Chapter V: Hybridizing Indigenous and Modern Knowledge Systems: The Potential for Sustainable Development through Increased Trade in Neo-Traditional Agroforestry Products

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HYBRIDIZING INDIGENOUS AND MODERN KNOWLEDGE SYSTEMS: THE POTENTIAL FOR SUSTAINABLE DEVELOPMENT THROUGH INCREASED TRADE IN NEO-TRADITIONAL AGROFORESTRY PRODUCTS

T.H. Culhane

"He participado en viajes de intercambio en Centro America y Espana, y mi anhelo es demostrar que hay metodos y formulas mas sencillas para vivir en armonia con la naturaleza, utilizando elementos que provienen de todas las culturas del mundo pero especialmente de la cultura Maya que es la nuestra. Y que puede constituir un modelo a retomar desde ahora para las nuevas generaciones[1]*."*
– Don Pedro Gonazalo Cuc Garcia, Maya Quiché Development Specialist

"Ramón is the most useful plant in the world."
– Don Samuel, Maya Itza forester and guide at Sayaxché Ecotourism Lodge, Petén, Guatemala.

Introduction

In a world where market demand in the United States determines the fate of the forests and the forest peoples of the world, and development funds and policies are driven by globalized economic transactions, gringo familiarity with sustainable natural resources and indigenous resource management techniques can make the difference between hometown opportunity or forced migration for farmers. It also can determine the choice between environmental enhancement or degradation. In many cases it could be the difference between life and death for the people of a region and existence or extinction for that region's biodiversity.

[1] "I have been involved with cultural exchanges in Central America and Spain and my dream is to demonstrate that there are much simpler methods and formulas for living that are in harmony with nature, using elements that are derived from all the cultures in the world but especially the Maya culture, which is our own. I dream that we can create a model to bring these ideas back so they can serve future generations."

Today, as Jill Sourial and Jennifer Ito have shown[2], the majority of Guatemala's arable land (12 %) is devoted to production of exotic "traditional agricultural export crops" – coffee, sugar, bananas and cattle. The "Non-traditional agricultural exports" (NTAE's) being promoted by the Guatemalan government through Agexpront, The Ministry of Agriculture (MAGA) and programs like Chapinas sin Fronteras, are also mostly made up of exotic crops (apples, peaches, African Oil Palm, kitchen vegetables) which are grown unsustainably and degrade the environment.[3] The Guatemalan rainforests that remain, concentrated in the Petén in the Maya Biosphere reserve, are rapidly being destroyed by competing land uses, chief among which are conversion to milpa (cornfield) and cow pasture. Official Guatemalan agricultural policy makes almost no provision for increasing the use of indigenous rainforest resources as alternatives to these practices, nor has it historically recognized the contributions of indigenous farmers who have used practical silvicultural methods for sustainable agriculture for millenia. Land policy decisions are, on the whole, market-led and demand-driven, while unsanctioned uses of land, such as conversion to corn and pasture in the Petén, are driven by desperation.

This paper deals with how the ancient practice of Maya silviculture[4] can help. Specifically, it champions the promise of a single underutilized natural resource in the Petén rainforest region that is well known to indigenous groups and local peasants but has been almost completely ignored by modern society. The specific silvicultural resource is an emergent rainforest tree called Ramón (Brosimum alicastrum) whose products, as "neo-traditional agricultural exports[5]", are available for immediate commercialization.

The Ramón tree, once the dietary staple of the Maya people[6], and others trees like it, could form the foundation of a new form of sustainable agriculture through the hybridization of indigenous and modern farming techniques. This paper suggests that by creating a world market for the multiple products locally made from Ramón and other agroforestry resources, California could stimulate a cycle of positive cumulative

[2] See Chapters III and IV of this document.
[3] See R. Schroeder and K. Surayatna, "Gender and Class Power in Agroforestry Systems," in *Liberation Ecologies: Environment, Development, Social Movements*, Richard Peet and Michael Watts (London: Routledge, 1996) for discussion of pesticide and fertilizer requirements of apple orchards in the tropics and Perkins' "The Rockefeller Foundation and the Green Revolution, 1941-1956" for discussion of criticism of the "Green Revolution"'s ecological effects.
[4] "Silviculture" implies the management of indigenous forest resources and is usually synonymous with "agroforestry". "Silva" or "selva" in Latin/Spanish means "forest".
[5] "Neo-traditional agricultural exports" are defined here as food crops with a history of indigenous use that either predates or has been independent of European influence. This is in contrast to Agexpront's definitions of "traditional agricultural exports" as Coffee, Sugar and Bananas and "non-traditional agricultural exports" as anything that isn't a traditional agricultural export.
[6] Dennis E. Puleston, *The Role of Ramon in Maya Subsistence* (New York: Academic Press, 1982), 353.

causation and upward convergence that could immediately benefit both sides of the border.

The paper is broken into six sections:

1. A Consideration of the Problem: Deforestation as Driver

The paper begins with a description of the basic problem facing development in the Petén region – the influx of highland Guatemala immigrants into the forest regions of the Petén instituting resource-destructive agricultural practices. Finding alternatives to the conversion of rainforest to cornfields and cow pastures by smallholders and squatters and into giant plantations of exotic crops by large landholders is suggested as the anvil upon which new agricultural policy must be forged.

2. The Suggestion of a Solution: Substituting Corn and Pasture Grass with Ramón, the Maya Breadnut Tree.

Here we assume the task of championing the cause for this tremendously valuable but underutilized plant resource, the indigenous "Ramón" or "Maya Breadnut Tree" (Brosimum alicastrum) which, by virtue of its production characteristics, could easily substitute for the very agricultural products and practices driving deforestation and poverty in the first place.

3. Maya Silviculture: Toward a future sustainable agricultural praxis

The larger scope of the "farms vs. forests" dilemma is addressed here. Current agroecological thinking has determined that "what humans have done that's different from previous world changers is allied ourselves with the annual grasses--quickly using up half a billion years of soil formation"[7] In this section we look at "Silviculture" (Agroforestry) in general as a plausible solution to this grass-crop induced resource degradation worldwide and suggest a vision of a future agriculture based on forest resources.

4. A look at a California/Guatemala "Best Practice Model"

This section looks at "Proyecto Iximché", a Ramón-based sustainable development plantation owned by Don Pedro Gonzalo Cuc Garcia, a Maya Quiché "Indian" development specialist, that is run through a cooperative effort with UCLA researchers and a Taiwanese philanthropist/investor.

[7] See Evan Eisenberg, *The Ecology of Eden* (Vintage Books, 1999) review at amazon.com.

5. An Exploration of the historical and theoretical information necessary to make a decision: Why other rainforest region conservation policies are doomed to fail.

This area explores why other policy measures to preserve the rainforests of the Maya Biosphere Reserve tend to fail, arguing that valuation exercises for non-timber forest products tend to emphasize "dessert crops", ecotourism and other luxury and trivial uses of the forest. It suggests that none of these land uses can compete with conversion to staple agricultural production. It also considers the political ecology of agroforestry and why otherwise "perfect" solutions fall apart.

6. A presentation of policy options on the particular issue or issues identified.

Finally, the paper endeavors to show how leadership from California, the World's 7th largest economy and America's most progressive state, can use its international trade linkages, its policies and its pluri-cultural reputation to ensure sustainable, resource enhancing growth in the Guatemalan tropical lowlands through export-led trade in Ramón products and other "neo-traditional agricultural exports".

1. A Consideration of the Problem

1.1 Deforestation: A Prime Driver of Outmigration to California.

In a May 16, 2000, Front Page, Column One story in the Los Angeles Times entitled "Mexico Forests at a Watershed," the Times reports of Central America that "the soil there is very fragile, and the destruction of the forests uncovers the soil very quickly, causing terrible erosion that affects the *campesinos* (peasant farmers) below… more than 60% of the water basins in Mexico are damaged by erosion, pollution and deforestation and… an increase in deforestation in damaged basins causes more damage, like a sickness that is contagious." A Roman Catholic Priest in the area is quoted as saying, "I see a real desperation among the people – there is a lot of immigration to the United States…"

This same dynamic is driving the outmigration of Guatemalans. They are moving both to other sensitive ecological areas in their homeland and to the U.S[8]. Meanwhile the environmental degradation within Guatemala is causing the number of threatened and endangered species to grow to crisis proportions, compromising ecosystem services, ruining fertility, declining productivity and furthering the cycle of poverty.

[8] see Chapters III and IV of this volume.

In California we read about the biodiversity crisis caused by rampant deforestation and wring our hands in despair, knowing that even as we win battles to preserve certain ecological "hot spots", vast areas of rainforest – far greater in size than any we can save -- are being slashed and burned into oblivion -- converted to monocrop fields for agriculture and pasture grass for cattle grazing. And yet the feeling is that we are unable to stop expanding our corn, wheat, rice, sugar, soybean, beef and cash crop production -- the principle causes of rainforest conversion in the American Tropics. We feel unable to address the displacement of forest people and small farmers from existing farmland by larger, land extensive and more "efficient" mechanized forms of agriculture. And we are afraid that we can neither secure livelihoods for peasants in rural areas, nor prevent the destruction of the remaining vital habitats and ecosytems upon which Guatemalan's indigenous people and ladino *campesinos* depend.

1.2 A Determination of the Causes

It is tempting to blame the "ignorant peasants" for burning and hacking their countryside into oblivion. It is tempting to blame "overpopulation" as the driver. The real story is far more complex. Land tenure rights, usufruct rights, power relations, class and gender issues, and contested ideas about space are all deeply enmeshed in the crisis. Most of the focus on current rates of deforestation ignores the fact that over 65% of Guatemala's forests have been removed for large scale agrobusiness, pushing the *campesinos* into the remaining 35%[9]. Ultimately, however, whether we are talking about land-extensive plantations or peasant small-holdings, the real issue we have to face as a civilization whose origins are exotic to the land of the Maya, is why today's farming and yesterday's forests seem so incompatible. For if the forests of Guatemala themselves provided the means for both subsistence and economic growth, then clearly there would be no deforestation at all…

2 The Maya Breadnut Solution:

Imagine, for a moment, that there was some way we could "have our cake and eat it too". Suppose there was a way, for example, to have "rainforest beef" without harming the rainforest. Suppose there was a reliable way to get our starch and our protein – our staple food, our daily bread – without having to cut down the trees to plant corn and beans. What if there was a tree that doubled as a cash crop and a wildlife refuge? Imagine there was a way to use the rainforest without abusing the rainforest and still feed exponentially rising urban populations worldwide. Specifically, what if there were some giant rainforest tree that could provide an abundant crop of high-protein, nutritious food

[9] Conservation International literature, Propetén office, Guatemala.

for humans, fodder for livestock and provided habitat for endangered species? What if we could have a farm that looked and acted like a forest?

To traditional western agronomists this may sound farfetched but that may be because we come from a culture of savanna-dwelling agriculturists and pastoralists who, for thousands of years, have made a habit of replacing forests with grasslands without ever paying much attention to the wisdom that forest-dwelling peoples have gleaned over the centuries.[10] But today, at the dawn of a new millenium, it is time to reexamine the evidence and see if this ongoing "battle" between producing food for humans and saving habitat for animals is really necessary. It is high time we looked at the concept of forest-farming and searched for such "miracle trees" that could replace grain-fields and pastures.

2.1 The Case for Ramón

New insights from agricultural and anthropological researchers in Central America suggest that not only do such trees exist, but that at least one of them has been known, cultivated and utilized for thousands of years, forming the basis of one of the greatest civilizations humanity has ever known.

The tree is called Ramón, the Maya Breadnut, (Brosimum alicastrum, Moraceae) and according to new archeological studies, it was this 40 meter tall rainforest giant that enabled the sophisticated Maya civilization to flourish in the lush jungles of Central America.[11]

Indigenous users of the Ramón tree have called it "the most useful plant in the world[12]" because seemingly every part of the tree has some benefit.

"A broad consensus has been reached that Ramón can spur rural development," says Don Pedro Cuc, Chief of Proyecto Iximché, an experimental agroforestry research station on the site of a classical Maya settlement at Laguna Macanche in the Petén. "There is also broad agreement on what needs to be achieved to make Ramón more competitive in domestic and international markets. Now it's time for us to work together to plan out the precise steps to reach these goals."

[10] Eisenberg, *Ecology of Eden*, Chapter 1.
[11] Dennis E. Puleston, "Brosimum alicastrum as a Subsistence Alternative for the Classic Maya of the Central Southern Lowlands" (A Thesis in Anthropology, University of Pennsylvania, 1968)
[12] Don Samuel, Maya forester and guide at Sayaxché Ecotourism lodge, Petén, personal communication.

