Non-Timber Forest Products and Community Development in Southern Mexico: A Case Study of The Maya Nut (Brosimum Alicastrum)

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Introduction

Forests have received increasing attention over the years. Beyond conceptualizing their benefits simply within the confines of timber extraction, society has reconsidered their ecological, intrinsic, subsistence, and other monetary values. Forests as income sources now include environmental services such as ecotourism and non-timber forest products (NTFPs). Peters, Gentry, and Mendelsohn (1989) were critical to the increased worth placed upon NTFPs (formally known as minor forest products) through their Amazonian research arguing that sustainable extraction of NTFPs might be more economically valuable than timber extraction. Since then NTFPs have been alternately hailed and questioned as both an economic development tool and a conservation approach (Thadani 2001; Belcher and Schreckenberg 2007). In some countries such as India NTFPs are now recognized as equally if not more important than timber for monetary value, making up 50% of national forest revenue and 70% of forest exports. Across the globe rural communities depend on NTFPs to meet both subsistence and income needs. For instance, in India 100 million people are directly reliant on NTFPs for their survival. Income dependence from the sale of NTFPs in India ranges from 5 to 55 percent with forest dwellers particularly dependent on NTFPs to meet both cash and subsistence needs. In some states of India "80 per cent of forest dwellers depend entirely on NTFP[s]" (Rasul, Karki, Sah 2008, 780). NTFPs are particularly important for the poor, for instance the World Bank calculates that "approximately 90 percent of the poorest people rely on forests for subsistence and income" (Donovan et al. 2006, 2).

This paper examines the potential of one NTFP, the Maya Nut (Brosimum alicastrum Swartz), to fulfill a dual function of conservation and economic development. The research utilized within this case study was conducted in rural southern Mexico, an area of particular interest given Mexico's regional and rural-urban disparities. A 2006 World Bank study of rural poverty in Mexico found that while only 25% of the population lives in rural areas, 60% of the extreme poor are concentrated there. Meanwhile, regional disparities between northern and southern states were even more pronounced ("A Study"). Poverty and inequality rates would be even higher in rural southern Mexico if NTFP income were nonexistent. This is due to the greater income importance of NTFPs there relative to more urban and northern areas (López-Feldman, Mora, and Taylor 2007).

The Maya Nut occurs from northern Mexico to the state of Acre, Brazil, as well as Jamaica and Cuba (Sánchez Garduño 2005). It grows in over one-third of the states of Mexico and can be found primarily in humid and sub-humid primary and older secondary tropical forests. It can grow as tall as 40 meters and have a diameter of more than a meter (Sánchez Garduño 2005). Within Mexico the Maya Nut is "one of the most dominant

and widely distributed trees in the country" (Peters and Pardo-Tejeda 1982, 166), supporting 85% of neotropical wildlife (Vohman 2008).

The Maya Nut is known by more than 50 common names, including ramón, meaning to browse or forage in Spanish, and ox, historically used by Yucatec Maya to describe "stocks of shelled maize kernels, [which] gives some indication of the ancient cultural importance of this tree" (Peters and Pardo-Tejeda 1982). The name used here, Maya Nut, appears to have originated from The Equilibrium Fund, a non-governmental organization (NGO) that I worked closely with to conduct this research. The name is meant to emphasize this historical connection. Prior research has found high densities of the Maya Nut surrounding Mayan ruins causing authors such as Puleston to argue that the Maya Nut was pivotal to the success of the Maya civilization.

> [T]he tropical forests of the Maya Lowlands, in fact, seem to have offered certain specific resources which, because they were utilized skillfully, permitted the rise of a state society, which was sustained by one of the highest regional population densities in the pre-industrial world. The key to this success appears to have been the utilization of the seed crop produced by a single tree species, *Brosimum alicastrum* Sw. (Puleston 1982, 354).

However, Peters 1983 offered a different interpretation of the high densities found around Mayan ruins. He argued that the Maya Nut was particularly conducive to the shallow limestone found near archeological sites and that bats had assisted in dispersing the seed. Despite this debate authors agree that the Maya Nut has been historically used as an alternative crop during famine. The Maya Nut was often used as a substitute when maize crops failed among a variety of other purposes including food, fodder, and medicine (Gillespie, Bocanegra-Ferguson, and Jimenez-Osornio 2004). Some medical uses include use as cough medicine, inducing menstruation, a soothing balm, a diaphoretic, asthma relief, treating diabetes, and treating tuberculosis (Arellano Rodriguez et al. 2003). Additional contemporary uses include approval as brake pads for the Mexican underground railway system, firewood, cheap furniture, beehives, tool handles, and paper (Sánchez Garduño 2005). Food, beverage, firewood, and fodder are the most common uses today.

In particular, use of the Maya Nut as fodder remains widespread throughout the Yucatan Peninsula and presents strong potential throughout other states as a way to preserve forests. Deforestation to achieve grasslands for cattle could be mitigated with increased use of the Maya Nut as fodder. Both the fruits and leaves can be used as fodder providing 12.96% crude protein from leaves and twigs (Carranza-Montaño et al. 2002), thereby potentially replacing the need for grain supplements among ruminants (Ayala and Bird 1992). Peters and Pardo-Tejada (1982) asserted, "Feeding trials using various mixtures of the seeds with sorghum resulted in excellent weight gains in cattle, sheep, hogs, and goats. As an additional benefit, B. alicastrum has been reported to increase milk production in dairy cattle by 1-2 liter/day" (170). The Maya Nut is also among the very few fresh forage sources during the dry season and an important income source for the Yucatec Maya (Gillespie, Bocanegra-Ferguson, and Jimenez-Osornio 2004).

Utilizing the Maya Nut as food is the primary focus of The Equilibrium Fund and international market use as it has developed to date. The culinary potential of Maya Nut

is one of its greatest strengths given its versatility and nutritional attributes. "Recipes for fresh Brosimum alicastrum seed include mock potato salad, ramón dough, croquettes, tamales, soup, tortillas, puree, dumplings, fritters, and quiche. Recipes for roasted ramón seed include pancakes, bread, banana bread, pudding, cereal, ice cream, cake, cookies, and a coffee-like beverage" ("GRAS report" 2007). Beyond versatility, the Maya Nut has also been championed for its nutritional value. Crude protein has been compared to eggs, wheat, corn, and milk (Sánchez Garduño 2005). The seeds contain carbohydrates, small amounts of fat and minor amounts of flavonoids ("GRAS report" 2007) as well as high levels of "iron, folate, calcium and micronutrients (vitamins A, E, B and C)" (Vohman, 2008).

> Chemical analyses indicate that the seeds are extremely nutritious. Their crude protein content compares favorably to wheat and is higher than corn. In terms of protein quality, tryptophan concentration of the seeds is 4 times greater than that of corn, an important difference because Latin American diets based mainly upon corn are usually deficient in this amino acid (Peters and Parado-Tejeda 1982, 169).

