëly	Bejuco	liana	liana	Construcción	amarre	familia	escaso	BI
Uma Grie	-	árbol	madera	Construcción	horcones	familia	escaso	BI
Üoru	Zapatero	árbol	gamba	Artesanía	batea	familia	escaso	BI
Uròn	-	arbusto	corteza y hojas tiernas	Múltiple: Artesanía y Rituales, Cultural	pintura	familia	escaso	BI
Wikin	-	árbol	corteza	Rituales, Cultural	aislante de espíritu malo	familia	escaso	BI
Zoguanda	Palo Zaino	árbol	corteza y madera	Múltiple: Artesanía y Construcción	petate (cama) (mujer) y amarre (hombre)	familia	escaso	BI

Appendix E. Survey Questionnaire, October-November 2010, Ratón, Comarca Ngöbe-Buglé, Panama.

PARTE I

Demografía

Nombre del jefe de la familia y números de personas que viven en este hogar:

Entrevista con cuantos hombres o mujeres:

Edad y años de vivir en Ratón de las personas entrevistadas:

Bosque Primario

1. ¿Para la comunidad de Ratón, el bosque primario es (y porque?)
Muy importante; Importante; Poco importante
2. ¿Cuántas horas usted debe caminar para llegar al bosque primario?
3. ¿Cómo ha cambiado el bosque primario desde que usted vive en Ratón:
Aumentado; Disminuido; Igual; No sabe
4. ¿Cortar el bosque primario en Ratón daña a todo los Ngöbes de la Comarca, verdad o falso, y porque? Verdad; Falso; No sabe

Recolección de plantas silvestres

5. ¿En qué medio ambiente colecta usted plantas silvestres?
Bosque primario, bosque secundario, rastrojo, sabana, camino/carretera, otro
6. ¿Cuándo fue la última vez que colectó usted plantas al bosque?
Esta semana; último mes; algunos meses atrás; más de un año; nunca
7. ¿Con quién va usted a recolectar plantas al bosque?
Esposo/a; amigo/a; niños; padres; solo; familia; otro
8. ¿Cual actividad (otra que colectar plantas) hace usted en el bosque?
Cazar con biombo (¿qué?); cazar con flecha (¿qué?); cazar con arma de fuego (¿qué?); otro

Plantas Comestibles

9. ¿Con que frecuencia colecta usted las siguientes plantas, y donde?
(Aumentado; disminuido; igual; no la colecta)
Judo/mitdra (palmito); ñurun (boda); ka teguea (iraka dulce); ka oگو (kalalu)
10. ¿Como ha cambiado la abundancia de estas plantas dese que su familia vive en Ratón?
(Aumentado; disminuido; igual; no sabe)
Judo/mitdra (palmito); ñurun (boda); ka teguea (iraka dulce); ka oگو (kalalu)

Plantas para construcción de casa

11. ¿De cuál material esta hecho el techo de su casa principal?
Juogo (penca); Zin; Paja (hierba)
12. ¿Hace cuantos años que usted construyó su casa de penca (o paja)?
¿Cuándo piensa cambiar la penca (o paja)?
13. ¿Tiene usted otras casas de penca y/o de paja en Ratón?
Casa familiar; casa de campo; casa para animales
14. ¿Usted compra, cultiva o recolecta penca (o paja)?
Compra de quien; cultiva dónde; colecta dónde

15. ¿Cual material usa usted para horcones?

General

16. ¿Cuál fuente de ingreso tiene usted?
Ganado; tienda; café; trabajo fijo; artesanía; otro
17. ¿Quisiera usted llevar a Adela a recolectar plantas al bosque?
Sí, cuál planta, cuándo y dónde; No

PARTE II

Bosque Primario

18. ¿Tiene usted bosque primario en su propiedad?
Sí, mucho; Sí, poco; No

Bejucos/Lianas: Tugue negro y/o Kõ guatda

19. ¿Tiene usted Tugue negro y/o Kõ guatda en su propiedad?
20. ¿Usa usted tugue negro y/o kõ guatda?
Sí, ¿ para qué? No, yo uso:
21. ¿Colecta o compra usted Tugue negro y kõ guatda?
(Colecta dónde; Compra a quien; No uso)
22. ¿Con que frecuencia colecta/compra Tugue negro y kõ guatda?
(Cada semana, mes, año, 10 años, nunca)
23. ¿Cómo ha cambiado la abundancia de Tugue negro y kõ guatda?
(Aumentado; disminuido; igual; no sabe)