2.1.1 Advantages of Ramón

The nutritional advantages of Ramón stem from the fact that it is not merely a superb source of starch, vitamins and minerals (high values of Calcium and Phosphorous for bone growth, Iron and B vitamins for healthy blood and outstanding levels of Vitamin C) but that it produces a flour that appears to be a complete protein. (Figure 2)

Figure 1: Amino Acid Profile of Ramón

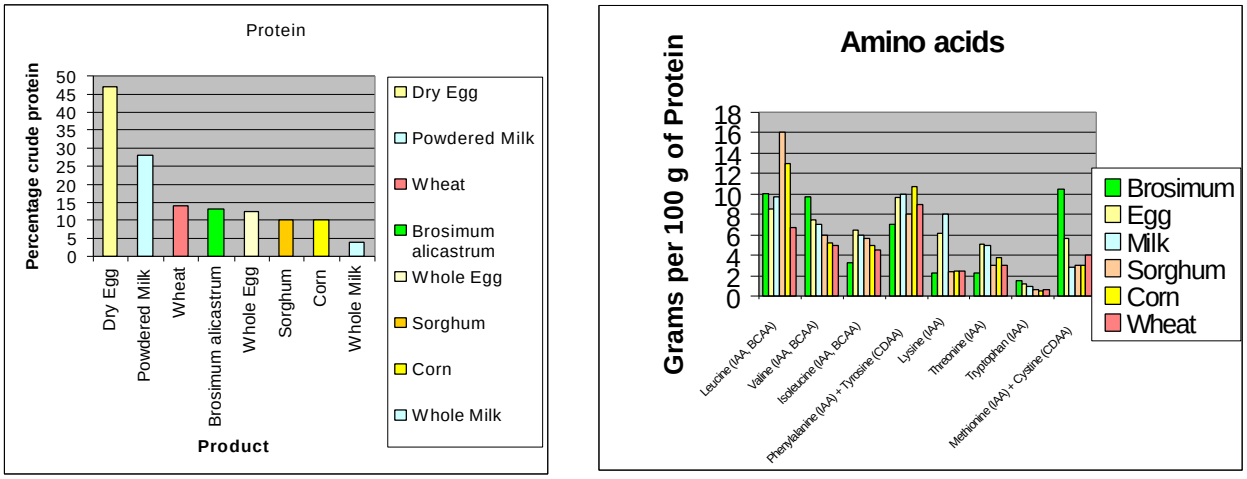

Figure 2: Crude Protein Content of Ramón

Sources: Instituto Nacional de la Proteccion a la Infancia (1976), Instituto Nacional de la Nutricion, Mexico (1974), The United States Department of Agriculture (1959)

2.1.2 Human Nutrition

As any vegetarian can tell you, it is extremely difficult to find any single food in the plant kingdom that contains enough of all nine essential amino acids in sufficient quantity to build a healthy body[13]. Most plant proteins are considered "incomplete" proteins because they are relatively low in one or more of these essential amino acids. Soybean is a famous exception, with nearly 30% of its dry weight being “complete

[13] AMINO ACIDS are the "building Blocks" of the body. Besides building cells and repairing tissue, they form antibodies to combat invading bacteria & viruses; they are part of the enzyme & hormonal system; they build nucleoproteins (RNA & DNA); they carry oxygen throughout the body and participate in muscle activity. When protein is broken down by digestion the result is 23 known amino acids. Nine are essential (cannot be manufactured by the body) the rest are non-essential (can be manufactured by the body with proper nutrition). <http://www.realtime.net/anr/aminoacd.html>

protein". Ramón, with a dry weight of 13 to 14% crude protein, may also be a relatively complete source of this essential nutrient.[14]

All plant proteins do contain all essential amino acids. But in most cases, levels of one amino acid or another are insufficient for human needs so we call them "incomplete". Grains are typically low in lysine; beans are typically low in the sulfur amino acids called methionine and cysteine. For this reason most vegetarians and nearly all vegans – people who eat no animal products whatsoever -- must combine foods that have complementary amino acid profiles to build a complete protein and each food in this combination must be ingested within a half hour of one another. This is why invading farmers in the Petén must plant and eat frijoles (beans) with their corn. Corn is notoriously tryptophane deficient. Only by eating the two foods in combination can they survive. Similarly, Middle Eastern cultures invented the cheese sandwich because wheat is deficient in an amino acid that cheese contains in quantity and vice versa. However, there appear to be exceptions to this general rule: the level of sulfur amino acids in soybeans, for example, is higher than in other beans, and as a result, soy protein is considered equivalent to animal protein in quality.[15]

All this is important to politicians and policy makers as they try to devise better regional development policies. As far back as the 9th century, when the Chinese Emperor Tai Tso of the Sung Dynasty visited the Kiang-Nan region in South China and found his farmers planting only rice, he ordered his agricultural officers to encourage them to plant a much wider variety of crops, including wheat, millet and soy bean[16]. In this way he ensured the health of both his people and their province.

In the quest to institute policy to encourage the planting of plants that combat poverty and malnutrition, however, we must be very careful to consider how food production methodologies themselves affect the long-term health of an agricultural region. Soybean production used to be restricted to temperate zones in Asia where it originated and functions as part of the regional ecology. But since the globalization of the soybean market, this single plant-based source of complete protein has become available for not only worldwide consumption but worldwide production. The problem is that demand-driven policies over the past 20 years have encouraged plant engineers to devise a new variety of soybean that can grow in tropical climates. This soy variety is now considered the leading cause of definitive tropical soil land conversion and Amazon basin

[14] , Enrique Pardo-Tejeda and Cecilia Sanchez Munoz, "Ramon, Capomo, Ojite, Ojoche, Brosimum Alicastrum: Recurso Silvestre Tropical Desaprovechado" (Xalapa, Veracruz: Instituto Nacional de Investigaciones sobre Recursos Bioticos, 16, 1984)
[15] <http://www.talksoy.com/protein.htm>
[16] T. Hymowitz. "On the Domestication of the Soybean", *Economic Botany* (Vol. 24, No. 4, October 1970), 408-421.

deforestation[17]. The consequences in terms of biodiversity loss as well as loss of future options for peasant farmers is devastating: soy plantations never go back to being forest. Clearly giving incentives for tropical soy production is as inappropriate a policy response for our region as encouraging people to plant higher yielding varieties of corn and cattle pasture.

As the above figure demonstrates, Ramón is high in methionine and cysteine as well as the tryptophane in which corn is so deficient. Studies indicate it might also be considered equivalent to animal protein (Gonzalez in 1939 reported that soldiers lost in the Petén were able to subsist on nothing but Ramón seeds for 15 days[18]). Although protein equivalency ratings (Protein Digestibility Corrected Amino Acid Scores -- PDCAAS – and Protein Efficiency Ratios - PER) are still an uncertain science (depending on how applicable animal studies are to human nutrition) and although Ramón's full nutritional value warrants further study[19] research for nearly a century has concluded that Ramón is a superb source of protein as well as essential vitamins and minerals. There is absolutely no question about its use as a replacement for the two leading drivers of deforestation and land degradation in the Petén and other Central American Forests: it has been proven to be superior to corn in terms of human nutrition and pasture in terms of livestock nutrition[20]. The policy question then becomes " which plants should dominate agricultural production in these tropical regions"?

Recognizing the need to stimulate production of grain substitutes and increase the size and variety of farmers' plant portfolios, the FAO is currently attaching a lot of importance to Cassava[21] as an alternative source of staple flour in the tropics. This governmental agency suggests that agricultural policy focus on reviving this indigenous Latin American staple crop and assisting farmers in planting and marketing cassava

[17] "This decade's governmental policies, which led to the appearance of "export brokers," have promoted the expansion of soy cultivation in the Amazon. The project is the opposite of what the GTA recommends as a development strategy for the region, which is based on the sustainable extraction of fruits, wood and other forest and river products. Soy cultivation employs just 1.7 workers per hectare compared to 30 per hectare on a family farm. The fear of the GTA is based on their studies showing that "soy is not sustainable in the Amazon," because the soil there is fragile, and quickly loses its fertility". <http://forests.org/archive/brazil/soyprods.htm>

[18] Puleston (1982), 353.

[19] Charles M. Peters and Enrique Pardo-Tejeda, "Brosimum alicastrum (Moraceae), Uses and Potential in Mexico" *Economic Botany* 36(2) (New York: Botanical Garden Press 1982),166-175.

[20] Enrique Pardo-Tejeda and Cecilia Sanchez Munoz, *Ramon, Capomo, Ojite, Ojoche, Brosimum Alicastrum: Recurso Silvestre Tropical Desaprovechado* (Xalapa, Veracruz: Instituto Nacional de Investigaciones sobre Recursos Bioticos, 1984), 16.

[21] Cassava (Manihot esculanta Crantz) is the source of tapioca. It originated in Latin America but was brought by Eropean conquistadors to the Zaire River in Africa by 1558 and to Asia by the 17th century. It goes by the names "Manioc," and "Mandioca," and is sometimes misnamed "Yucca" (a different plant).

products worldwide[22]. But although Cassava may be important in indigenous cultures and provides food energy today for over 500 million people, policies touting it as "the ultimate future crop[23]" are misguided. Ironically, the clearing of land for cassava (manioc) farming was one of the leading causes of deforestation in Indonesia's destructive transmigration programs in Borneo and Sumatra during the 1980's. Farmers there expressed their dismay to us when I was part of an Oxford Ethnobotanical research team in 1986 saying, "the government cleared the forest and put us here to grow cassava. Now the land turns to stone and nothing will grow. If they had left the forest and let us decide what to cut and what to plant, we would all be much better off." Not only is cassava nutritionally deficient and land exhaustive but many varieties are toxic unless processed properly. Policy makers who focus on tubers such as cassava and potatoes are not considering sustained human nutrition or sustainable land use, they are merely trying to give market incentives to land owners and farmers to use plants that give quick, highly productive yields in the short term, under the guise of "incorporating indigenous knowledge systems". We question the use of annual plants of low nutritional value when better, long-term perennial crops exist.

As in the case of tubers, high productivity without high nutritional value would not favor Ramón's inclusion as a basic food product for the human diet. For this reason, it is important to examine the nutritional aspects of Ramón. According to studies conducted by Leung INCAP-ICNNP in 1961, it was demonstrated that:

- The seed produces 362 calories in each 100 grams, a little more than either corn or beans and from 2 to 7 times more than tubers.

- The seed contains a percentage of protein that varies from 11.4% to 13.4%, while corn shows 9.4% and the roots of yams only 1.3%.

- Ramón compares favorably with corn, beans, squash and tubers in its content of iron, vitamin A, riboflavin, niacin and ascorbic acid, with a greater quantity of some nutritional components that the other products.

- The content of water in the seed is very meager (only 6.5%). This contributes to better adaptability of the fruit to the danger of moisture before germination or once fallen on moist ground; comparing the water percentage of seed from Ramón with that of the California acorn (9.0%), we obtain a percentage of water that is significantly less than that of the acorn; this percentage of water in the Ramón seed results in great advantages, because it guarantees its preservation for months.

[22] "Championing the cause of cassava", Food and Agriculture Organization of the United States, <http://www.fao.org/NEWS/2000/000405-e.htm>
[23] <http://www.nutrition.uu.se/studentprojects/group97/cassava/cassava.htm>

Subsistence farmers have long appreciated Ramón's advantages. It can grow in poor soils on marginal lands where other crops cannot. It requires minimal fertilizer, pesticides and water. It's leaves and branches are preferred to pasture grass by cows and the seeds are a nutritionally superior substitute for corn. Thus it addresses both of the main drivers of deforestation in the Petén. Also, because Ramón seeds store better than corn and beans – its chief competitors in the region -- surplus harvests can easily be kept as a safeguard against unexpected food shortages. As Don Pedro points out, "Because it has traditionally been a crop of the indigenous poor, expanding the market for Ramón can bring direct economic benefits to those who need it most."

Global Ramón production is insignificant at this point due to underutilization. However estimating from the productivity of existing Ramón plantations, UCLA forecasts that production could rise to several million tons within a decade. On average, farmers can produce about 5 tons of Ramón leaf forage and 10 tons of grain per hectare (estimating a mean density of 125 trees/ha), but plantations can support up to 250 trees/ha and yields can easily be doubled . During a three year study of extraction from a natural "Ramónal" (natural Ramón grove in unmanaged rainforest) in Tikal, MAGA researchers found a minimum production of 3,805.83 pounds (1.9 tons) of seed and a maximum of 5,768.28 pounds (2.8 tons) of seed per hectare per year. These figures are in themselves between 7 and 9 times the estimate for deliberate corn production. Corn, even with minimal fallow periods, cannot produce more than 705.47 pounds (0.35 tons) per hectare per year in the areas surrounding Lake Petén Itza. It is estimated that the introduction of high-yield varieties, improved pest and disease control and better processing methods could increase Ramón production in Guatemala by 150 percent[24].

A review of the literature on Ramón's nutritional qualities has shown just how important improving Ramón cultivation can be in the fight against hunger. With an increase in Ramón production, Guatemala could probably reduce undernourishment more rapidly than any other country because Ramón seeds, in themselves provide a complete protein, while the forage can support livestock[25]. The well-funded Global Cassava project can not begin to match that!

Improved processing is desirable but not essential. Unlike most crops in the region, once harvested and dried, Ramón seeds, which are only 6.5% water, do not deteriorate quickly, thus it need not be eaten or processed quickly like Cassava. All varieties can be eaten raw or cooked like potatoes, and unlike Cassava, none contain any

[24] A. Ayala & M. Bird "Brosimum alicastrum – the riches of ramon trees in Mexico" (*Agroforestry Today*, 9(2) 1997), 26-27
[25] Ibid.

levels of cyanogenic glucosides that must be removed before they can be eaten. Where many plants require toxins to be removed from some parts of the plant, or must be shelled or processed, Ramón is both benign and simple to use. In Guatemala, processed Ramón meal is known as harina de Ramón and is made in the same grinders used for corn. In Belize it is known as Maya Breadnut Flour. Breadnut flour, added to corn to make it last longer, accounts for 70 percent of Guatemala's total Ramón consumption. In other parts of Guatemala, the Ramón pulp is pounded into a paste and made into conserves, jellies, jams, and sugars, or fermented into alcoholic beverages.

Certainly if neo- traditional foods are to become the basis for commercially viable local industries operating on a global scale, new and improved processing technologies will be desired. Commercial Ramón producers and processors need to find ways of increasing production, reducing labor costs and improving product quality in order to compete with imported grains. But starting out with a plant this easy to work with, this is all realizable once modern science (techne) turns its attention to improving what indigenous farmers have known for millenia (metis)[26].

Since consumer trends are expected to change as more and more people move to the cities, and more and more people "want to be like us" and eat packaged food, Ramón producers and processors of "tree-cereal" flour will need to respond to the growing urban demand for foods that are more convenient or seen as more modern, such as store-bought bread and baked goods made from imported wheat flour. To do this they will have to manufacture competitive products from Ramón.

The development of high-quality Ramón flour could help many developing countries reduce their dependence on imported grains[27]. The FAO report has stated that a 15 percent substitution of Cassava flour for wheat flour could save Nigeria close to US$ 15 million a year in foreign exchange. The same could be true for developing countries in this hemisphere if our Guatemala-California initiative substituted Ramón flour for wheat and corn flour. In Jamaica, bakers of 'bammy bread' made from Cassava meal have been successful in carving out a profitable market niche. Guatemalan producers of Ramón could do the same thing. "Simply put, many governments could save money by making sound investments in the development of their commercial Ramón industry," says Don Pedro.

[26] James C. Scott, *Seeing Like a State : How Certain Schemes to Improve the Human Condition Have Failed*. (New Haven:Yale University Press, 1999) "Techne" refers to codifiable, immutable mobile knowledge systems; "Metis" refers to uncodifiable, experience-based mutable immobile knowledge systems.