Despite these obvious benefits, the Maya Nut is not part of local diets throughout southern Mexico. The greatest limitation is a lack of knowledge. Drawing from the work of Nations and Nigh 1980 and Ross 2002 it appears evident that this is due to both recent immigrants never being introduced to the Maya Nut or the ecological knowledge not being passed down by elders. Furthermore, the Maya Nut being associated with famine increases the social stigma of utilization. The Equilibrium Fund's primary goal is therefore to educate women about the Maya Nut. They teach rural women about the nutritional value of this seed and aim to promote women empowerment, fight malnutrition, increase food security, and combat deforestation. They are currently operating in Mexico, Nicaragua, Honduras, Guatemala, El Salvador, Haiti, and Costa Rica, with plans to expand to Peru, Belize and Colombia (The Equilibrium Fund, 2010). Community workshops demonstrate how women can integrate the seed back into their everyday diet utilizing local ingredients and resources. The most intrigued and ambitious women are then given the opportunity to earn an income from The Equilibrium Fund by traveling to neighboring rural villages and undertaking similar presentations. Eighteen autonomous cooperatives have resulted from The Equilibrium Fund workshops. However, cooperative developments are the work of former workshop attendees and are not affiliated with The Equilibrium Fund. Given that the organization promotes the Maya Nut as a means to fight malnutrition, empower women, and provide food security they are more concerned with reforestation for consumption and not commercialization. Commercialization particularly on the international level remains a worry of The Equilibrium Fund due to fear of worker exploitation, even within the Fair Trade market. Past experiences working primarily with United States and British businesses to market the Maya Nut have caused The Equilibrium Fund's director, Erika Vohman, to believe that many businesses are simply seeking profit and have no benevolent interest in bettering the lives of the women selling the Maya Nut. However, one cooperative from Guatemala has already begun exporting the Maya Nut to Guyaki and appears to have a

positive working relationship with the company (Vohman, Personal Interview 2009-10; Farag 2010).

This paper highlights The Equilibrium Fund's rural development work and explores the potential of commercialization of the Maya Nut. It addresses rural farmer's livelihood methods, their knowledge of the Maya Nut, and ultimately their willingness to reforest with this particular NTFP. The main goal was to understand the obstacles and opportunities of reforesting with the Maya Nut for rural southern Mexican communities. Central American populations of the Maya Nut have experienced greater rates of deforestation than most of Mexico, becoming extinct in some regions, but areas such as Veracruz still remain threatened. This is primarily due to cattle ranching, deforestation for food production, and knowledge of the Maya Nut as good firewood (Sánchez Garduño). To address deforestation and food security The Equilibrium Fund promotes reforestation of the Maya Nut in plantations outside of its natural environment (Vohman). While plantations have begun in the Central American states of Guatemala, El Salvador, and Nicaragua (The Equilibrium Fund), they have yet to fully develop within Mexico. The role of study was to conduct interviews addressing Mexican communities' willingness to reforest with the Maya Nut.

Evidence from the surveys suggests that market development of the Maya Nut could create incentives for reforestation in hopes of economic development. Furthermore, commercialization of the Maya Nut appears possible given that United States and British companies are already utilizing the seed and one Guatemalan cooperative is exporting to one of these companies. The question then must be asked: Can the Maya Nut actually achieve both conservation and development goals? To answer this question a better understanding of NTFP potential advantages and shortcomings is necessary. Pursuing this discussion should not negate many respondents' unconditional support for The Equilibrium Fund's work, nor the potential benefit that increased education and assistance would bring from other organizations. What shall proceed is simply an informed hypothesis of what could occur from market development of the Maya Nut in attempting to achieve both conservation and rural development.

This research is important given that former literature advocated the commercialization of the Maya Nut (Peters and Pardo-Tejeda 1982) but no subsequent research has been published exploring rural resident's desire for commercialization and potential benefits and drawbacks of market development. Peters and Pardo-Tejeda (1982) concluded their research advocating for increased biological knowledge of the Maya Nut but emphasized market development as the most pressing issue to utilization of the Maya Nut as another cash crop. While biological knowledge of Maya Nut is advancing (Ayala and Bird 1992; Carranza-Montaño et al. 2002; Gillespie, Bocanegra-Ferguson, and Jimenez-Osornio 2004; Sánchez Garduño 2005) the social analysis of the potentials of commercialization of the Maya Nut remain under explored. This paper seeks to contribute to that discussion by adding to the literature concerning this undervalued NTFP and assisting organizations and communities who are considering promoting the commercialization of the Maya Nut.

Field Study

Materials, Methods, and Location

This field research was conducted over a period of approximately three months from April to June of 2008 in the southern States of Mexico. Survey interviews were conducted as part of Maya Nut cooking workshops sponsored by The Equilibrium Fund. All interviews were conducted in Spanish by a regional authority and myself. In Chiapas, an employee of the CONANP (*Comisión Nacional de Areas Naturales Protegidas* or Natural Commission of Protected Natural Areas) assisted in all interviews. His presence proved beneficial for translation confusions and seemed to bring legitimacy to The Equilibrium Fund's presence in the region. In Veracruz and Yucatan all interviews were conducted alone. Juxtaposing these two experiences of interviewing with a government official and without did not reveal differences in interviewee's responses.

Interviews took place primarily in Chiapas, with supplementary interviews in Veracruz and Yucatan. (Table 1). Forty-four total interviews were conducted. The communities in Chiapas included: La Democracia, San Felipe, Nueva Argentina, Plan de Rio Azul, Pena Blanca, Nuevo San Andres La Paz, Quiringuicharo, Lacanja Chan Sayab, and Nueva Palestina. These communities serve as a buffer zone of ejidos surrounding the Montes Azules Biosphere Reserve. Interview respondents stated that these ejidos were established in the late 1970s and early 1980s, complementing the establishment of Montes Azules in 1978 (Nations 2006). These communities are composed of primarily indigenous communities including Chol, Tzeltal, Tzotzil, Lacandon, and Tojolabal. The Lacandon predate all other indigenous groups in the area by several centuries, entering these forests during the eighteenth and nineteenth century after fleeing the colonizing Spaniards in southern Campeche and the Guatemalan Petén (Nations 2006). Other inhabitants immigrated between 1940 and the present. These immigrants included the Tzeltal and Chol Maya who were returning to their ancestral land after being removed from these jungles by the Spaniards in the sixteenth century (Nations and Nigh 1980). Within Veracruz interviews took place in two ejidos: Benito Juàrez and Ojoxapan. These ejidos surrounded the Los Tuxtlas Biosphere Reserve, similar to the situation in Chiapas. Finally, the interviews conducted in the state of Yucatan took place in Ticul and Oxkutzcab. Time spent in each community was admittedly limited. The average time spent in a community was eight hours. Four people were interviewed per community on average, with some interviews being conducted in group settings and others in individual settings.