Maderables: Zoguanda (palo zaino), Mrã (cigua), Ngri grie (palo de carne)

24. ¿Tiene usted los siguientes árboles en su propiedad?
25. ¿Cómo ha cambiado la abundancia de estos árboles?
(Aumentado; disminuido; igual; no sabe)
26. ¿Usted compra, cultiva o recolecta estos árboles?
(Colecta dónde; Compra a quien; No uso)

General

27. ¿De lo que su familia consume diario, de donde viene?
(Mayoritario, mitad, poco, nada)
Comprado con bono; comprado con dinero; cosechado en la finca; recolectado en el bosque

Appendix F. Guidelines for informal interviews about selected useful plants, October-November 2010, Ratón, Comarca Ngöbe-Buglé, Panama.

Lista de especies seleccionadas:

Ka teguea (iraka dulce)	comestible	bejuco
Ka uguö (calalu)	comestible	helecho
Tugue nigro (bejuco)	construcción	bejuco
Ñürün(bodá)	comestible	palma
Judö/mitdra (palmito)	comestible	palma
Juogo (penca)	construcción	palma
Zoguanda (palo zaino)	casa (petate)	maderable
Mrä (cigua)	construcción	maderable
Ngri grie (palo de carne)	construcción	maderable

Parte I. General

1. ¿Hace cuanto tiempo que su familia vino a vivir en Ratón?
2. ¿Cuánto tierra usted tiene? (ej muchas montañas? lado de Bocas del Toro?)
3. ¿Cómo ha cambiado la cobertura boscosa, sea bosque primario (ko toguo) o secundario, desde que su familia vive en Ratón?
4. ¿Cuáles son los factores que han influenciado los cambios del uso de la tierra? (ej. aumentativo de población, de ganadería, cambio en la cultura, etc)
5. ¿Sabe usted si ocurrió eventos específicos que influenciaron estos cambios de uso de la tierra? (ej. minería, carretera, bonos, cambio de gobierno, creación de la comarca, etc)
6. ¿Cual uso de la tierra le trae mas beneficios?
7. ¿Cómo se imagina usted su tierra en el futuro?
8. ¿Conoce usted razones por cuales una persona no tumbaría o champearía una parte del bosque primario? (ej. servicios ecológicos, biodiversidad, etc.)
9. ¿Qué significa para usted "conservación"? como le aplica?
10. ¿Conoce usted personas que tienen áreas de conservación del bosque? describe.
11. ¿Como usted piensa que sus prácticas y gestión de la tierra influencia los demás de la comunidad de Ratón? Y de la Comarca?

Parte II.

Especies seleccionadas

Distribución

- ¿Esta planta se encuentra en su propiedad?
 - ¿En qué tipo de medio ambiente se encuentra esta planta?
 - a. BI, BII, rastrojo, etc?
 - b. Micro-env: elevación? pendiente? sombra? orilla de quebrada?
 - ¿Cómo ha cambiado la abundancia de esta planta en su propiedad con el tiempo?
 - ¿Esta planta se encuentra con otras plantas o con animales?
- (Ej. Suportar el bejuco, animales comiendo semillas, polinizadores, etc)

Reproducción

- ¿Podría explicarme como esta planta se reproduce?
 - a. temporada específica?
 - b. presencia de flores? semillas? por raíces?
 - c. planta hembra y macho?
 - d. tamaño de la planta a la reproducción?
 - e. presencia de jóvenes en proximidad?
 - f. dependencia sobre animales?

Uso de la planta

- Cual parte de la planta se usa, y para qué?

Recolección y acceso

- ¿Hay una temporada de recolección? Cuál es el tamaño mínimo o máximo de recolección?
- ¿Se cultiva esta planta, sea aquí o en otras comunidades? Explique.
- ¿A quién se permite la recolección en su propiedad de esta planta?
- ¿Cuánto se vende la planta recolectada, y con qué frecuencia?
- ¿En su opinión, cual factor ha afectado esta planta hasta hoy?
(Ej. Ganado compatible con arboles maderables pero come el bejuco, etc.)
- ¿Conoce usted medidas para ayudar la regeneración de esta plata en la naturaleza?

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