[27] Peters and Pardo Tejeda, (1982).

In addition, aided by California's progressive food manufacturers and distributors, Latin American countries, particularly Guatemala and Mexico, could easily develop and market Ramón snack foods, similar to health bars and nutrition supplement products, as well as frozen 'heat and serve' Ramón products. The growing importance of manufactured "Rainforest products" in Central and South America has led to the creation of franchising chains with worldwide distribution, such as Ben and Jerry's "Rainforest Crunch", which sells Brazil nut and cashew nut confections, and such chain grocers as Whole Foods and Trader Joe's, which specialize in neo-traditional agricultural products. The marketing of Ramón specialty breads and Café Iximché – Ramón based "coffee-free-coffee"[28] could easily compete with businesses like "Casa do Pão de Queijo", which has 141 stores in Brazil selling "cassava and cheese" bread and coffee.

2.1.3 Ease of Harvest

From both a subsistence and an industrial production point of view, Ramón is actually much easier to harvest than either corn or beans. As a "mast fruiting/ predator saturation"[29] species Ramón literally dumps its crop on the ground. Efficient harvest of Ramón is as simple as putting a tarp or a net under the tree to collect the fallen fruit.

> "The harvest of Ramón doesn't require any more force than the collection of fruits that have fallen to the earth. Investing 8 hours a day, in 8 days, a woman with 2 or 3 children can collect 2,998.26 pounds of food which are needed to sustain a family for an entire year"[30].

A 1986 Guatemalan government report concluded:

> "With all this considered, in comparison with Corn, the cultivation of Ramón promises to be a nutritious product of great acceptance. Laying the foundations of a basic nutrition for our families using flour made from Ramón would be a great resource, whose production is many times more efficient than Corn in terms of physical labor and in every other sense[31]."

[28] C.W. Post, originator of Post Cereals, made his millions in 1895 marketing Postum™ America's first "coffee-free coffee". This naturally caffeine-free beverage is made from molasses and roasted wheat and barley grains and was initially targeted at the Mormon community. It is still a big seller today. Our California-Guatemalan Project has had success re-introducing Café Iximché, based on the Maya practice of roasting Ramon seeds, to the Mormon Community of San Andrés in the Petén.
[29] Michael J. Balick, and Paul Alan Cox. *Plants, People and Culture: The Science of Ethnobotany* .(New York: Scientific American Library, 1996)
[30] Alfredo Guzman, *Conozcamos el Ramón* (Ministerio de Agricultura, Ganaderia y Alimentacion, Unidad De Comunicacion Social, Guatemala, C.A. 1986)
[31] Ibid.

"Experience will show that growth in Ramón production and consumption can be an import engine for agricultural development in developing countries," says Don Pedro.

2.1.4 Animal feed, industrial starch

In areas where Ramón flour cannot gain entry into the human foods market because of culinary prejudice, commercial Ramón production would focus on animal feed, mainly in the form of chips and pellets for export. Thailand's experience shows us the way. Over the past 30 years, thanks to effective public/private partnerships and sound Government policies, a competitive Cassava industry for animal feed has been created almost from scratch. In 1995, Thailand exported 3.3 million tonnes of Cassava pellets, mostly to the European Union. A California led Ramón industry should easily be able to penetrate the same market, particularly given the nutritional superiority of the product.

In Africa and Latin America, the domestic market for Ramón-based animal feed shows potential for growth. Most Ramón production in Latin America and the Caribbean is already used for domestic animal feed. Research in Mexico has shown that poultry breeders could lower their production costs by 40 percent by incorporating Ramón into their chicken feed.[32] The same has been said for cow and hog breeders –in several Cuban studies Ramón added to their animals' feed led to pronounced weight gain[33].

California could also lead the way in the production of proteins derived from Ramón. Ramón protein has unique properties, such as its high complete amino acid profile and its galactogenic properties which make it competitive with other industrial and pharmaceutical proteins. More research needs to be done on the development and marketing of Ramón-based proteins.

2.2 Perceived Disadvantages of Ramón: Barriers to market entry

I am constantly asked by people who learn about Ramón "if this tree is so spectacular, why haven't we heard of it before?" Of course, the same question was asked about Soy Products 20 years ago when they were being introduced into the U.S.

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[32] J.C. Ku Vera, et.al. "Arboles y arbustos para la produccion animal en el tropico Mexicano". *Conferencia electonica de la FAO sobre "Agroforesteria para la produccion animal en LatinoAmerica"*(Trop. Anim. Prod. 4:3, 1979)

[33] A. Priego,., R. Elliot and T.R. Preston. "Studies on the digestion in the forestomachs of cattle of a diet based on Sisal pulp: Supplementation with Ramon (Brosimum Alicastrum) forage and Rice Polishings" (*Trop. Anim. Prod.* 4:3, 1979).

consumer market. Soy, of course has been used in Asia as a primary staple food for thousands of years and yet most Europeans only noticed rice. There were attempts to introduce soy to the American market as early as 1770 when Benjamin Franklin himself promoted the plant and helped establish a plantation in Philadelphia from seeds procured in London's Royal Botanical Gardens at Kew. Nonetheless it took until 1850 for U.S. Farmers to begin serious experimentation with Soybeans in the Midwest. There its use was confined to animal forage. Despite late 19th century testimonials as to the potential value of soybeans appearing in newspapers and agricultural journals, and a slew of patents issued for soy products (Henry Ford made industrial plastics for car bodies out of soy) it wasn't until the 1920's that it began to be considered seriously as a grain substitute. But the real boom in soy only began when the Western food market "discovered" soy's remarkable properties in the later half of the twentieth century. During World War II, U.S. government policy made a concerted effort to introduce soy as a protein-extender in war-torn Europe. Even so, until the beginning of the environmental era in the 1970's, soy was still considered only fit for animal consumption[34] here at home. Abroad, however, soybeans played a vital post war role in the Marshall Plan whose policies pushed its use to help feed millions of starving persons in third world countries. Because of these policies, where about 5 million bushels of soybeans were produced in the U.S. in 1924, we produced almost 2 billion bushels in 1984[35]. The great American success with soy, in turn, stimulated soy bean production all over the world. The same could easily happen with Ramón. As Professor Ho, an historian at the University of Chicago, has aptly written (1955),

> "It is foolish to believe that a certain plant can be introduced into a new area only once, and then only by a certain route. A new plant may score an immediate success in one region and remain neglected in another for a considerable time. Sometimes only through repeated trial and error can a new plant strike root. Sometimes a new plant may actually be introduced more than once."[36]

Today, as a review of FAO research and recommendations illustrates, Ramón is in the same position as soy was less than a century ago – touted as being of considerable merit for animal feed, but completely ignored as a human food. Given that the Maya people have been even more thoroughly "orientalized" ("othered" or "marginalized")

[34] John Culhane, midwestern author, pers.com.
[35] Prof. Theodore Hymowitz, Dept. of Crop Sciences UIUC, Urbana-Champaign, IL *Soybeans: The Success Story*, *Advances in New Crops*, Edited by Jules Janick and James Simon, (Timber Press, Portland, Oregon, 1990), 159-163.
[36]Theodore Hymowitz, Soybeans: The Success Story
<http://www.nsrl.uiuc.edu/beanhistory/soysuccess1.html>

than the Oriental cultures[37] we expect their ancient staple food has faced similar market entry problems.

We see 5 major problems keeping Ramón from making it to the market:

- Erosion of indigenous knowledge
- Artificially low prices of government subsidized corn and rice
- Sociological stigma
- Misinformation affecting issues of historical and cultural pride
- Unfamiliarity of the market

2.2.1 Erosion of indigenous knowledge

The gradual disintegration of botanical knowledge regarding forest foods in general and Ramón in particular has been studied by Suzanne Yates and Carlos Ramirez Sosa who found that knowledge of the use of Ramón in El Salvador[38] can be lost within one generation, particularly in families that have made the transition from rural to urban life. Ramón can be found from the Amazon through to Central Mexico, and throughout the Caribbean from Jamaica to Cuba and even South Florida in the U.S. It has a long history of use wherever the Maya people have ranged. But because knowledge of its use has never been institutionalized and the products have never been commodified, it's recognition is dependent on the vulnerable uncodifiable oral transmission of knowledge. The reasons for its disuse are completely within the spheres of political ecology and political economy, not agronomy.

Says Peterson and Pardo Tejeda's study:

> "That B. alicastrum is especially abundant near Maya ruins has long been known to archeologists and anthropologists (Thompson, 1930; Lundell, 1938; Rupert and Denison, 1943) but until recently, the significance of this association was not realized. Studies by Puleston (1968, 1972) near the ruins of Tikal in Guatemala have revealed that not only was the tree widely used by the Maya, it may also have been deliberately cultivated. According to these studies, the seeds of B. alicastrum were an important alternative food when the yield of the usual

[37] see Edward W. Said, *Orientalism* (Random House Press, 1968) and *Culture and Imperialism*. (Vintage Books, 1994) for discussion on the "othering" of hegemonic discourse and its effects on the disintegration of culture.

[38] Suzanne Yates and Carlos Ramirez. "Etnobotanica del Ujushte, Brosimum alicastrum, en Tacuba, Ahuachapan, El Salvador: Un estudio piloto" *(Pankia Boletin Informativo JBLL*, Ano XV Numero 2, Abril-Junio 1996).

> crops was low. Traditionally, fruits were collected and either eaten raw or made into juice or marmalades (Roys, 1931). The seeds were then dried, ground into a masa, and mixed with corn to make tortillas. In many instances, seeds were boiled, mashed and eaten as a substitute for root crops (Thompson, 1930). A dessert was also made by combining the ground seeds with honey.
>
> The seeds of B. alicastrum are utilized in a similar manner today, but only rarely. The tree is frequently found in household gardens in rural areas (especially in Yucatan), but the fruits and seeds are not commonly collected for consumption by families living near dense stands. It appears that the seeds are currently more a specialty item than a subsistence food. **The ready availability and low price of government-subsidized maize may be partially responsible for the limited use, but in many regions there also appears to be a sociological stigma associated with consumption of the seeds."**[39]

2.2.2 Of stigmas and subsidies:

It is precisely this sociological stigma that keeps most forest foods from adequate commercialization. Today in the Petén, Las Puertas Restaurant owner Carlos Salazar tells us " A poor peasant family will eat Ramón, but only during times of scarcity or crop failure. Wealthier peasants will rely on corn year round, buying what they cannot produce themselves. As for the rich, they consider Ramón to be 'monkey food' fit only for savages, and they even look down on eating corn. For them, wheat tortillas are preferred – the whiter the better. This is what the Spaniards eat, so it symbolizes status."[40] The current low status of foods associated with the forest and with forest people is something of an impediment to shifting our current emphasis on savanna-derived crops (wheat, rice and corn) to forest derived crops.

The fact that "cheap food policies" have focussed only on exotic crops in general and grain cereals in particular has furthered the erosion of indigenous systems and the stigma attached to them. When money is being literally given away for growing unsustainable crops and subsidies make them cheaper than anything else, naturally the exploration of alternatives is precluded.

2.2.3 Misinformation affecting issues of historical and cultural pride

It is interesting that even Peters and Pardo-Tejeda, the authors of the study quoted above and champions of policies to expand the market for Ramón, make the assumption that this Maya cultivar was important only when the yields of the "usual crops" were low. There is actually little evidence that there were any other crops more "usual" than Ramón

[39]. Peters and Pardo-Tejeda (1982)
[40] Carlos Salazar, Las Puertas restaurant owner, Flores, Peten. Personal Communication

in the classical diet of the Maya. Some Maya individuals we interviewed told us that the belief that the Maya relied on Corn, almost a canon among Anglo-Saxon archaeologists and anthropologists, is flawed. According to these indigenous informants Ramón WAS the usual crop and maize was actually more of a ceremonial food rather than a food staple among the classical Maya. This idea is supported by archeologists Denis Puleston's arguments:

> "Though this dependence on maize is one of the oldest and most hallowed building blocks for our reconstructions of Classic Maya culture and civilization, it must be recognized that it is still only an assumption based on very little proof. To date this proof has been primarily inferential, in spite of the fact that a few corn cob fragments have been found at Tikal and Uaxactun; but half a dozen corn cob fragments hardly form the subsistence base of a civilization. New data seems to be continually forcing us to revise population estimates upwards (Haviland et. Al. 1968: 93). In the face of this trend and the known limitations of slash-and-burn agriculture, any subsistence alternatives should receive full attention."[41]

Puleston's work for the next 10 years, until his untimely death by lightning bolt, (he was struck by lightning while standing on top of Chichen Itza during one research expedition) was devoted to proving that only reliance on Ramón as the prime staple could have permitted the high population densities we now know to have occurred in the Central American lowlands during the period that Maya civilization flourished.

Had the Maya subsisted on Corn, he pointed out, they would never have achieved, let alone sustained for millennia, the densities their archeological sites suggest, for the extensive use of corn would have destroyed their resource base within a few generations – just as we see happening today[42].

Since we can't go back in time we must recognize that all of our reconstructions pass through our own cultural filters. Linguistics may help us piece together the puzzle though. Interestingly, the name for Ramón in classical Mayan -- "Iximché" -- literally translates into "The Grain Tree" or "The Corn Tree" (Ixim – corn or grain, Che – Tree) Translators unfamiliar with the concept of tree cereals reading Maya codices may easily have assumed that Iximché simply meant "corn-plant". Our Maya informers assured us,

[41] Puleston, (1969),3.

[42] "…investigations produced evidence that makes it necessary for us to revise some of the previous conceptions about the everyday life of the Maya. Such a density of population precludes the idea of a slash-and-burn system of husbandry. It is now thought that each compound consisted of houses, buildings and a surrounding plot of intensively cultivated gardens. Though doubtless maize was grown, it must have taken its place in a crop rotation which probably included a number of root crops and also ramon trees, which yield an edible fruit, the bread-nut." – Ralph Whitlock, *Everyday Life of the Maya*. (New York: Dorset Press, 1976), 165.

however, that Iximché is used quite specifically to refer to Brosimum alicastrum, not maize. It is easy to see how cultures that believe civilization to be impossible without grass crops could easily ignore the contributions of agroforestry practicing peoples – particularly since we have a great body of evidence showing that the conquistadors forbid the indigenous Americans to grow or utilize their local sacred plants[43] (Amaranth and Quinoa are two other plants that were almost erased from history by deliberate Spanish policy).