The interview process became increasingly informal throughout the study and should be considered semi-structured. While several initial interviews were conducted with a tape recorder and a regimented order of questions, as the interviewer became more familiar with local social dynamics a less formal semi-structured approach evolved, centered on key questions to guide each interview. The primary purpose for the interviews was to understand the willingness of respondents to reforest with Maya Nut, and the informal questioning mostly centered on this issue. Due to interviews being conducted to allow for the greatest amount of comfort among interviewees the results are better suited for conveying ethnographic evidence rather than cross-national implications. The data collected in this case study tell the story of In reviewing my statistical findings the reader should take note of each question's sample size given that sample sizes of each question varies. Informality resulted in some questions never being addressed and when

interviewees were perceived as unwilling to answer the question I simply moved forward to the next question at hand.

Interview findings have been divided into individual interviews and group interviews reflecting documented variation in the results of both approaches. For instance, interviews conducted in a group setting often result in some respondents answering questions more than others, which is often representative of age and prestige within the community. The benefit of group interviews is stated nicely by Tuxil and Nabhan 2001: "Group interviews and collective oral histories of places have the advantage of presenting multiple perspectives from a single community all at once. The resulting interplay between residents during discussions often reveals valuable information on local social arrangements" (36). Conducted interviews consist of twenty-three individual interviews and five group interviews composed of twenty-one individuals. The resulting figure is forty-four total respondents. Most respondents were men given that The Equilibrium Fund's cooking workshops are entirely geared towards women who were therefore preoccupied while I conducted my interviews. Traditional gender divisions also make men a better resource for understanding prospects of reforestation given their primary role as land stewards beyond the home garden. Consequently, of the twenty-three individual interviews only three were women. Meanwhile, among the group interviews only one group was comprised of women, totaling four respondents. Therefore, only 16% of interviewed respondents were women and 84% were men.

Households in this case study practiced a mixture of subsistence and cash crop livelihood methods. Crops grown included: corn, beans, chilies, bananas, yucca, squash, cacao, pineapple, coffee, oranges, sweet potatoes, grapefruit, coconuts, lemons, and pepper. Women tended to manage the garden surrounding the home, while men took care of the larger growing plot. Land management techniques are remarkably different between recent immigrants and inhabitants who have resided in their location for the past few centuries. The milpa management system of the Lacandon and Yucatec Maya draws upon passed down knowledge that is particular to the local environment and contains information that has been gleaned over centuries. Recent immigrants typically are not equipped with this knowledge, resulting in greater environmental degradation (Ewell and Merrill-Sands 1987; Meyers 1992; Nations and Nigh 1980; Tuxill Personal Interview 2010).

Occupations of male respondents were mostly farmers and ranchers, comprising 68% and 24% respectively. (Figure 1). Only two of these respondents indicated having an occupation in addition to their occupation as a farmer. Meanwhile, two respondents indicated being part-time ranchers who were mostly retired. It should be noted that the occupations of respondents was largely dependent on geographical location. 86% of male respondents in the state of Chiapas indicated occupations of farming. Only the community of Quiringuicharo was comprised of mostly ranchers within the state of Chiapas. The environmental degradation appeared to be particularly pronounced here. Those in Veracruz discussed their switch to ranching as a survival decision. Increased importation of subsidized corn from the United States resulting from the North American Free Trade Agreement and the low prices offered by produce transporting middle-men had necessitated their switch from farming to ranching. One rancher from Benito Juarez commented: "Coyotes [middlemen] would come and buy our corn for one peso per kilo

and then sell it for two pesos per kilo. We were getting less money back than we were putting into it. Ranching doesn't pay that well either, but it's a lot easier." The remaining occupations included tourism (a significant economic activity in Lacandon communities), a convenient-store owner, and a non-governmental organization employee.

Women's primary occupation was within the home. Cooking, cleaning, looking after the children, managing the home garden, and preparing harvested food for storage were predominantly reserved for women. Only one woman interviewee indicated having a job outside of the home. In this instance she was part of a cooperative that sold bread. However, six communities indicated having cooperatives, signifying that other women within these communities engage in occupations outside of the home.

Results

Among the individual interviews an equal number of respondents gave positive responses as gave negative responses concerning utilizing NTFPs. (Table 2). Among group interviews not utilizing non-timber forest products dominated, with 41% utilizing NTFPs and 59% not. Overall findings remain slightly in favor of not utilizing NTFPs, with 54% responding negatively to utilization and 46% responding positively. The expressed mixed response has multiple possible explanations. One is a methodological answer, whereby respondents appeared to not fully understand the question. When some respondents would indicate that they did not use NTFPs I would proceed to mention particular NTFPs that other community members had indicated using and respondents would then state similar use. An instance such as this proves that respondents often use NTFPs without associating it with coming from the forest. Meanwhile, when some respondents indicated utilizing NTFPs they would proceed to describe fruits such as oranges that were obviously being grown in the garden next to their home and not coming from the forest. This signifies that more precise questions would be necessary to truly feel confident with respondent's utilization of NTFPs. Other potential answers are that NTFPs may be losing importance relative to cash crops, manufactured foods could be of increased importance (Nations and Nigh 1980), knowledge of NTFPs are not being passed down to new generations (N. Ross 2002), or recent immigrants from the highlands and other parts of Mexico could have never obtained the knowledge of usable NTFPs while others have. Despite the cause, findings show that some respondents knew nothing of NTFP utilization. Emblematic of this response one interviewee replied: "What is there to use in the forest?"

Maya Nut findings can be split into three main categories: limited knowledge and low utilization, regional variation in knowledge regarding use, and age specific knowledge. Most respondents had heard of the Maya Nut, but knowledge was often limited and not based upon personal experience. 96% of respondents had heard of the Maya Nut but only 11% were actually utilizing it in a manner other than as firewood. The majority of who are educators that promote the Maya Nut independently throughout their locality and have some connection with The Equilibrium Fund. Respondents knew about various uses of the Maya Nut, but current utilization centered on use as firewood. Knowledge regarding potential use was regionally specific. In Chiapas respondents' knowledge of potential uses of Maya Nut was largely limited to use as food. Only 9% of respondents had heard or witnessed livestock eating the Maya Nut. The Lacandon people

did not indicate knowledge of Maya Nut leaves or seed being used as fodder for livestock as well. This is probably due to the Lacandon people's minimal use of cattle given their relative isolation from Spaniard influence until recently and the negative consequences cattle would bring to the Lacandon milpa system (Nations and Nigh 1980). Cattle were introduced in Mesoamerica with the arrival of the Spaniards (Sluyter 1996), therefore isolation has limited the influence of ranching, which was verified by study observations. Experience in Lacanja Chan Sayab found no ranching occupations. In Veracruz knowledge was mixed, 43% of respondents knew of the Maya Nut as a potential food source, while 57% knew of the Maya Nut as fodder. This finding is limited by sample size however, totaling of only seven respondents. Yucatan findings are also limited by sample size given that only two respondents were interviewed. Both had knowledge of the Maya Nut beyond food and fodder, but they were associated with a recent cooperative that had started in Yucatan to promote the Maya Nut and were connected with The Equilibrium Fund. Most utilization of the Maya Nut as fodder is limited to cattle but surveys also showed that horses, goats, and swine eat the nuts and leaves. Gillespie, Bocanegra-Ferguson, and Jimenez-Osornio 2004 found that the Maya Nut is not currently used as a food source throughout the Yucatan Peninsula. They assert that use is mostly limited to fodder and confirm this study's findings that knowledge is also limited by age. "[O]lder interviewees remembered that previous generations used Ramón as a substitute or supplement for maize" (30). Throughout Chiapas and Veracruz knowledge was much greater among older generations than younger generations. Those who had actually eaten the Maya Nut or witnessed livestock eat the Maya Nut were all of an older generation. This research suggests geographical and generational limitations for knowledge surrounding the use of the Maya Nut. Where knowledge does exist about the Maya Nut as a food source, social stigma remains a barrier. Due to the Maya Nut's historical use as a famine crop for the Maya people when corn harvests failed, Mesoamerican communities continue to associate the Maya Nut with low social standing.

Interviews revealed unanimous consensus regarding tree planting benefiting future generations. (Table 2). However, most respondents are concerned with the near-term rather than the long-term. Out of twenty-nine respondents an equal proportion of 42% stated unconditional willingness to reforest with the Maya Nut as those who would only do so contingent on market development. (Figure 2). Group interviewees echoed this last response. All three groups voiced a desire to reforest with Brosimum alicastrum but the group of ten individuals from Nuevo Argentina was adamant that their willingness to reforest would be contingent on market development. Almost every respondent within this group reiterated the question: "How will plantations benefit us if there is no market to sell the product?" This response is indeed significant. 3% of respondents stated an unwillingness to reforest with the Maya Nut given the failure of past seed growth from seeds provided by CONAMP. 7% of respondents voiced an inability to reforest given their lack of property rights or communal land to grow upon. Overall market development remains the biggest barrier to development utilizing the Maya Nut. This obstacle should not however entirely overshadow the almost equal response of unconditional support for the Maya Nut. When respondents were asked whether The Equilibrium Fund's workshops were perceived as beneficial to the community 78% of individually interviewed respondents replied yes. (Table 2). 11% said no, with an equal proportion stating that it would only be beneficial contingent on

market development. However, among group interviews only 29% said yes, 0% said no, and 71% said the workshops could only be beneficial contingent on market development. It should be stated that this data is largely driven by a group of ten men in the Chiapas village of Nuevo Argentina who were interviewed while the cooking workshops were taking place, and therefore had limited information to draw their response from. Total responses indicated 48% stating that The Equilibrium Fund's workshops would be beneficial to the community, 4% stating they would not be, and 48% contingent on market development.

When respondents were asked what could assist them in reforesting with the Maya Nut beyond market development five main issues became apparent. (Figure 3). First, the majority of respondents saw no need for reforestation given that the Maya Nut could already be harvested in the surrounding rainforest. Second, greater education was emphasized. Many respondents admitted that their only prior knowledge of the Maya Nut was its use as firewood. Within this context, respondents hoped that future workshops would be held in an effort to continue to build on their new knowledge. They also voiced desire for technical assistance to teach entrepreneurial and business skills in hopes of commercializing the Maya Nut. Third, financial assistance was desired. Fourth, the need for more resources was stressed, including such items as metal cages to protect seedlings from cattle grazing and plastic bags to grow seedling in. Finally, one respondent mentioned the need to include men in the Maya Nut workshops. Although this response is not statistically significant I find it particularly noteworthy given that men's established gender role as land stewards makes them the primary link to implementing reforestation. When one female respondent was asked whether she would be willing to reforest with the Maya Nut she replied favorably and mentioned that she would go home and ask her husband's opinion.

Discussion

Overwhelmingly respondents see the nutritional, community building, and environmental benefits of Maya Nut reforestation, but a slightly larger number of respondents still see market development as necessary for reforestation to take place. Therefore a discussion of the potentials of marketing NTFPs is necessary. Belcher, Ruíz-Pérez, and Achdiawan (2005) have placed particular importance on understanding NTFP household economy strategies and management intensities as a means of differentiating reliance and use of NTFPs. Their research separates management intensity into wild, managed, and cultivated. Household economies then fall into subsistence, supplementary, integrated, and specialized (either natural or cultivated) strategies. Given that the Maya Nut can be gathered relatively easily from the forests surrounding communities in southern Mexico, a supplementary strategy would be a logical first step for integrating the Maya Nut into the cash economy. In this case the Maya Nut would not be the primary income source and would continue to be harvested from wild populations. However, cultivated NTFP strategies provide the greatest productivity and profitability (Belcher, Ruíz-Pérez, and Achdiawan 2005). Therefore communities must weigh potential profits against potential losses in biodiversity (Arnold and Pérez 2001).

Numerous authors (Arnold and Pérez 2001; Belcher, Ruíz-Pérez, and Achdiawan 2005; Belcher and Schreckenberg 2007; Gubbi and MacMillan 2008) have highlighted

commercialization of NTFPs results in a loss of forest biodiversity. Belcher and Schreckenberg 2007 and Arnold and Pérez 2001 argue this point from a theoretical framework, while Belcher, Ruíz-Pérez, and Achdiawan 2005, Gubbi and MacMillan 2008 utilize empirical case studies. All authors acknowledge that market demand is at odds with the conservation of biodiversity. Larger profit margins result from increased intensification of NTFPs and declining biodiversity of the cultivated site. As Belcher and Schreckenberg (2007) point out this needs to be qualified. "Should the current management system be compared with a natural undisturbed forest? Or should it be compared with a degraded forest or even an agricultural field?" (365). Belcher, Ruíz-Pérez, and Achdiawan (2005) argue that increasing the intensity of a management system for NTFPs can remain high in biodiversity relative to intensive agriculture methods such as monocultures. Especially when weighed against the economic benefits to rural communities, the maintained biodiversity under intensive NTFP management can be quite favorable. Achieving such an end is largely dependent on understanding the ecology and sustainable harvesting levels of the particular NTFP, having secure tenure, and maintaining good organization (Belcher and Schreckenberg 2007; Pendleton and Howe 2002). Harvesting high yielding varieties of fruits, seeds, and leaves provide the greatest guarantee against over-exploitation (Belcher and Schreckenberg 2007). Increased intensity of management of the Maya Nut compares favorably to these conditions. First, Maya Nut food and beverage products come from the seed and fodder can be in the form of leaves or seed. This requires minimal harm to the tree. Second, an adult Maya Nut tree can produce 400-800 kg of forage and 30-58 kg of seed each year, with plantation systems of up to 40,000 trees per hectare, yielding 6 to 15 tons of fresh forage per hectare per year (Ayala and Bird 1992). Other studies look even more promising for seed yield, calculated to be 50-75 kg per tree (Peters 1982). Third, the Yucatan variety of the Maya Nut is particularly promising given that it can bear fruit within 4 years of planting (Jesus Hernandez) while the Chiapas variety takes up to 20 years (Sánchez Garduño). Seed yield discrepancies, patterns of fruiting, and regional differences have led The Equilibrium Fund's Mexico director, Dr. Sánchez Garduño, to desire more biological evidence concerning the sustainable harvesting levels and biological characteristics of the Maya Nut tree (Sánchez Garduño and Hernández 2005; Sánchez Garduño 2005). Recent grants should shed light on these topics (Sánchez Garduño Personal Interview). The ejido land tenure system also presents itself favorably to plantations. Among the twenty-nine respondents who conveyed their willingness to reforest with the Maya Nut only 7% were unwilling due to a lack of property. The research locations of Chiapas and Veracruz are exceptionally promising given that Belcher and Schreckenberg (2007) claim that buffer zones surrounding protected areas are particularly suited to allow NTFPs to provide income for rural communities while still meeting conservation goals.