But although the Spaniards may have discouraged the transmission of knowledge of Ramón as a human food, it remained well known for its qualities as a superior livestock feed. In fact the Spanish name "Ramón" comes from the verb "Ramónear" which means "to forage or browse."

> "Soon after the introduction of livestock into Mexico, it was discovered that B. alicastrum is a very good forage. Currently, this is the most widespread use of the tree. Wherever it is abundant the leaves, twigs and seeds are a highly valued stock feed. This is especially true in the more subtropical parts of its range where its evergreen leaves may furnish the only fresh forage available during the dry season.
>
> Forage is harvested by climbing the tree and lopping the branches. Between 25-50% of the crown is cut each year, but the repeated pruning does not appear to injure the tree seriously. Where dense stands occur, climbing is not necessary and cattle are allowed to graze freely on the seedlings, newly fallen leaves, and seeds. An interesting description of the harvesting of B. alicastrum forage by Ramóneros[44] is given by Fairchild (1945).
>
> Brosimum alicastrum is a nutritious stock feed. The leaves contain an average of 10% crude protein on a dry weight basis (Fortum, 1911, Perez-Toro, 1950), and recent studies have shown that their digestibility is superior to that of the more widely utilized Leucaena leucocephala (Lam.) DeWit and buffelgrass (Cenchrus ciliaris L.) (Yerena et. Al., 1978). Feeding trials using various mixtures of the seeds with sorghum resulted in excellent weight gains in cattle, sheep, hogs and goats (Pardo-Tejeda and Sanchez-Munoz, 1980). As an additional benefit, B. alicastrum forage has been reported to increase milk production in dairy cattle by 1-2 liter/day (Gonzalez, 1939; Calvino, 1952)."[45]

The irony here is that the use of Ramón makes the "rainforest beef" debate (conversion of rainforest to cow pasture) almost moot. Using Ramón one can have one's rainforest and eat one's beef too! The problem, which can be solved through finance,

[43] Friar Bernardino da Sahagún. *Historia Universal de las cosas de Nueva España.* Biblioteca Palatina.1589)

[44] "Ramoneros" are forest-dwelling ranchers and extractive farmers who drive their cattle, mules and horses through the woods gathering Ramon. There are, in effect, "forest cowboys".

[45] Peters and Pardo Tejeda, (1982)

policy, and technique is establishing the Ramón plantation so that it can provide the same ease of grazing that a pasture provides. Once that is done, as with most permaculture agroforestry plantations, proper up-front investment yields a system that should be more or less self-maintaining.

2.2.4 Unfamiliarity of the market

It is disgraceful in a society that spends millions to solve problems such as poverty, malnutrition and deforestation that with all the studies that have been done proving Ramón's value as both an animal feed and a human food, so little has been done to promote or encourage its use. Usually this is due to the fact that innovation rarely occurs in areas that are benefiting from the status quo, and up until this time both U.S. and Guatemalan political elites have profited from current land-use policies. Also, development efforts that favor rainforest conservation and the use of neo-traditionals have traditionally focused on encouraging the peasantry to be the direct consumers of their own products or trying to gain entry into the domestic market. This operates under the flawed assumption that it is the subsistence farmers and not the large agrobusiness landholders who are causing the damage, and that changing the consumption patterns of the peasants is the key. It is the same kind of misguided policy maneuver that had California homeowners taking shorter showers during the drought while agrobusiness continued to waste millions of cubic feet of water inappropriately irrigating during the heat of day.

One Conservation International official from Washington D.C. tried to warn us away from developing Ramón as a resource for development, claiming that their organization had done research and shown that most Guatemalan's will not return to eating Ramón. We feel their approach was flawed because it failed to take into account the fact that most modernizing populations reject forest products precisely because they have learned by hegemonic discourse to see them as "primitive". The best way to expand production of and market Ramón, we feel, is not to try to overcome the cultural resistance of people in the areas of production, but to appeal to consumers in the industrial nations for whom association with the disappearing forest adds value.[46]

There are precedents for using indirect markets for the expansion of stigmatized foods. At one time both Peanuts and Potatoes (originally cultivated by indigenous South Americans) were considered by Europeans to be the food of slaves and savages, unfit for middle and upper class consumption. Potatoes didn't become popular until Antoine

[46] A website called "Rainforest.com" sells leather jackets and clothing, while an international restaurant chain called Rainforest Café serves nothing from the rainforest – the entire menu is made up of your typical hamburger fare and temperate zone fruit juices. Both companies merely capitalize on the mystique of the rainforest to bring consumers in to shop.

August Parmentier convinced King Louis XVI of France to create policy supporting the plant at the end of the seven years war (1763), claiming it was an aphrodisiac![47]. And it wasn't until the development of a snack foods industry centered around sporting events (baseball in particular) that the peanut gained popular acceptance[48].

We propose California use its position as environmental and alternative lifestyle trend-setter to promote Ramón, using a combination of "green consumer" festivals (L.A.'s yearly Eco-Expo, Hopland's yearly Solfest, Earth Day and Eco-Maya festivals, Rainforest rallies etc.) as well as events at theme parks, botanical gardens and zoos, to get the word out and gain consumer acceptance in industrialized nations. We also propose using the celebrity machinery of Hollywood to gain endorsement by internationally famous television and movie stars. Product placement in feature films dealing with rainforest themes could assure global popularity for these neo-tradional foods. It is our feeling that once Californians shows their interest, consumers in Less Developed Countries will follow suit.

2.3 The emphasis is on information

"The emphasis on information", says Don Pedro. "It's important for us to get the message out about the importance of Ramón to millions and millions of families in Africa, Asia, Latin America and the Caribbean, and the contribution that Ramón can make to the well-being of potential millions of Ramón producers and processors."

However, as Don Pedro makes clear it's not just the general public that needs to become more aware of the importance of Ramón. "Everyone who has a stake in the growth of the Ramón industry, including governments, producers and processors, needs to be better informed", says Don Pedro. "Also donor agencies need to know more about ongoing development projects related to Ramón so that they don't waste money duplicating their efforts."

A cursory cost/benefit analysis shows Ramón to be superior to both of its competitors, particularly when viewed over the long haul with full cost accounting. Once the negative externalities generated by each plant regime are included the advantages of Ramón become even greater. With California's participation in addressing the major disadvantages of Ramón – its low demand, small market and initial

[47] " At first the plant was treated with distrust and fear, or grown only as a novelty. Fear of the potato lasted for centuries, as some people believed that it was unholy or unchristian, dirty, primitive, or unhealthy." <http://collections.ic.gc.ca/potato/history/migration.asp>

[48]Today, peanuts contribute over four billion dollars to the U.S. economy each year. <http://www.aboutpeanuts.com/infohis.html.>

startup investment costs, it is possible to see how Ramón, the Maya breadnut, bred and cultivated by the ingenious Maya over thousands of years, could help us boost the economy and protect the rain forest in the 21st century.

The task ahead of us now is getting the word out (promotion), creating robust, stable markets for the multitude of products this plant produces (marketing), shifting subsidies from corn and other destructive crops to Ramón and other tree-foods and providing technical and financial assistance for farmers who would like to switch from grass farming to forest farming.

2.4 Seizing the day: California's Potential for Competitive Leadership in Ramón Production

Regardless of the current social stigmas associated with a food like Ramón among many modern Central Americans some well-informed crop experts are convinced that there would be great benefits to California from moving fast in overcoming these stigmas and creating local demand to bring Central American supplies into the California market. They believe that if California doesn't move on this, somebody else will. The Australian New Crops Newsletter, Issue No 11, January 1999, already lists Ramón as a food tree of enormous potential. Given our strong linkages with Central America, this potential could most easily be realized in California.

If we wait, the same thing could happen to the Americas with Ramón that happened with another of our hemisphere's indigenous resources – the Pitahaya cactus fruit. Often described as "the most delicious cactus fruit," this rainforest epiphytic climbing cactus naturally occurs on Ramón trees. In our meetings with Agexpront in the summer of 1999 we found out that the Guatemala government is just beginning to explore the idea of exporting Pitahaya. The irony is that while Guatemala has been studying the possible market potential in the U.S. this past decade, Israeli, Thai, and Vietnamese entrepreneurs began plantations in anticipation of an Asian market that has now become huge. Sold under the name "Dragon fruit" Pitahaya is now found everywhere from Singapore to Sydney, from Taiwan to Tianamen square. In Singapore "Dragon Fruit" shakes are popular. Ramón's cousin, the Milk tree, has been established in plantations in Java and in Sri Lanka and it is only a matter of time before Ramón makes it east.

> "Some foreign entrepreneur is going to realize that as the Eastern markets open up the lack of stigmas against unusual foods will create the same great opportunities for Ramón as they found here for the Pitahaya," says Taiwanese textile broker Martha Liu, who has already contributed $5,000 to Proyecto Iximché in Guatemala, and recently brought Ramón to

> the attention of scientists in Beijing. "Already Chinese entrepreneurs are looking at opportunities for establishing Ramón plantations on Hainan island and we are talking about starting such a farm in the Puli district of Taiwan." [49]

As yet, Ramón has not commanded full attention from the market. California can seize upon this temporary lapse in familiarity with the plant and get in to the game early, engaging in the same kind of crop varietal improvement that the Israelis did for their burgeoning Pitahaya industry. The genetic modification of rain forest trees is already underway for timber producing species. There is no reason it can't be done with food producing species. In fact, there is evidence that the ancient Maya themselves engaged in some selective breeding of Ramón. The fact that while most "wild" Ramón trees bear fruit only once a year, the trees around the Tikal ruins bear fruit twice a year suggests this. California could make its resources and expertise available for improving Ramón production stock and capture the market before anybody else does. In partnership with Guatemala, California could help establish the first mass scale Ramón plantations.

According to the Guatemalan Ministry of Agriculture (MAGA) report:

> "The advantages of cultivating Ramón in orchards, as opposed to the cultivation of corn as the basis of agricultural production, are many. Corn, even with minimal fallow periods, cannot produce more that 320 kilos (705.47 pounds) per hectare per year in the areas surrounding Lake Petén Itza. This is explained by the fact that corn as a plant of the highlands, does not adapt well to the lime rich (calcium rich) soils of the rainforest (lowland forests); the harvests of corn are more efficient in many areas of the highlands. The practice of cultivating Ramón in orchards would present advantages significantly higher with respect to the cultivation of corn, especially if the Ramón trees were associated with other annual species of economic importance. The primary advantage of Ramón is that it has a superior production capacity per hectare. Collecting fruits from a single tree in Tikal we obtained 32.6 kilos (71.86 pounds) of seed, and according to an eminent scientist, a medium-sized tree can produce up to 75 kilos (165.34 pounds) of "grain". In dense forests we estimate that up to 250 trees can be planted in a single hectare, although a plantation with ample spacings would suggest a density of 100 to 125 trees per hectare where the Ramón trees are associated with other food-bearing plants or plants of agrosocioeconomic importance[50]."

[49] Martha Liu, owner of M&D International Inc. and philanthropist is currently working with Don Pedro, the Maya community and UCLA to set up the first international conference on Ramon to foster cultural exchanges between "the oldest Civilization in the East and the oldest Civilization in the West".
[50] Alfredo Guzman (1986), 15.

3. Maya Silviculture: Agroforestry as Agricultural Policy

3.1 Attacking the Problem at Its Root:

We know that the root problem causing the degradation of the remaining regions of rainforest is the unsustainable conversion of land with tree cover and stable root systems to erosion-prone land without trees[51]. Since that conversion is being made to provide staple food for both humans and animals in the form of a handful of grasses it would make sense to tackle the problem at this root level.

3.2 Forest Farming as Solution

USA Today, Monday May 22, 2000, reported "World's farmland imperiled: Nearly 40% of the Earth's agricultural land is "seriously degraded"… already reducing food production on about 16% of the world's cropland." The study implicated flooding (caused by deforestation of watersheds uphill) as one cause but the major cause turns out to be farming itself.

This commands an immediate need to alter the way that farming is done because "green revolution" gains are falling day by day. As the report by the International Food Policy Research Institute states, "Without high productivity you have to bring more land into agriculture and we don't have that land to bring in." The search for trees that can replace grass and grain crops goes beyond our need to preserve the remaining forest-land. It is also important for reclaiming soils that never should have been put under the plow to begin with. Forest cropping seems to be the most tenable solution for recovering the fertility of many areas of prime farmland too.

In a world in which planners truly recognize the extreme vulnerability of annual cropping agriculture on tropical soils, money would be spent scouring the world's tropical forests for potential "tree-cereals" that could be improved. Genetic engineers and crop breeders would devote their resources toward creating and enhancing the capabilities of such trees with the same dedication they now spend on coming up with miracle hybrid corn and wheat and rice plants. But the irony is that such a solution does not have to be invented, merely implemented. Such trees already exist and indeed are well-known by millions.

[51] Schroeder. and Suryanata (1996)

There is no dearth of long-term staple-food producing trees that could compete with short-term grass-grain crops such as corn, rice, wheat and pasture. The real problem is that the people who have long used such agroforestry solutions to sustain a high quality lifestyle have been and remain victims of tremendous marginalization and bigotry. They are the indigenous forest peoples themselves who have been systematically displaced and erased by encroaching savanna cultures whose agricultural practices, unsuitable for most tropical soil regimes, cause its destruction. Many of the forest-use experts are also women whose contributions to planning and environmental management have historically been ignored. Gender issues are important in all of this because women, as a marginalized class, have been responsible for providing the bulk staple items that their families eat, while men have been responsible for most land-use decisions. If policies actively involved peasant women in international dialogues about appropriate resource management and land use the outcomes would be significantly different. We would expect to see trees and forests to have use-values that go far beyond the current male-driven bias that sees them as good only for timber[52].

We focus in this paper on just one of the many "tree-cereals" that exist in the world – the Maya breadnut, known as Ramón. But the FAO identifies 528 different agroforestry species with edible nuts that can be made into flour. At least 25 others ready for immediate commercialization (Appendix III, Table 2.)[53]

All of these trees have tremendous potential as alternative commodities in the cereal market. We pick Ramón because it comprises up to 20% of the natural forests in Central America (reaching densities of over 50% in areas of classical Maya habitation) and is therefore an important source of natural capital that can be immediately utilized without any sunk investment.