NTFPs are important to both the poor and the relatively wealthy (Rana 2009). For the poor, NTFPs often act as a safety net during natural disasters or when agricultural yields are low (Rasul, Karki, Sah 2008; Belcher, Ruíz-Pérez, and Achdiawan 2005). The Maya Nut itself has been used in this way in Guatemala after hurricane Stan in 2005 and in Nicaragua after hurricane Felix in 2007 (Kajenje 2008). Other factors such as unemployment, death, or illness can also necessitate the harvest or sale of NTFPs (Belcher, Ruíz-Pérez, and Achdiawan 2005). The majority of NTFPs are consumed

rather than sold. In India 60% of harvested NTFPs become subsistence rather than an income source (Rasul, Karki, Sah 2008). Overall this is true of the Maya Nut as well given that practically no commercialization of the Maya Nut is taking place, but as described earlier, general use is remarkably low except among the Yucatec Maya. NTFPs require low amounts of processing and traditional technologies, and therefore more accessible (Belcher, Ruíz-Pérez, and Achdiawan 2005). While the poor are often more reliant on NTFPs in terms of subsistence and primary income source, commercialization often favors the relatively wealthy (Belcher and Schreckenberg 2007; Belcher, Ruiz-Perez and Achdiawan 2005; Gubbi and MacMillan 2008; Poole, Gauthier, and Mizrahi 2007). This deserves qualification. "Even commercial NTFP producers tend to be poor or very poor relative to national averages" (Belcher, Ruiz-Perez and Achdiawan 2005, 1443). Nonetheless, there are impediments for the very poorest of rural communities in achieving commercialization of NTFPs. This includes low levels of education, infrastructure impediments, predatory middlemen, and insufficient technology to process and market their product (Gubbi and MacMillan 2008). "[A]ccess to markets is a function of assets: ownership of transport services; finance to assemble and sell products" (Poole, Gauthier, and Mizrahi 2007, 326). This anti-poor bias was not observed for the Maya Nut given that commercialization has yet to occur. The same causes that make rural communities poor in the first place, hinder their ability to market NTFPs. "Poor people are poor because they have poor access to markets, insufficient human capital, insufficient productive capital, weak institutions, and generally weak bargaining power. (Some) NTFPs may offer the potential to create employment and income generating opportunities, but realizing this potential will require investments in other areas as well" (Belcher, Ruiz-Perez and Achdiawan 2005, 1447). Moreover, commercialization exposes rural communities to volatile market forces that can be extremely disruptive to rural economies (Arnold and Pérez 2001). However, some NTFPs are not inhibited by all these impediments to commercialization and are not necessarily anti-poor. López-Feldman, Mora, and Taylor 2007 assert that xate is one such NTFP, requiring little capital investment or infrastructure development. The Maya Nut appears to be a similar NTFP.

Maya Nut cooperatives provide encouraging evidence for commercialization. As mentioned in the introduction these cooperatives are comprised of women who attended The Equilibrium Fund's workshops but were set up by the women themselves without the help of the NGO. In Central America and Mexico there are 18 autonomous women cooperatives, with Guatemala having the largest, composed of 56 associate groups. This large cooperative is the only cooperative involved in exporting the Maya Nut. On the supply side United States and British organizations such as Traditional Medicinals, Guayaki, ForesTrade, TJ Enterprises, and Teeccino sell the Maya Nut in either beverage or flour form (Vohman Personal Interviews 2009-10). Guyaki sells three Maya Nut blends called "Java Mate" and was one of the first organizations to source directly from the Guatemalan cooperative. They were excited to work with the cooperative but had initial difficulty getting orders to the United States in a timely matter. Subsequent orders have been timelier however (Farag 2010). This shows that overcoming international market obstacles posed by Belcher and Schreckenberg (2007) is possible in the context of the Maya Nut. However, consumer knowledge of the Maya Nut still remains an impediment to marketing (Farag 2010; Diamondstone 2010). According to ForesTrade

consumers are primarily attracted to the versatility of the product, followed by the nutritional benefits and social responsibility (Diamondstone 2010). Furthermore, these companies import the Maya Nut seed in an unprocessed form providing producers with low profit margins (Vohman Personal Interviews 2009-10). While this is understandable from a quality control perspective, producers would be better off selling the Maya Nut seed processed, increasing its value-added. Currently this is more realistic within small local markets but still requires the proper technology and business training, something that the researched communities still lack. Mexico has only developed two autonomous Maya Nut cooperatives to date, one in Jalisco and one in Yucatan and both are concentrating on local markets (The Equilibrium Fund). The Equilibrium Fund staff believes that Guatemala will always have a price advantage on Mexico in terms of selling internationally (Vohman Personal Interviews 2009-10). However, given that Mexican cooperatives are among the youngest in the region, the speed at which Yucatan varieties of the Maya Nut fruit, and the miniscule amount of attention the Maya Nut has received within Mexico until The Equilibrium Fund's presence in 2005, this study postulates that Mexico could integrate into this niche international market.

Given the nature of the Maya Nut, alternative markets designated as "green" and "fair trade" are likely to continue to provide the greatest opportunity for market access. Maya Nut products have already found themselves within this set of markets and NTFP literature advocating this option (Belcher and Schreckenberg 2007). Economists often present Fair Trade markets as a perpetuation of misplaced labor (Collier 2007). They argue that Fair Trade encourages rural producers to continue supplying the very crops that make them impoverished in the first place. The charity provided by Fair Trade inhibits producers from diversifying into other products that would better facilitate their exit from poverty. However, Smith (2009) points out that such conceptualizations of Fair Trade are more based on theory than reality. Contrary to Fair Trade critiques, developing country markets are not perfect and Fairtrade helps develop non-existent markets and provide a Social Premium that can be invested back into the community to increase human and physical capital. These funds are used to provide otherwise absent infrastructure, credit, equipment, business training, quality controls, and crop enhancement techniques. Ultimately, these improvements have even led to diversification opportunities beyond agriculture and into artisan crafts and industrial textiles. Valkila (2009) found that Fair Trade could also act as a social safety net when market prices bottom out and Bacon (2005) asserts that Fair Trade and organic networks protect producers from livelihood vulnerability. Fair Trade also increases social development through the process of creating cooperatives and strengthening organizations (Ruben, Fort, Zúñiga-Arias 2009). However, the mainstreaming of Fair Trade has also contributed to the erosion of a true partnership between producers and suppliers (Raynolds 2009) and made organizations committed to alternative grassroots development such as The Equilibrium Fund disenchanted with the label altogether (Vohman Personal Interviews 2009-10). The task then becomes finding those organizations that truly uphold the stated social and environmental responsibility goals among a proliferation of certification labels. Many certifications are not easily adapted to NTFP products and act as barriers to entry for producers who eventually see no better option than creating their own label. One such instance is PhytoTrade Africa, which connects tens of thousands of southern Africans from eight different countries who make