3.3 Forest Valuation Exercises: Conceiving Different Forms of Capital

Leach, Mearnes and Scoones [54] provide a very useful framework for understanding the kinds of transformations and one-way degradations of "nature" by

[52] See Gillian Hart, "Engendering Everyday Resistance: Gender, Patronage and Production Politics in Rural Malaysia" (London, *The Journal of Peasant Studies*. Vol. 19, October 1991) 93. Cecile Jackson, "Women/Nature or Gender/History? A Critique of Ecofeminist 'Development'" (London, *The Journal of Peasant Studies*, Vol. 20, No. 3, April 1993) 389 and Bina Agrawal, "The Gender and Environment Debate: Lessons from India" (*Feminist Studies* 18, no. 1 Spring 1992) 138,142.

[53] FAO Report: NON-WOOD FOREST PRODUCTS 5: Edible nuts <http://www.fao.org/docrep/V8929e/V8929e00.htm>

[54] Melissa, Leach, Robin Mearns and Ian Scoones. "Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management" (*World Development* Vol. 27, No. 2, , 1999), 225-247.

looking at them in terms of capital flows and capital transformations. We can apply this to our analysis to get a better idea of the obstacles to and possibilities for expanding production of neo-traditional non-timber forest products.

The Leach, Mearnes, Scoones model starts with Environmental Goods and Services (roughly equivalent to Bebbington's Natural Capital Stocks[55]) which, mediated by certain Macro, Meso and Micro Institutions, are transformed into Endowments. These endowments are again mediated by Institutions and are, in turn, transformed into Entitlements. The Entitlements again are mediated and transformed into Capabilities affecting differentiated Social Actors. In theory these transformations should not be strictly linear. There should be regenerative feedback loops going "upstream" too. The model shows capabilities being back-transformed into Entitlements, Endowments and Environmental Goods and Services. But in today's land conversions, there is no upstream investment. The land is mined and left for dead. This is what drives people to migrate.

3.4 Moving toward Postmodern Deindustrialization in Agriculture

If rainforests were looked at as post-industrial factories instead of nature parks, and we took a long term profit maximization view, not a "get rich quick" boom and bust approach to their maintenance, we might more easily devise ways to get the proper factor inputs (nutrients, water, pollinating, seed dispersing and recycling organisms that maintain the natural machinery) back into the system. The problem with rainforests is that they are actually "mined" rather than farmed – mass production without reinvestment in natural capital amounts to little more than rape. However, if we apply the logic of California's own successes in tackling globalization in the technological sectors to modes of production in rural areas of Central America, we could plausibly argue that mass production is soon to be as obsolete in Agriculture as it is in Industry. We might see that once we replace 19th century agricultural practice (Fordist mass production of standardized outputs) with the ecological science-based industries of the 21st Century (permacultural equivalents of flexible specialization, short-run product diversity stemming from intercropped biodiversity, customized production runs based on the overlapping harvesting schedules permitted by a hyper-speciated, hypercomplex tree-shrub-groundcover matrices) we might predict more complex core-periphery relationships between temperate and tropical regions and better feedback loops between them.

[55] Anthony Bebbington. "Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty". (*World Development*, Volume 27, Issue 12, December 1999)

Strategies for moving toward Postmodern Deindustrialization in the Agriculture of the Peten rainforest region are given as a model for what might be accomplished, beginning with Section 3.4 of this paper, and continuing through Section 5.1. In sum, these sections argue from some experience that, as mass production of standardized outputs falters and fails, “anthropogenic rainforests” (human managed forest farms) will be shown to perform much better, and should become the ultimate expression of de-standardized economies.

The Taylorist way of viewing agriculture (mass-production with high efficiencies resulting from dehumanized labor) is regarded by a growing number of Latinos as outmoded, and they have also gone beyond thinking that the only hi-tech alternatives are cloned sheep and piglets and winged beans, which are symptomatic of the old mass-production mentality. These Latinos, already wary of what they call “Fordismo”, and the loss of opportunity and control resulting from mechanized agriculture and the advent of “terminator” seeds, want to see a new hybridized form of indigenous and modern practice. Tropical scientists want to see policy cease favoring bio-tech solutions for increasing yields of soil exhaustive species (a one-way ticket to destruction). They insist that true bioengineering in a post-modern world implies de-standardization, and that rainforests are the ultimate expression of de-standardized economies[56]!

The competitive edge should go to hi-tech areas of high biodiversity. If we apply our bio-engineering acumen not on all the different things we can make out of transgenic corn or soy or wheat or rice or tobacco, and instead on all the different things we can make out of the thousands of commodifiable, manipulable species already available in the tropics, we might begin to see the "De-industrialisation" of the Industrial Agriculture Heartlands, just as we saw happen to the Mechanical Industries in the US Rustbelt post 1966, when they failed to keep up with post-modern science.

California might lead the emergence in the tropical periphery of leading edge agroforest industries that serve multiple markets (Horizontally integrated, vertically disintegrated) where lots and lots of sub-contracted small scale organic producers in the forest aggregate and disaggregate their production runs for dynamically shifting markets. This would mean having farms that produce so many different products that you could flexibly specialize in whatever the market demanded in its whimsical way. I propose this could be as true for "staple" crops and "bulk" items as for luxury gourmet foods. In the right kind of post-industrial agroforest you could sell Ramón flour today (Brosimum and Trophis) and Provision tree (Pachira aquatica) flour tomorrow, and still be growing Treculia africana for next month's fashion run. All year long you would be producing “flour” but it would come from a wide variety of tree resources. The result would be a type of continuous batch production that no grain-field could possibly compete with. If,

[56] Ir. Ismayadi Samsoedin, Indonesian Department of Forestry, pers. Comm.

as UCLA's Michael Storper says "Industrialisation is not just about manufacturing" then we should see the agricultural sector de-industrialize in the wake of more complex information management systems the same way that all other sectors have.

3.5 Toward Computer-Based Complexity in Agriculture: The End of Monocropping.

If the industrialization process can change so radically with the advent of the computer in industries that do machine manufacturing, why not in agricultural manufacturing? Why wouldn't we consider a partnership between "forest ecology machines" (living ecosystem units of production) and human computing power a formula for dramatically improved profitability? And why shouldn't agro-industry go the way of machine-industry?

If policy makers who are interested in preserving the rainforests and the dignity of forest-dependent people would stop thinking of them and other living organisms and systems in that romantic "don't touch" way and truly adopt the logic of capital, we should be able to predict that by Schumpeter's "process of creative destruction" the technology of computer enhanced agroforest complexity will win out over mass production standardization and simplification.

We have abundant historical examples of technology (such as the Jacquard loom, the precursor of modern numerically controlled machine tools) and infrastructure (the Lyonese system of 'caisse de prets' and the system Motte that linked embedded familialism with start up capital) that defied Taylorist production methods. Piore and Sabel[57] demonstrate the early existence of technologies and organizing principles that permit quick, inexpensive shifts. These precursors suggest that we've always had (and thus could resurrect) models, not of industrial dualism, but of flexible specialization. Thus, today's "discovery" of "craft heterodoxy" in agriculture turns out, like the "discovery" of America, to be merely another example of something that "lots of people already knew about, but because they were robbed of their voice, nobody could effectively talk about.[58]" This is particularly true of Indigenous people and women.

Say Piore and Sabel:

"This alternative form of production had its visionary exponents…like Pierre-Joseph Proudhon. In one form or other they propagated the idea of a republic of independent craftsmen linked by dependence on one another's skills."

[57] Michael J. Piore and Charles Sabel, *The Second Industrial Divide* (New York: Basic Books, 1984).
[58] *Ibid*, 28

The idea of small independent farmers working as contractors, aggregating their forest products to meet market demand is a lot like the way the Garment Industry works.[59] Such a system functions very well in a post-industrial economy. Under the auspices of Proudhon's socialism none of this could flourish but viewed as neo-indigenously hybridized post-modern capitalism it just might work.

Today global competition is finally permitting us to challenge the synonymity of mass production and industrialism that the power orthodoxy wanted to keep as sacrosanct in the realm of ideas as it was in the realm of practice.[60]

If California can help the world apply this logic as effectively to agriculture as it did to technology it could usher in a new era of high-profit sustainable agriculture and spawn a bio-tech sector that would be applauded by capital, labor, and environmental lobbies alike.

4. A Best Practice Model: Proyecto Iximché and Sustainable Devlopment

In the village of Macanche, sandwiched between the forest and the lagoon, on a degraded parcel of milpa and pasture-land, is an experimental plantation which could provide a model for sustainable development. The plantation is designed to demonstrates the potential of a Ramón-based agrosilvipastoral system and hopes to address the community's need for a sustainable income while providing incentives and methods for preserving and enhancing the forest ecosystem and illustrate proper use of remittance monies and transnational flows of capital, labor and knowledge systems.

The Plantation is part of a California/Guatemala partnership project called "Proyecto Iximché". Its design includes a school for sustainable development at which *campesinos* and development students from around the world can share ideas and resources for non-destructive resource use. The project, developed as a cooperative effort by a Maya Quiché landowner and graduate students at the University of California, Los Angeles, is intended to serve as a local best practice model which can be generalized to help rural people in other tropical forest regions. A description of the model can illuminate the areas where linkage with California can benefit both regions' economies.

The model area was until recently a rainforest, denuded in the last decade by immigrants from the Guatemalan highlands to plant corn and graze cattle and then abandoned when the fertility of the thin soil gave out and the crops failed. Two parcels of land – one 2 acres, the other 10 acres -- were purchased by Don Pedro Gonzalo Cuc, a

[59] See Russel Horning's study on Textiles, forthcoming.
[60] Piore and Sabel,(1984),47.

Maya Quiché development specialist with a vision for an alternative future for Guatemala.

Don Pedro saved up from his small government salary to buy his land because he believed that the problem with most "community-based" development was that it naively assumed community consensus over the use of "the commons" and too often ignored the political ecology and political economy of the area. Don Pedro's idea was to "get land that nobody else wanted, assemble an international group of like-minded visionaries and demonstrate the efficacy of agrosilvipastoralism and appropriate technology in providing returns on investment before trying to foist some ill conceived policy on people who are, of necessity, only concerned with eking out a living.

Thus, Don Pedro's approach, which he calls "obras, no palabras" (actions, not words), lies perpendicular to both of the prevailing, competing development ideologies – "top down management" and "bottom up planning". Don Pedro's idea is more lateral and overlapping – inviting private-public partnerships through a loose and evolving cooperative of small land-owners that can grow with the market and the profitability of the enterprise.

Perhaps the greatest distinction between Don Pedro's private enterprise and that of other land holders in the area who are establishing plantations, is that Don Pedro's value system is Quiché. To be sure, it is a modern Quiché, hybridized with Christian ethics brought by the Spanish. But because Don Pedro is a member of the marginalized population, his approach, his goals and the way he is perceived by the villagers differ dramatically from the usual landholders who are thought to operate not for the benefit of , but in spite of, the community. Don Pedro is dedicated to realizing the long-term benefits to the Maya community. He believes that Maya silvicultural systems, time tested over millennia, are inherently better suited to this tropical lowland than agricultural systems imported from and imposed by invaders from the highlands and temperate zones.[61]

4.1 The Don Pedro Development Strategy:

Too many projects are simply plopped down in a community because the "experts" outside have declared them "good" for poor people. So-called "representatives

[61] Neglect of Maya wisdom, like neglect of Maya aesthetics, is one of history's great wastes. As the Franco-Mexican muralist, Jean Charlot, observed, in "Art from the Mayans to Disney" (New York: Sheed and Ward, 1939, p. 17), "the study of Mayan art and the appreciation of its monuments has been left wholly to the taste of scientists, and those precise gentlemen, being most interested in chronology, too often overlook its beauty to indulge in technical discussions which make the layman yawn. This may account for the fact that Mayan art, although one of the few fully ripe racial expressions the world has known, is still waiting to become a part of our common aesthetic heritage".

of the community" are often either wooed or bought into accepting the project. The people themselves don't get a chance to form their own conclusions. When, for various reasons, the project does not live up to expectations, the project is abandoned, rejected and never gets a second chance. Don Pedro has lived through all of this depressing cycle several times before and will not let it happen again. His attitude is, "If it is good enough for an entire community, it is certainly good enough for me – so I should take the risk and prove the benefits first. Experiments should not be imposed on others. If they prove true, others will quickly adopt the winning techniques."

Don Pedro's model -- his home-grown development strategy, so to speak -- says:

- Funders and investors should first identify private individuals from marginalized or "at-risk" groups who have an alternative praxis and the willingness to engage in experimental trials.

- Loans, grants and policies should favor those individuals securing the land and resources for the period of time necessary to prove or disprove the alternative methodology. Policies -- and money -- should not favor people engaged in the same old unsustainable practices.

- Indigenous practitioners should be embraced as experimentalists and scientists who can push the envelope of world knowledge.

- Community members resisting the project should not be forced to adopt it.

- Members of the community who are interested should be hired to work on the project for a fair wage so that no matter what becomes of the project they never feel their time or labor was lost.

- Technical support and expertise should flow freely around the world so that vital insights that could make or break the project can be implemented when needed.

- Projects should be oriented to spread benefits, not risks.

4.2 From degraded land to enhanced productivity:

Don Pedro's plan is to prove that "if you can make a living off of degraded land like this, you can do it anywhere." This is similar to the philosophy of the Permaculture movement in Australia where people seek to improve infertile land through organic

design and environmental management, re-engineering with the help of natural ecosystem dynamics and a sophisiticated understanding of complementary ecologies and biological processes. Don Pedro's attitude when he looked at the Permaculture literature was "it's common sense – it is what Maya silviculture has been about for thousands of years." But to work poor soil back into health demands capital investment.

4.3 Semi-Proletarian/Semi-Peasant Strategies

Step I in Don Pedro's plan is soil amendment. This is the phase that is most difficult and labor intensive. Because of demands of bringing degraded land back to productivity, *campesinos* are driven by poverty and the desire for short term gains to move on to a new parcel of forest. In the United States, we compensate for soil exhaustion by massive inputs of subsidized fossil fuel, machine, fertilizer and pesticide input. We do so at our peril, but because the costs of the negative externalities are passed on to the country as a whole, farmers stay in business. In Guatemala this kind of strategy is not feasible. Those who degrade the land do not usually have the means to rehabilitate it, either artificially or naturally.