food and cosmetic products from NTFPs. PhytoTrade Africa found that only two "green" and "fair trade" labels (FSC and RainForest Alliance) make any mention of NTFPs in their standards. While organic certification did assist three PhytoTrade Africa members in achieving 50 per cent more per kilogram on sold products, the creation of the Ethical BioTrade verification framework ultimately provided the greatest benefit to PhytoTrade Africa members (Welford and Breton 2008). The Equilibrium Fund is currently planning on helping cooperative members take the self-certification route to develop their own organic and fair trade standards. By working directly with buyers to establish these standards, the Maya Nut cooperatives hope to find themselves both favorably certified and free from certification costs (Vohman Personal Interviews 2009-10) that are imposed by organic standards, though born by Fairtrade Labelling Organizations International (FLO) suppliers (Raynolds 2000). This approach appears plausible given that United States and British Maya Nut suppliers mentioned earlier already have various Fair Trade certifications, including Guyaki, who is working directly with the Guatemalan cooperative.

Conclusion

Market development of the Maya Nut appears capable of achieving both conservation and economic development goals. It could act as another cash crop during otherwise idle seasons (Peters and Pardo-Tejeda 1982) and provide economic diversification for rural households and communities with limited economic options and capital (Belcher and Schreckenberg 2007). Promoting Maya Nut commercialization within Mexico will require investments in processing and trade, transportation improvements, business development, and access to credit (Donovan et. al 2006). To achieve such ends government and NGO assistance will be crucial. The Equilibrium Fund's emphasis on education, women's empowerment, and food security make it more adept at providing social development and less capable of addressing economic development. However, the jobs provided by The Equilibrium Fund for women to facilitate workshops should not be minimized. Overcoming the social stigma associated with the Maya Nut as a famine crop will also be crucial to successful development of the Maya Nut. Bypassing this obstacle will require education of the nutritional values of the Maya Nut and a re-conceptualization of the nut within social contexts. Increased education is also needed in terms of the benefits of the Maya Nut being used as fodder, particularly in the state of Chiapas. Emphasis should be placed on the potential for increased milk yields achieved from dairy cattle eating the Maya Nut and the ability to use Maya Nut when grasses have been overgrazed and during the dry season.

Ultimately development planning has to directly involve the community (Barkin 2009) and communities must weigh potential losses in biodiversity against potential economic gains (Arnold and Pérez 2001). As Belcher, Ruiz-Perez and Achdiawan (2005) have pointed out, if external constraints were lifted enabling effective commercialization of NTFPs rural dwellers might choose another profession outside of NTFP extraction. However, Maya Nut commercialization still represents a good first step towards development while meeting many of the recommendations for mitigating unsustainable NTFP extraction.

State	Village	Interview Type	Number of People Interviewed
Chiapas	La Democracia	Individual	2
Chiapas	San Felipe	Individual	4
Chiapas	Nuevo Argentina	Group	10
Chiapas	Plan de Rio Azul	Individual	1
Chiapas	Plan de Rio Azul	Group	4
Chiapas	Plan de Rio Azul	Group	2
Chiapas	Pena Blanca	Individual	2
Chiapas	Nuevo San Andres La Paz	Individual	3
Chiapas	Nuevo San Andres La Paz	Group	3
Chiapas	Quiringuicharo	Indivdual	2
Chiapas	Lacanja Chansayab	Individual	1
Chiapas	Nueva Palestina	Individual	1
Veracruz	Benito Juàrez	Individual	3
Veracruz	Ojoxapan	Individual	2
Veracruz	Ojoxapan	Group	2
Yucatan	Ticul	Individual	1
Yucatan	Oxkutzcab	Individual	1
			44

Table 1 n=44

Table 2

Do you use non-timber forest products?	**Have you heard of the Maya Nut?**	**Do you utilize the Maya Nut?**	**Have you seen cows eat the Maya Nut?**	**Do you believe The Equilibrium Fund's workshops will be beneficial to your immediate future?**	**Would you support the formation of a women's cooperative?**	**Do you believe that your kids will be able to use the trees you plant?**
Individual Response	Individual Response	Individual Response	Individual Response	Individual Response	Individual Response	Individual Response
50% Yes	92% Yes	22% Yes	58% Yes	78% Yes	58% Yes	100% Yes
50% No	8% No	78% No	42% No	11% No	8% No	0% No
n=20	n=12	n=23	n=12	11% Contingent on Market Development	34% Already Established	n=9
Group Response	Group Response	Group Response	Group Response	n=9	n=12	Group Response
41% Yes	100% Yes	0% Yes	12% Yes	Group Response	Group Response	100% Yes
59% No	0% No	100% No	88% No	29% Yes	18% Yes	0% No
n=17	n=14	n=21	n=16	0% No	0% No	n=14
Total	Total	Total	Total	71% Contingent on Market Development	82% Already Established	Total
46% Yes	96% Yes	11% Yes	32% Yes	n=14	n=17	100% Yes
54% No	4% No	89% No	68% No[1]	Total	Total	0% No
n=37	n=26	n=44	n=28	48% Yes	34% Yes	n=23
				4% No	3% No	
				48% Contingent on Market Development	63% Already Established	
				n=23	n=29	