Natural forest succession and regeneration have been compromised by the elimination of buffer forests which harbor animals that can act as reforestation seed dispersal agents. Because of this, Don Pedro uses a managed fallow/silviculture technique practiced by the Maya. He works with nature to positively influence how the land regrows. By mulching and composting and sporadically grazing animals with different feeding and manuring characteristics (pigs, horses, cows, chickens, ducks) he gradually builds fertility back into the soil. Fast-growing trees are encouraged or introduced to provide a first layer of shade for more vulnerable but more valuable tree species which he has deliberately planted. Unlike the owners of, most plantations, Don Pedro is not looking to "get rich quick" by working only with quick-yielding commercial species whose role in the larger ecosystem dynamic is so often problematic[62]. He is investing in the creation of a system that will produce constant yields over the long term.

The key to Don Pedro's success, and a compelling basis for policy, is that he is not dependent on his land for subsistence or income at this point. He works in a government office and reinvests a portion of his salary in the plantation. In this sense, he could be called a "semi-peasantized proletarian."[63] He also uses his government

[62] Bina Argawal,. "The Gender and the Environmental Debate: Lessons from India". *Feminist Studies 18*, no. 1, 119-58. Spring 1992.

[63] The semi-proletarianization of the peasantry is a well studied phenomenon but lately we are seeing the emergence of a "back to the land movement" of semi-peasantized proletarians. See Bernstein, H. "Notes on Capital and Peasantry".*(Review of African Political Economy 10, 1977*) *60-73.*

connections to attract outside allies and investors. He is building an international base of both social and financial capital that can subsidize the initial years of land rehabilitiation and low productivity while he engages in mixed silviculture crop establishment. He uses his college age son, who lives in urban Guatemala City and studies computer engineering, to be his electronic liason with our UCLA team in California. And he uses the funds he generates, either through his own salary or the donation and investments from the California and International network, to build expensive infrastructure on the plantation that can reduce the risk of the enterprise. In effect, he and his allies in California and elsewhere are supplying the "remittances" that make sustainable plantation development possible.

What emerges is a compelling model for how internationally linked, semi-proletarian, cyclical transnational communities can be organized to achieve sustainable development in the rainforest regions of Latin America (and elsewhere!).

The model we are proposing plays on the successes we have observed working with Don Pedro. It suggests that one of the first flaws policy makers are guilty of is trying to maintain a neat division between peasant and proletarian populations and their lifestyles. The idea that in a globalized economy we can somehow keep one group of people "down on the farm" while another group works for wages in the city, may be one of the most powerful drivers of the cycle of poverty leading to mass outmigration in the first place. The so-called "back-wash" effects pointed out by Myrdal[64] easily take place when the world is broken into "cores" and "peripheries". De Janvry's "disarticulated accumulation"[65] manifested in one or the other region leads to an inability for local people to reinvest in their own communities. The cycling of the various forms and embodiments of energy that sustains both economics and ecology is broken when the flow of resources is always from the rural to the urban and nothing ever comes back to replenish the depleted stocks of natural capital. This is one of the great paradoxes of rural development. If products and the "surpluses" and profits of an area of agricultural production, and/or its labor, are flowing out to centers of consumption or industrial production; but no investment greater than that necessary for subsistence maintenance is coming back into the community, how is the community and its environment to continue thriving? The global economy doesn't seem to mind when one of its sources dries up, withers away, or crashes – it simply reconnects with another source of production until it, in turn, is exhausted. It will continue doing so until there are no other sources left. But for the rural people themselves this linear way of servicing a rapacious economy is

[64] Gunnar Myrdal, *Challenges of World Poverty* (New Press, 2000).
[65] Alain De Janvry, *The Agrarian Question and Reformism in Latin America: Disarticulated Accumulation and Agrarian Crisis* (Johns Hopkins Press, 1981).

disastrous. Policies that maintain this disarticulated divide between *campesinos* and consumers are recipes for a disaster for the global community.

Far more compelling is the idea of Portes,[66] where transmigrants are encouraged to flow freely from farm to factory, from rural to urban regions, and then back again, trading ideas and techniques as freely as products and labor and capital. If sensible, sustainable agroforestry practice demands a period of investment and latent productivity, why shouldn't families be able to send members to work elsewhere so that they can remit the needed funds back home? If creating a farm that does not degrade the land, but ensures long term income and preserves regional biodiversity, takes five or ten years to accomplish, why shouldn't people be able to go where they need to, and do what they have to, in order to bring those funds in?

4.4 Production plan:

One of Ramón's initial disadvantages is that it is a slow growing tree. In the long run this becomes an asset, however, because once it starts producing, it remains productive for over a hundred years, thus guaranteeing a source of income for generations. Nonetheless, we have an establishment period that varies between 6-10 years to contend with. This is not a prohibitively long period of time to wait for a capital investor. It is commensurate with production of already commercial agroforestry dessert crops (Brazil nuts, Cashews, Macademias, Avocados, Mangos). For subsistence crops, though, this can be a serious impediment to investment. Prices will need to be low to compete with grains, so it will be hard to both recoup investment and payments for subsistence during the initial phases of establishment. At Proyecto Iximché we get around this by taking advantage of a multi-crop production strategy known as managed fallows.

While the Ramón seedlings are establishing themselves we are planting pitahaya cactus from cuttings at the base of each tree. Pitahaya will grow along any vertical support and so is expected to produce major returns while the entire mixed forest plantation is coming up. Pitahaya on artificial supports have started commercial production in as little as 2 years with full production within 5 years.[67]

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[66] Alejandro Portes. *Globalization from Below: The Rise of Transnational Communities. Latin America in the World Economy* (Westport: Greenwood Press, 1996).

[67] Australian New Crops Newsletter <http://www.newcrops.uq.edu.au/newslett/ncn11163.htm>

At Macanche, as elsewhere in Latin America, wherever indigenous knowledge systems prevail, some Ramón, Jocote, Corozo palm, Guamuche, Pimienta and Chicle/Zapote trees are generally spared when land is being cleared for corn or pasture. Although there is little or no external market for the products of these trees, subsistence peasants do rely on them during periods of famine and engage in petty commodity trading during periods of plenty. On Don Pedro's land there is a small production forest of Pimienta trees along the edge of the lake which doubles as a shaded picnic and camping ground for expected agro-tourists. Within and surrounding this tiny forest there are a few chicle trees, a couple of coconut trees and a single mature Ramón tree. Beyond his fence, in a forested "commons" there are a half dozen large Ramón trees along with some Jocote. It is from this buffer zone that Pedro collected seeds and seedlings to establish the Project's nursery and plantation. While the yields are not enormous, they are sufficient for the subsistence of the workers and for them to create and test product while waiting for the plantation to bear fruit.

4.5 Applying the Agroforestry Model

Capitalizing on existing resources and knowledge on both sides of the border and hybridizing these natural, cultural and social forms of capital, the California/Guatemala Proyecto Iximché partnership is working hard to create the best practice model for the area. We are currently nursing 10,000 Ramón seedlings and 5,000 seedlings of other valuable and nutritious standing tree crops (sericote, jocote, chicozapote, cacao, ceiba, cedro, aguacate, guama, capulín, chontaduro, and corozo palms – to name just a few of the many other indigenous plants of socioeconomic/ecologic value that we are using). These seedlings (called "viveros") will be available for eventual planting on the site and elsewhere (we plan to distribute them to neighboring farmers to help them reclaim their ruined land). We estimate a mean density of 100 - 125 Ramón trees per hectare, interplanted with up to 100 other kinds of trees in this pluricultural plantation.

Since Ramón trees don't begin producing fruit for about 6 years, the fields will grow in transition phases, producing light-tolerant vegetables and fast growing plants of nutritional and economic value until the Ramón forest canopy begins to shade them out. This is the managed fallow system used by the ancient Mayans, which is now being used by us for this reforestation initiative.

4.6 Agrosilvipastoralism: The Rain-Forest/Ranch-Forest

Proper agrosilvipastoral practices can ensure that regardless of market fluctuations in the prices for Ramón products, farmers can always be sure of having plenty of meat for local consumption, domestic sale and international export. In Proyecto

Iximché we are taking this concept a step further. Working with animal breeder and woman's cooperative activist Alba Huex, from the indigenous Maya Itza group, we are integrating the breeding of regional meat specialties onto our plantation. Within our rain-forest "ranch-forest", native animals of economic value will be introduced to be harvested at sustainable-yield levels. Our working plan includes the nocturnal Tepescuintle (Agouti paca - a favorite dish of Peténeros and my favorite too!), the diurnal Guatusa (Dasyprocta punctata), Venado(Odocoileus virginianus) and Venado Colorado (Mazama americana), Coche de monte (Tayassu pecari) and Saíno (Tayassu tajacu), Armadillo (Dasypus novemcinctus) and Pava Cojolita (Penelope purpurascens). All of these animals form part of a nutritious Mayan diet, but they are becoming rare and threatened in the wild by habitat loss.

Following successful models developed by ranchers in Africa, we see our ranch-forest serving as part of a sustainable-yield continuing/stock replenisher with buffer zones and wildlife corridors. In our ranch-forest concept, grassland pastures tenuously supporting destructive European and Middle Eastern Animals such as Cattle, Horses, Pigs, and Mules, are replaced with fodder and fruit producing "tree pastures" that sustainably provide food and forage for indigenous animals that have low-fat, high nutrition food value and do not exhaust the natural resources of the environment. The need to cut and burn more forest to provide more pasture diminishes; instead, an incentive is created to plant yet more "ranch-forest" to encourage higher animal fecundity and "more meat on the hoof".

The rain-forest ranch-forest, rather than negatively impacting other wildlife, acts as a nature preserve, supporting myriad species of birds, monkeys and other mammals (in particular the gravely endangered Danta -- Tapirus bairdii). These animals, once plentiful, are currently under seige. When a "milpa" (corn field) or pasture is converted into a Ramón forest, arboreal animals can feed on the fruit husk and pulp of the tree; browsers and grazers can feed on the fallen or harvested leaves; the seed that drops to the ground is harvested by human beings and is then processed into flour and/or animal fodder. It is definitely a win-win.

Our experimental five-hectare ranch-forest draws on the principles of bio-intensive, well-planned, efficiency-zoned "permanent agriculture" developed by Bill Mollison, the Australian visionary-practitioner who started the "Permaculture movement". Besides providing sustainable food self-sufficiency for the local community, it will feature an area that demonstrates integrated intermediate technology systems. Independent renewable energy production will be achieved using bio-gas (from animal waste) and other biomass fuel resources (ethanol, methanol, and

methane) as well as micro-hydro-electric, wind-powered-electric and photo-voltaic systems.

4.7 The promise of "Agro-Tourism"

The "integrated human habitat" zone in our Ranch Forest will include our Escuela Iximché -- a "School for Sustainable Development and Agro-tourism", one of the first of its kind. The Escuela Iximché is a place where students from all over the world -- and most especially local immigrant *campesinos* who are struggling to eke out a day to day living from the Petén's diminishing forests -- can come and learn sustainable ways of managing forested land so as to acheive high, permanent yields without damaging their environment or endangering their biodiversity.

Unlike "Eco-tourism", which engenders a "look but don't touch" attitude toward "nature" (which we consider an often dangerous social construct), the concept of "Agro-tourism" which we have developed encourages people to consider themselves a part of the natural ecosystem as the Maya and other indigenous groups do, and challenges them to work with it and within it to achieve a life-style that will endure for generations to come. Also, unlike "Eco-tourism", which is the province of the leisure class, "Agro-tourism" satisfies the needs of all people, enabling visitors and residents to share information on an equal basis, helping people work together toward common solutions to common problems. In agro-tourism (as we have conceived it) there will be no artificial division between "haves" and "have-nots." Moreover, local people will not be forced to become a "service class", catering to the needs and whims of vacationers who come to Guatemala to satisfy their idiosyncratic romantic notions of "nature", "undeveloped areas" and "third world countries".

In agrotourism, Peténeros will be able to receive their foreign guests with pride. Guests will learn from the local silviculturalist. Indeed, guests as well as silviculturalists will be able to benefit from over 3,000 years of accumulated Mayan knowledge and experience. The agro-silvo-pastoral systems demonstrated at the school will hopefully not only change the practices of Guatemalan immigrant farmers, but hopefully all those mono-culturalists whose inappropriate practices have been the source of so much damage and suffering in the tropics and sub-tropics. The ultimate goal is to encourage people to rethink the artificial separation between "Man" and "Nature" and demonstrate conclusively that Homo sapiens and the other wildlife with whom we share this planet need not be at odds. The principles of permaculture, applied on a foundation of Mayan indigenous practice, using indigenous flora and fauna with a maximum level of

biodiversity, can go a long way toward solving the "development of underdevelopment" paradox.

And it all starts with the sacred "Iximché", the "Corn-Tree" or "Bread-Nut Tree" of the Ancient Maya, now known as "Ramón."

5. Lessons Learned: An Exploration of the Historical and Theoretical Information Necessary to Make a Decision:

5.1 Why other regional development and rainforest conservation policies are doomed to fail.

There are theoretical as well as practical problems to be avoided in seeking sustainable commodification of the Rain Forest. It isn't that the idea of commercializing rainforests has not been proposed before. Besides the obvious idea of revenues from tourism, there is a growing body of literature focusing on making the rainforests "more profitable alive than dead" through the sale of "not-timber forest products" (NTFP's).

In our region of study (the Maya Biosphere Reserve) there has been a lot of NGO activity seeking to commercialize NTFP's (*productos forestales non maderables*). The CINCAP (*Centro Informacion sobre la Naturelaza Cultural y Artesania del Petén*) building next to the Cathedral on the highest point on the island of Flores, the seat of the Petén's government, is at once a museum, library and retail store where the history and the products of 12 forest community cooperatives are on display and sold. But there is limited availability on the world market and these efforts are having a negligible impact on deforestation rates. Furthermore, ecotourism, the much touted revenue generator for rainforest preservation, seems to have peaked in the Petén. As two INGUAT officials told me when I gave a presentation at their national tourism conference "When people come to the Petén to see the rainforest they go to Tikal, where they can see both Maya ruins and wildlife in comfort. Because of this we have plenty of funding to preserve Tikal. But after that, almost nobody wants to see any of our other rainforests. So the other forests suffer. Pretty soon all we will have is Tikal."

Conservation international has been working with CINCAP by creating an organization called "Pro-Petén" to find ways to commodify NTFPs from the Buffer Zones in the Maya Biosphere Reserves around Tikal and generate revenues to preserve the forest and the livelihoods of forest dependent people. In the CINCAP retail store they sell 9 different kinds of specialty jungle teas and infusions produced by the "Handicraft Project at El Remate with full lists of the traditional medicinal benefits of the species

included. They also sell 10 kinds of medicinal tinctures produced by an indigenous Maya Itza women's cooperative known as "*Agrupacion Feminina Prorescate Plantitas Medicinales Itzaj*. All of these are sold at the CINCAP tourist shop where the products are advertised with lists of ingredients and literature stating how their sale can both help preserve the Maya Biosphere Reserve and improve community fortunes. Nonetheless, our observations are that most consumers with differential income mistrust traditional medicines and are not fond of bitter teas; sales volumes appear to be low (our Maya Itza collaborator who works on the traditional medicines marketing for an international NGO called EcoLogic reported that sales were almost nil). More successful are the line of packaged potpourri's called "Gatherings" – hand collected rainforest botanicals" which contain dried leaves, flowers and fruits from 27 different rainforest species but they don't generate enough revenue to sustain livelihoods.

Another more popular item in the tourist market is a line by Cil ProPetén called "*Joyas de Hojas – Joyas de Hojas enchapadas en oro de la selva Peténera*) – gold dipped rainforest leaves worn as brooches or on necklaces. But none of these produce the kind of short-term returns that would make them competitive with other, more destructive but more lucrative land uses.

There is a further dilemma: The sales of these non-timber forest items seems to depend on the ability of the selling agency to add value by capturing the imagination of the buyer. This is usually done using some rhetoric about the rare and threatened status of the forest producing the products. Ironically the value of the products is therefore directly proportional to the amount of deforestation – the less forest there is the greater the chance of selling these "disappearing treasures". As a strategy for long term sustainability and low risk community livelihoods this paradox is problematic.

There are three extractive products from the forests of the Petén that do provide a steady income for a sizeable number of Peténeros and have provided the strongest incentive to preserve large tracts of forest. These are, in order of importance, Xate, an ornamental palm frond used in Floral arrangements, Pimienta (allspice) and Chicle, or natural chewing gum. Since the giant trees producing Chicle also produce Zapote, a fruit which, like Ramón, was exploited and cultivated by the Maya for 1,000's of years in the Petén, the forests are full of majestic Chicle trees. Chicleros fought to protect these forests from encroachment and conversion to other destructive land uses.

Unfortunately, Chicle has suffered the same fate as new world rubber – synthetics have all but eliminated the chicle trade with the U.S. What Chicle demand remains is confined to Japan and to health food markets. Today, Chicle production is a tenuous livelihood for most Peténeros and just as Chico Mendez, president of the Brazilian Rubber Tappers' Union, was assassinated by ranchers who saw a more lucrative short

term use of the land in converting it from forest to pasture, Chicleros in the Petén are finding themselves severely threatened by similar big money interests when they endeavor to protect their forest holdings.

Pimienta production continues apace, but most production occurs on single stand plantations of this relatively fast growing tree. The tree isn't tall enough to contribute to a multi-strata forest canopy structure so the contribution of these plantations to the preservation of a multi-layered rainforest ecosystem is relatively small.

Xate (Chaemadora) palm is an interesting case which shows how quickly foreign demand can create livelihoods for forest dependent people. The Xate palm is a dioecious shrub-sized plant that grows on the forest floor under low-light conditions. The female of the species has fine featherlike leaflets while the male has larger fish-like leaves. As understory plants they were virtually ignored until a Texas flower importer in 1960 developed a market for the leaves as a background for floral arrangements. What ensued from this one trend setting entrepreneurs action was a huge market in the U.S., Germany, Belgium, Switzerland, the Netherlands and Denmark (female plants in the U.S., male in Europe) that has turned Xate (Jade palm, C. oblongata) into the most important source of employment in the region. (Cincap, 1999) Xate, however, is a shrub-sized plant that is increasingly grown in greenhouses. Hence, it too holds no promise for the preservation of climax-species dominated rainforests. Furthermore, as we learned by witnessing the deliberate burning of Borneo's rainforests by cronies of former President Soeharto's business buddy, Bob Hassan, to establish Pineapple plantations, the monocropping of single understory rainforest species can spell disaster for forest ecosystems (Pineapple is a bromeliad originally discovered in the Amazon. Today entire rainforests are removed to create plantations for it.)

The Xate example does, however, strongly suggest that the right combination of business acumen and opportunity could help create a market for any rainforest plant, and could be used to revive the ancient Amerindian trade in Ramón.

5.2 Vulnerabilities of current NTFP markets

Since the rainforest products currently in use serve luxury markets and are not essential or basic goods they will always be subject to boom and bust cycles and competition from synthetics. Furthermore, since with every bust cycle the forest ecology that maintains them gets degraded, simplified or converted to some other short-term profit generating land use, a shift away from these commodities becomes inevitable.

This leads to what Hecht calls "definitive conversion[68]". The sheer cost of replanting such a degraded area prohibits its return to a rainforest with high functional biodiversity.

5.3 Historical Perspective and Review

One could argue that if our agricultural and trading policies actively promoted – nay, insisted on -- the involvement and participation of indigenous people and women in our practices, we might find that many of the solutions we are seeking already exist. From within our own immigrant community here in the U.S. there is an enormous bank of knowledge to pull from.

Many immigrant working class Central Americans who shop and prepare food for power brokers in centers of financial and commercial power, or who do the gardening, the planting, the picking and the food processing in our globalized economy are almost never asked to contribute their expertise on forest-derived alternative foods or cultural contributions. Yet we are at a time when even the popular press is acknowledging an agricultural and environmental crisis. It is as though the forest and its people were lost in some romantic never-never land of no practical value. People with power decry the loss of rainforest and rainforest issues are seen to be part of the "white environmentalist agenda" – the fate of forest-dependent people is rarely brought into the argument. Many upscale vegetarians tout the eating of soy beans to help "save the forest" ignoring that soy is one of the most destructive crops in the Amazon today, leading to more definitive conversion of forest to cropland than any other food. Americans outraged by images of deforestation continue to import and consume cheap beef subsidized by the unsustainable conversion of forests to pastures. Policy makers who continue to funnel development funds and loans to soil destructive agricultural practices wring their hands in despair over stemming the "tide" of immigrants to the U.S. Somewhere there is a disconnect.

Ironically, as films like El Norte (1984) make clear, most Central Americans are not migrating to the U.S. to "find a better life", they are migrating to avoid a worsening life back home. Whether fleeing civil wars, slaughter and oppression caused by land tenure conflicts, such as the struggle of Guatemalan *campesinos* to take back land expropriated by the United Fruit Company (privatized for feeding U.S. market demand for bananas, sugar cane or coffee) or abandoning marginal landholdings that are no longer productive because of massive deforestation on a state-wide level, *campesinos* are literally forced out of their homes by bad agricultural policies and practices outside their control. The major causes of deforestation in Central America, as Jill Sourial has pointed out, and the Los Angeles Times corroborates, is conversion to cropland – milpa (cornfields) and pasture grass for cows in Guatemala. What isn't reported is WHY

[68] Susanna B. Hecht, lecture on Rural Peasant Issues, UCLA Spring 2000.

peasants are trapped into growing crops that destroy the very forests they depend on. The news stories usually fail to tell us why the activity of smallscale farmers is having such a large scale impact today, and what the real alternatives are. Nor is there much discussion of the impact trade in non-timber forest products and neo-traditional agricultural exports with California – the World's 7th largest economy – can have on fostering alternatives.

Ultimately, by looking at the potential for a California-led world market in products from agroforestry staple crops like the Ramón tree, I hope to show that responsibly managed production and trade practices and policies can encourage the entrance of neo-traditional non-timber forest products into world markets. Immigrants can then have the chance and choice of returning to their beloved homelands, confident that they can regain a high quality of life there, achieving economic growth at home via sustainable development. In the shift from what is now called "traditional agriculture and exports" to what we call "neo-traditional agriculture and exports" lies those immigrants hopes.

5.4 Neo-traditional Rainforest Products and other Forest Valuation Options:

The vast majority of the rainforest uses now being exploited are recent social constructs concocted solely for the benefit of tourists. Traditionally forest people made no use of gold-dipped forest leaves and potpourris, have never engaged in the "look but don't touch" luxury of "eco-tourism" and used infusions and medicines derived from the forest because they had no alternative, not because they preferred to. [69]

Part of what makes forest conservation so difficult is that, in the short term, standing forests are seen to be luxuries, producing aesthetic values for wealthy tourists and/or dessert crops for the rainforest crunch crowd. Even when considering the needs of "forest dependent people" authors have a hard time defending the maintenance of vast areas of biodiverse forest trees. Byron and Arnold[70] fall into the usual trap of discounting the value of forests even as they try to argue for their preservation:

> "Forests and forest trees are the sources of a variety of foods *that supplement and complement what is obtained from agriculture*, (italics mine) of fuels with which to cook food, and of a wide range of medicines and other products that contribute to health and hygiene… [but*] forest foods seldom provide the staple, bulk items that people eat*.

[69] This is not to say that forest medicines are ineffective. Because of current western cultural hegemony and advertising, industrially produced medicines are replacing traditional medicines among indigenous groups despite environmental rhetoric fueling the "rainforest remedy" niche market.
[70] Neil Byron and Michael Arnold "What Futures for the People of the Tropical Forests" (*World Development* Vol. 27, No. 5, 1999), 789.

> (again, italics mine) For the majority of rural people, forest foods add variety to diets, improve palatability, and provide essential vitamins, minerals, protein, and calories. The quantities consumed may not be great in comparison to the main food staples, but they often form an essential part of people's diets".

This sounds quaint, and certainly doesn't provide any compelling reason why we should preserve forests rather than simply take a fraction of the profits we gain from forest conversion to give rural people Oscar Meyer variety packs, bottles of MSG, One-a –day-brand vitamin bottles and soy based nutritional supplements. Since the people with political and economic power today are not technically "forest dependent", trying to find a rationale for wholesale preservation of forest products that are not "the staple, bulk items that people eat" becomes a hollow exercise in "othering". If supplementing one's diet with forest food isn't essential for us, why should it be for them, especially since modernism has been all about getting the rest of the world to aspire to be more like us? Byron and Arnold go on to make the usual "forest as insurance policy" argument:

> "Forest foods are most extensively used to help meet dietary shortfalls during particular seasons in the year. Forests are especially important *as a source of food during emergency periods such as floods, famines, droughts and wars* … [italics mine]. Many agricultural communities suffer from seasonal food shortages, which commonly occur at the time of year when stored food supplies have dwindled and harvest of new crops is only just beginning. Forest and farm tree products are also valued during the peak agricultural labor period, when less time is available for cooking and people consume more snack foods."[71]

This argument also doesn't wear well when you consider that other forms of food security and food insurance exist that do not require forests (eg. airdrops of food relief that can be used to strengthen political ties and international obligations). The immediate costs would be more than offset by the value accrued through the mining of the forest rather than its preservation. At best, the idea of forest buffers for famine food or shortfall supplements only encourages the maintenance of forest fragments and tree gardens, not entire forests. And if it is snack foods the people want, corn chips and twinkies are abundantly available the world over. To acquire them, the argument can be made, we need more jobs, not more trees!

No wonder policies to "help" forest-dependent people so rarely protect or defend their forest life-styles and the forests they depend on. Forest factors, when viewed as luxury or snack items, are infinitely substitutable.

[71] N. Byron and M. Arnold (1999),792.

Eventually, however, pressure on rural resources will force a search for "multiple-purpose" alternatives to those single-product yielding crops that have proven to be unsustainable and unsuitable in those tropical regions. Natural capital stocks are diminishing to the point of ecological collapse. Real rural poverty, measured not in terms of abstracts like "money income" and "formal education" but in terms of starvation and loss of subsistence capacity, may happen in Central America, as in Africa now. Moreover, a confident anticipation of a hopeful outcome in the remaining rainforests of the world assumes that there will remain sufficient "banks" or "stocks" of the alternative natural and cultural capital left from which to make withdrawals. As the world's 7th largest economy, California should act now to make sure those stocks remain viable.

Issues of "Access" to that capital will also become problematic, as will "rates of accumulation". In effect, if it takes too long for tree crops to reach maturity a time could come when nobody will be able to afford to wait, no matter how sustainable they are. Hence the natural capital will never be re-accumulated. On our visit to Veracruz in the winter of 2000 A.D., our experience conversing with Senor Lutarco, the Mexican campesino who was involved in the Ramón plantation study cited by Alcorn[72], illustrates this point:

> "10 years ago scientists from other universities came in and got us all excited. We worked with them to establish a plantation according to principles of sustainable management of agroforestry resources. Then, after a few years they left, and with them went the energy, the funding, the resources and the expertise. They had gained enough information to publish their papers and get their degrees, but they failed to transfer to us the management skills to make the project succeed on the local level and what is worse, they never helped us create any robust links to the international market. What could we do but return to business as usual, carving out more areas for corn and cow pasture from what is left of the forest? We know these practices are destructive in the long run, but we also know that they provide immediate returns in the short term, and we are forced to live day to day. If you want to succeed where others failed you must work with our communities for the long term, and use your oratorical and persuasive skills and your contacts in the centers of power to help us and other forest communities achieve the necessary returns on our long term investments.[73]"

5.5 Getting there from here: Politics vs. Biology and Technology

[72] Janis Alcorn, "Ethnobotanical Knowledge Systems – A Resource for meeting rural development Goals." In *The Cultural Dimension of Development: Indigenous Knowledge Systems*. (Warren M. ed. 1995).
[73] Senor Lutarco, campesino in Veracruz Mexico, Personal Communication, December, 1999

The limitations of a Ramón-based agroforestry industry are political and not biological or technological. For one thing, Ramón is so highly productive that the argument that non-timber forest agricultures cannot compete with the yields of grain cereal agriculture falls apart. Studies of Ramón's productivity focus on its survival strategy of "predator saturation"[74] i.e., the tree is a "mast fruiting tree" that survives by overwhelming its predators through sheer abundance. What is unusual about Ramón is that whereas most predator saturation plants produce an abundance of "cheap food" (starch) for those who would eat their seeds, this remarkable tree seems to have no problem putting out an enormous quantity of high-quality protein seeds. Certainly further productivity improvements can be made if policy encouraged investment in crop breeding for tree cereals, just as we have made Green Revolution gains in grains. The plant kingdom does not care which of its families we work with, and there is no inherent reason why food borne on the end of tree branches should be any less abundant than food borne on the ends of grass stalks. If anything the three dimensional nature of trees and forests should give them even greater productive capacity than the relatively two-dimensional structure of short-term crops and grain fields[75].