1 Regionally notable. All negative responses from Chiapas.

Figure 1 n=44

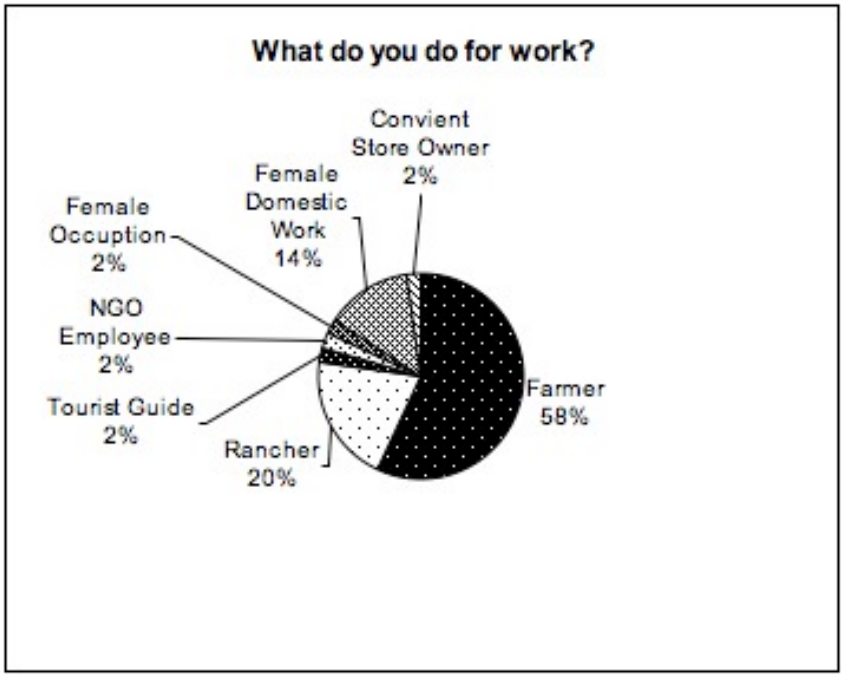


Figure 2 n=29

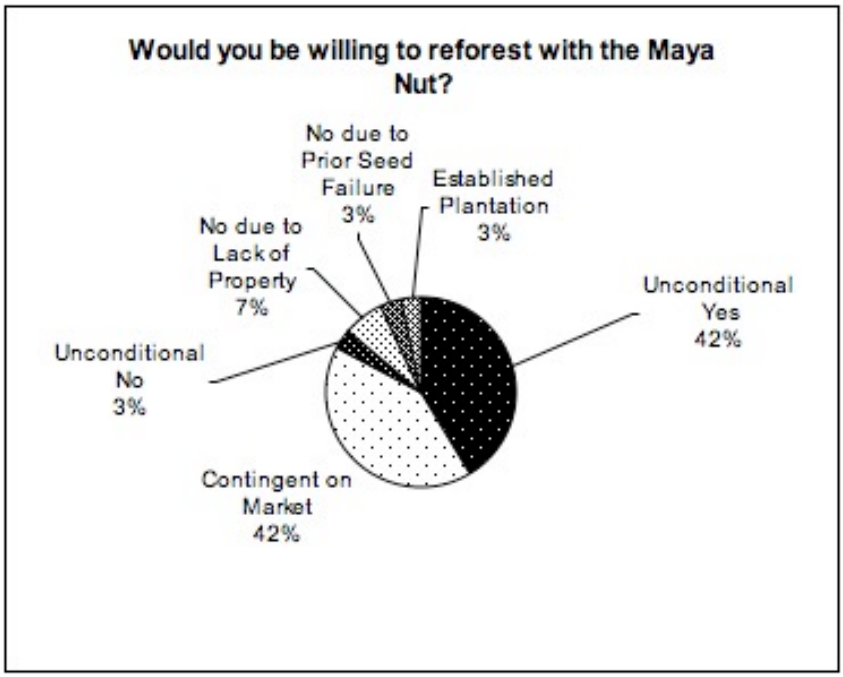
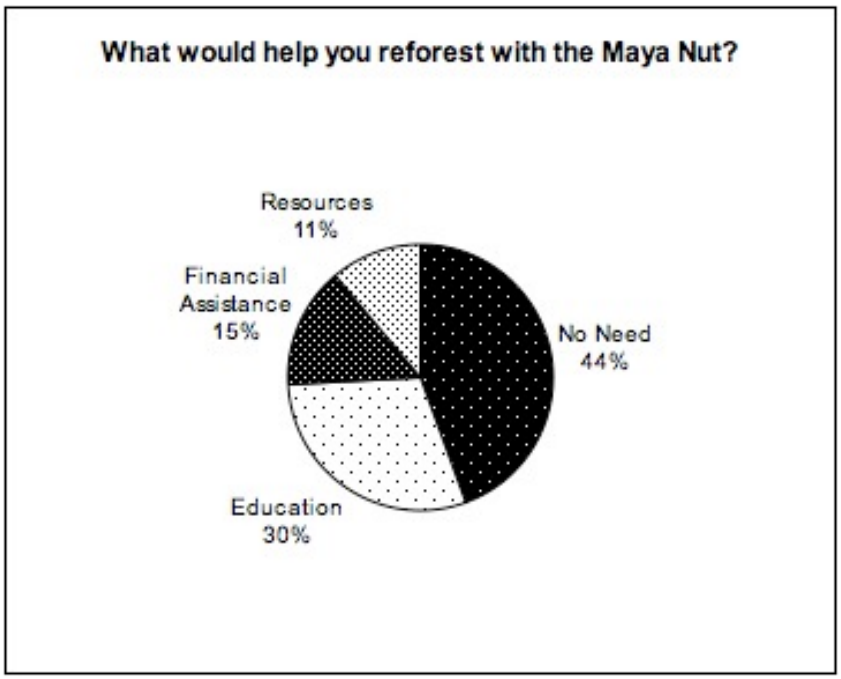


Figure 3 n=24


What would help you reforest with the Maya Nut?
Resources
11%
Financial
Assistance
15%
No Need
44%
Education
30%

Bibliography

"A Study of Rural Poverty in Mexico." 2006. World Bank. http://siteresources.worldbank.org/INTMEXICO/Resources/A_Study_of_Rural_Poverty_in_Mexico.pdf

Arellano Rodriguez, Alberto, et al. ed. 2003. Ox. Pp 433. Nomenclatura, forma de vida, uso, manejo y distribución de las especies vegetales de la Península de Yucatán. Universidad Autónoma De Yucatán: Mérida.

Ayala, Alejandro, and Margaret Bird. 1992. Brosimum alicastrum: the riches of ramon trees in Mexico. *Agroforestry Today* 9 (2): 26-27.

Bacon, Christopher. 2005. Confronting the coffee crisis: can fair trade, organic, and specialty coffees reduce small-scale farmer vulnerability in northern Nicaragua? *World Development* 33 (3): 497-511.

Barkin, David. 2009. Principles for constructing alternative socio-economic organizations: lessons learned from working outside institutional structures. *Review of Radical Political Economics* 41 (3): 372-379.

Belcher, Brian, and Kathrin Schreckenberg. 2007. Commercialization of non-timber forest products: a reality check. *Development Policy Review* 25 (3): 355-377.

Belcher, Brian, Manuel Ruíz-Pérez, and Ramadhani Achdiawan. 2005. Global patterns and trends in the use and management of commercial NTFPs: implication for livelihoods and conservation. *World Development* 33 (9): 1435-1452.

Carranza-Montaño, Mario A., Lázaro R. Sánchez-Velásquez, Ma. Del Rosario Pineda-López, and Ramón Cuevas-Guzmán. 2003. Forage quality and potential of species from the Sierra de Manantlán (México) tropical dry forest. *Agrociencia* 37: 203-210.

Collier, Paul. 2007. The Bottom Billion. Oxford University Press: Oxford.

Diamondstone, Ian. March 12, 2010. Personal interview via email.

Donovan, Jason, Dietmar Stoian, Duncan Macqueen, and Sophie Grouwels. 2006. The business side of sustainable forest management: small and medium forest enterprise development for poverty reduction. *Natural Resource Perspectives* 104 http://www.odi.org.uk/resources/download/37.pdf, viewed 11 March, 2010.

Ervin, Jamison B., and Patrick Mallet. 2002. The rise of certification, the current state of the playing field for NTFP certification programmes and future prospects. Pp. 7-19, in Patricia Shanley, Alan R Pierce, Sarah A Laird and Abraham Guillen, ed.

Tapping The Green Market: Certification and Management of Non-Timber Forest Products. Earthscan Publication Ltd: London.

Ewell, Peter T., and Deborah Merrill-Sands. 1987. Milpa in Yucatán: A Long-Fallow Maize System and Its Alternatives in the Maya Peasant Economy. Pp. 95-129, in B.L. Tuner II and Stephen B. Brush, ed. Comparative Farming Systems. The Guilford Press: New York.

Farag, James. March 26, 2010. Personal interview via email.

Gillespie, A.R., D.M. Bocanegra-Ferguson, and J.J. Jimenez-Osornio. 2004. The propagation of ramón (brosimum alicastrum sw.; moraceae) in Mayan homegardens of the Yucatan peninsula of Mexico. *New Forests* 27: 25-38.

GRAS report. 2007. "Ramòn Seed (Brosimum Alicastrum SW.) and Ramòn Seed-Derived Ingredients for use in Traditional Foods: Generally Recognized as Safe (GRAS) Self-Affirmation Report." Unpublished Application Report. 46 pages.

Gubbi, Sanjay, and Douglas C. MacMillan. 2008. Can non-timber forest products solve livelihood problems? A case study from Periyar Tiger Reserve, India. *Oryx* 42 (2): 222-228.

Hernandez, Jesus. May 2008. Personal interview.

Kajenje, Yussuf. New Agriculturalist. 2008. *Maya Nut: A Forgotten Treasure.* http://www.new-ag.info/focus/focusItem.php?a=424

López-Feldman, Alejandro, Jorge Mora, and J. Edward Taylor. 2007. Does natural resource extraction mitigate poverty and inequality? Evidence from rural Mexico and a lacandona rainforest community. *Environment and Development Economics* 12 (2): 251-269.

Mallet, Patrick. Certifying the harvest: developments in NTFP certification. http://www.ncrs.fs.fed.us/pubs/gtr/other/gtr-nc217/gtr_nc217page124.pdf, viewed 11 March 2010.

Myers, Norman. The Primary Source: Tropical Forests and Our Future. New York: W.W. Norton, 1992.

Nations, James D. 2006. The Tropical Forest: People, Parks, and Ancient Cities. University of Austin Press: Austin.

Nations, James D. and Ronald B. Nigh. 1980. The Evolutionary Potential of Lacandon Maya Sustained-Yield Tropical Forest Agriculture. *The Journal of Anthropological Research* 36 (1): 1-30.

Pendleton, Linwood H., and E. Lance Howe. 2002. Market integration, development, and smallholder forest clearance. *Land Economics* 78 (1): 1-19.

Peters, Charles M., Alwyn H. Gentry, and Robert O. Mendelsohn. 1989. Valuation of an Amazonian Rainforest. *Nature* 339: 655-656.

Peters, Charles M. 1983. Observations on Maya Subsistence and the Ecology of a Tropical Tree. *American Antiquity* 48 (3): 610-615.

Peters, Charles M., and Enrique Pardo-Tejeda. 1982. Brosimum alicastrum (moraceae): uses and potential in Mexico. *Economic Botany.* 36 (2): 166-175.

Poole, Nigel, Remi Gauthier, and Aliza Mizrahi. 2007. Rural Poverty in Mexico: assets and livelihood strategies among the Mayas of Yucatán. *National Journal of Agricultural Sustainability* 5 (4): 315-330.

Puleston, Dennis E. 1982. The Role of Ramon in Maya Subsistence. Pp 349-366, in K. Flannery, ed. Maya Subsistence: Studies in Memory of Dennis E. Puleston. Academic Press: New York.

Rana, Parvez. 2009. Implication of livelihood dependence on NTFPs in Lawachara National Park. *Non-Wood News* (19) July, 40.

Rasul, Golam, Madhav Karki, and Ram P. Sah. 2008. The role of non-timber forest products in poverty reduction in India: prospects and problems. *Development in Practice* 18 (6): 779-788.

Raynolds, Laura T. 2000. Re-embedding global agriculture: the international organic and fair trade movements. *Agriculture and Human Values* 17: 297-309.

Raynolds, Laura T. 2009. Mainstreaming fair trade coffee: from partnership to traceability. *World Development* 37 (6): 1083-1093.

Ross, Norbert. 2002. Cognitive Aspects of Intergenerational Change: Mental Models, Cultural Change, and Environmental Behavior among the Lacandon Maya of Southern Mexico. *Human Organization* 61 (2): 125-138.

Ruben, Ruerd, Ricardo Fort, and Guillermo Zúñiga-Arias. 2009. Measuring the impact of fair trade on development. *Development in Practice* 19 (6): 777-788.

Sánchez Garduño, Cecilia. 2008-10. Personal interview via email and in person.

Sánchez Garduño, Cecilia. 2005. "Reproductive Ecology of *Brosimum alicastrum* (Moraceae) in the Neotropical Rainforest." Unpublished Ph. D. Thesis.

Sánchez Garduño, Cecilia, and Sindy Hernández. 2005. Participatory management

practices for brosimum alicastrum by rural Central American communities. Grant proposal.

Smith, Alastair M. 2009. Fair trade, diversification and structural change: towards a broader theoretical framework of analysis. *Oxford Development Studies* 37 (4): 457-478.

Sluyter, Andrew. 1996. The ecological origins and consequences of cattle ranching in sixteenth-century New Spain. *Geographical Review* 86 (2): 161-178.

Thadani, Rajesh. 2001. International non-timber forest product issues. Pp. 5-23, in Marla R. Emery and Rebecca J. McLain, ed. Non-Timber Forest Products: Medicainal Herbs, Fungi, Edible Fruits and Nuts, and Other Natural Products from the Forest. Food Products Press: Binghamton.

The Equilibrium Fund. Accessed May 2010. http://www.theequilibriumfund.org

Tuxill, John. 2010. Personal Interview in Person.

Tuxill, John, and Gary Paul Nabhan. 2001. People, Plants, and Protected Areas: A guide to In Situ Management. Earthscan Publications Ltd: London.

Valkila, Joni. 2009. Fair trade organic coffee production in Nicaragua—sustainable development or a poverty trap? *Ecological Economics* 68: 3018-3025.

Welford, Lucy, and Gus Le Breton. 2008. Bridging the gap: phytotrade Africa's experience of the certification of natural products. *Forests, Trees, and Livlihoods* 18: 69-79.

Vohman, Erika Catherine. "The 2008 World Business and Development Awards*:* Nomination Form." 2008.

Vohman, Erika Catherine. 2009-10. Personal interview via email.