Can policies that encourage the growth of a single plant species really have such a tremendous effect? In some areas, like El Salvador, the only biodiversity left is that found in the agroforestry coffee plantations. Looking at the history of land-use in El Salvador (Martinez, 2000), once a region of extensive forest and abundant Ramón trees, we see how short-sighted policies have led to the country becoming the most deforested country in Central America and the second most degraded country in all of Latin America.[76] But we also see how a single program can spawn an industry. In the 1850's official Salvadoran policy favored landowners who planted coffee and gave incentives to convert forests to cafetals. These policies came on the heels of a single experiment by a single private landowner, one of the infamous "14 families of El Salvador" who believed coffee could be a major export crop for the country[77]. He took the risk on his plantation and the risk paid off. Within a few years the government was offering many manzanas to anybody in the elite classes who wanted to use land for that purpose.

74 "Predation was negatively correlated with seed density, not positively, as the Janzen-Connell model assumes -- presumably due to predator satiation" Tormod Vaaland Burkey, University of Oslo Center for Development and the Environment (SUM) <http://www.uio.no/~tvburkey/sd/Tropical_tree_species.html>

75 Susanna Hecht, Amazonia: Agriculture and Land Use Research. (Columbia: University of Missouri, 1982)

76 Nestor Martinez, *Anatomia de un Crimen Ambiental.* (Berkeley, Independent Press, 2000)

77 Jeffrey M. Paige. *Coffee and Power: Revolution and the Rise of Democracy in Central America*. (Cambridge: Harvard University Press, 1997).

Similar incentives could be put into place for Ramón-based agroforestry, and the payoffs this round can be shown to extend into multiple dimensions.

In our product review we have already discussed many of the use-values of such plantations from a utilitarian "commodity" point of view. But there are powerful socio-political benefits

Given the lack of capital investment for establishing and employing biointensive high yield farming methods and given the problems in obtaining and sustaining the use of external forms of fertilizer input, destructive land patterns continue with a relentless push into new territory and the destruction of the remaining forest cover; within a few years the former agricultural fields are abandoned to weed and are subject to fires, soil run-off and further degradation. Policy must address this. Since forest cover is the only long-term source of fertilizer in this region and since sufficient fallow periods for reforestation are not achievable under the current land-use regime's population pressures, only a new praxis that can make forests and farming synonymous can readily address the root problems causing poverty in the Petén.

5.6 Using Carbon Offset Trading to Stimulate both Economies

With California promoting the use of the Ramón tree, the potential exists to create systems that not only provide subsistence and agricultural export commodities but solve several international ecological and economic problems as well. Today both the specter of unparalleled biodiversity loss and fears of the greenhouse effect on global weather patterns are motivating industrialized nations to find ways of not only preserving tropical forest cover but increasing total amounts of standing tree plantings. One problem that reforestation efforts face is the reluctance of tropical governments to take vast areas out of realized or potential food production solely for the purposes of protecting endangered species and/or mopping up industrial gases produced in the temperate zone. What is needed to get around this dilemma are large, carbon-fixing forest trees that not only sequester greenhouse gases, generate carbon-offset trading revenues and provide habitat for wildlife, but produce food as efficiently as the grain crops that are responsible for most of the deforestation in the Petén region in the first place[78]. Australia is currently leading efforts to use "Carbon Offset Trading" through agroforestry as a major revenue generator[79]. California could inspire the use of Ramón and other "tree-cereals" to provide similar funds for debt-relief and development.

[78] Sandra Brown, *Forests and Climate Change: Role of Forest Lands as Carbon Sink.* <http://www.fao.org/montes/foda/wforcong/publi/PDF/V1E_T4.PDF>
[79] Australian New Crops Newsletter, no. 11 <http://www.newcrops.uq.edu.au/newslett/ncn11188.htm>

6. Policies for Longevity Planning – using the promise of globalization

Kay Gilbert[80] addresses in her paper the problems facing longevity planning when seeking to establish new "best practice" models that link the economies of producing and consuming regions. If we don't expose our hidden agendas and really define our policy goals, we are likely to fail. The FAVACA model tried to help Florida avoid the draconian anti-immigrant policy measures introduced into California (Prop 187 and 209) by helping communities in immigrant sending regions develop sustainable businesses, like bee-keeping, that would keep folks "down on the farm". But as Alejandro Portes points out in "Globalization from Below: The Rise of Transnational Communities", many immigrants today have adapted their subsistence strategy to one of cyclical cross-border migration patterns. Many people would prefer to move back and forth in a world that offered sustainable opportunities on both sides of the border. A more productive long term policy for California to take is not to help develop sustainable livelihoods in Guatemala merely to "keep them out of California" but to simultaneously create healthy, long-lasting opportunities in both regions, permitting a fluid transfer of ideas, capital, goods labor and technology in both directions.

Anthony Bebbington points out that,

> "The Andes is full of projects that have attempted – and failed – to stop … out-migration… in some cases migration has allowed significant family accumulation… migrants'remittances from the United States allow the rest of their families not only to keep living in communities, but also to combine subsistence agriculture with a remarkable improvement of housing conditions. .. it is therefore informative to look at cases where migration has gone beyond a survival strategy and has become part of an accumulation strategy…. To be able to engage in such livelihoods, families need the skill to do the work required (a human capital issue) and the access to the intermediating agent (industrialists, traders, organizers of production networks) that links rural families to wider markets and chains of production. In particular, it seems that links to higher value markets are important, and more able to withstand the effects of structural adjustment policy.[81]"

6.1 We are What We Eat

Theories of comparative advantage have focussed on factor endowments that give regions incentives to specialize in production, but curiously enough, these factors

[80] Kay Gilbert, Chapter I.
[81] Anthony Bebbington. "Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty"(*World Development,* Volume 27, Issue 12, December 1999), 9.

(climate, labor, capital, transportation, topography) rarely have included cultural and natural capital constructed through indigenous knowledge systems.

Every region has cultural and biological factor endowments that can be capitalized but whereas European producers have been exploiting their endowments with great success for generations (by transplanting only the plants they approve of all over the world and limiting farmers success to the specific use of this hegemonic crop pallette)[82] only recently has the lifestyle arena of indigenous cultures begun to cross over into market arenas that can protect and reinforce their cultural and biological diversity. We certainly cannot argue that Central American cultivars are not part of that pallette, for potatoes, tomatoes, peanuts, pineapples, cocoa and corn itself were discovered by the Europeans in the Americas, and then commodified by them. But with the exception of cocoa, almost none of the dominant agricultural exports on the world market come from indigenous rain-forest crops, and hence the forest is fast disappearing as more land is devoted to only those plants selected for commercialization by the Europeans in the 16th through 19th centuries. Given that Guatemala alone has 7,750 endemic plants found nowhere else in the world, of which at least 1,000 have commercial potential, it is a waste to allow such a reduced botanical palette to dominate the landscape. This dependency on such a few crops and this major failure to capitalize on rather obvious endemic possibilities exposes countries enmeshed in global trade networks to tremendous fluctuations in unstable markets. We believe trade policy should encourage the introduction into the market of as many rainforest species as possible. This will both protect biodiversity and buffer the economy from the stormy seas of fickle demand-driven fortunes.

It is important to understand that the use of Brosimum alicastrum (Ramón) as a foundational agroforestry component is in no way meant to imply that we propose its use as "the solution" to the myriad and complex problems plaguing the forest-ready regions of Central America. The "agricultural revolution" mentality of the high modernist regime which seeks technological fixes to complex and problematic socio-historical processes will no sooner work with Brosimum than it has with the "miracle crops" of other magic bullet approaches. As DeWalt tells us,

> "In just the past two decades, eucalyptus, leucaena, velvet bean, IR-8 rice, tilapia, opaque maize, and a host of other pretenders have not lived up to their advance billing as potential saviors. The current efforts to breed high lysine maize and

[82] Alfred W. Crosby *Ecological Imperialism : The Biological Expansion of Europe, 900-1900 (Studies in Environment and History)*(Cambridge, Cambridge University Press. 1993)

> sorghums and to biotechnologically engineer "super-plants" are part of this same syndrome.[83]"

But it would be foolish to discount the advantages of substituting a perennial, low maintenance, high yielding agroforestry crop like Ramón that serves multiple economic, social and environmental functions for annual crops that have proven their unsuitability in tropical soil regimes. Far from being a magic bullet, we see Ramón as the keystone species in the building of a sustainable anthropogenic forest ecosystem of high economic potency. In as much as corn in the region acts as a support pole for beans, gourds and pumpkins, we see Ramón as acting as a support structure for economically importing cacti and vines such as Pitahaya and vanilla, and a shade tree for sun-sensitive plant species such as Cacao and Coffee and as both shade and fodder for saleable meat bearing animals such as cattle, pigs, agouti, armadillos, iguanas and deer.

This notion of "species packing" in an agrosilvipastoral system does not in any way degrade the economies of scale achieved through productivist plantation methodologies, but permits multi-cropping throughout the year, adding value to the system as a whole by offering complementary outputs[84].

One area that needs immediate policy intervention is subsidizing quality control, inspection and quarantine procedures so that small scale organic producers can get their products to the market fresh. American immigrants to Florida have begun Zapote plantations there, bypassing the cross border trade restrictions. By easing restrictions between countries in the Americas we could pass the same gains on to Central American farmers.

Linkages between Latin American agroforestry commodity producers and consumers in the California economy can be shaped in other ways to direct subsidies to the establishment of sustainable forest farms, again, by following the European example.

> " Abram (1996) notes that the act of going to a farm and buying fresh produce is a defining feature of a holiday in the region of Cantal, for French people and tourists alike… these trends within the lifestyle arena could provide fertile ground for the strengthening of markets for regional Specialty Food Products…[85]"

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[83] Billie R. DeWalt. "*Combining Indigenous and Scientific Knowledge to Improve Agriculture and Natural Resource Management in Latin America*" (In *Resource Based Development Reader*, Winter 2000), 116.

[84] R. Schroeder and K. Suryanata, (1996).

[85] B. Ilbery. and M. Kneafsey. "Niche markets and regional specialty food products in Europe: towards a research agenda". (*Environment and Planning A* Volume 31, 1999), 2214.

We have proposed to the municipal and local governments of Flores and Macanche that our Brosimum-based agrosilvipastoral plantation be the site of a "sustainable development school and research center" designed to attract such "Agrotourists". A venture such as this, marketed through Californian tourist agencies, would provide a community empowering alternative to "ecotourism" which is problematic for local forest communities in so far as the appeal of the experience to the tourist is travelling to an area relatively devoid of people. In agrotourism, by contrast, the point of the adventure is to spend time with agroforestry farmers, observe their methods and have a cultural experience in the forest mediated by and through culture. Such tourist experiences could set up a positive loop of circular and cumulative causation, whereby North Americans return to their home country eager to once again experience the foods they tried on the plantation and share them with their friends. Thus they would dramatically increase demand of the Non-timber forest products and further solidify the linkages. In so far as the commodity chains are already established between Latin American producers and Latin American grocers, retailers, distributors and restaurants in California, strengthening and extending of these chains should lead to higher incomes and greater opportunities in the Californian Latino Community while simultaneously providing real market incentives for preserving regional biodiversity and tropical forest structure and environmental services.

6.2 Population and Deforestation – a Necessary Correlation?

Melissa Leach and James Fairchild, revisiting the historical records for African forests have been turning popular discourse about population on its head. Their study, reported in the April issue of the Economist[86], shows that between 1900 and 1980 as the number of people have grew in their study region so did the number of trees – from 7m-8m hectares to 14.5m hectares! Photographs taken several generations apart confirm this, showing that some regions that were savannas and deserts and had low population density at the turn of the century subsequently supported both large forests and large groups of people. The reason: people actively plant trees. People manage and improve the productivity of land over time. They suppress tree-killing brush fires and enrich the soil through manuring. Trees have high value as constant providers of food, medicine, fodder, shade, fuel and construction materials so wherever people go they inevitably bring trees. It is only since 1980 that industrial agricultural practices have begun reversing this trend. But the authors conclude by praising the agroforestry wisdom of the

[86] Melissa Leach and Robin Mearns and Ian Scoones. "Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management" (*World Development* Vol. 27, No. 2, 1999), 225-247.

African farmers saying, "Peasant farmers may yet be the bastions of African reforestation[87]."

This data is consistent with some of the conclusions presented in Jill Sourial's study that the human population of the Petén in Maya Times was orders of magnitude greater than it is today and yet forest cover persisted. Thus simple Malthusian policies allegedly aiming to preserve biodiversity and forest cover by excluding people turn out to be misguided and can dangerously alienate and further marginalize forest-dependent people without doing anything to achieve any net increase in forest cover. Often forest dependent people who are excluded from their traditional resource base resort to deliberate acts of resource degradation (poaching, arson, sabotage) as a form of rebellion.[88]

This perspective is further supported by Bina Argawal[89] who has shown that most deforestation in India actually occurs in areas of large landholdings occupied by very few people. Other evidence comes from the beleaguered Northeast coastal forests of Brazil, 93% of which have been definitively converted by a few large private land holders to sugar cane, coffee and bananas, leaving the remaining 7% hotly contested by small scale farmers.[90] While World opinion comes down strongly against the "short-sighted destructive practices" of these already downtrodden peasants, it does not address the root causes of the earlier mass deforestation which involve conversion to large monocropping agricultural estates producing exotic commodities for the world market (what Agexpront, the Non-Traditional Agriculture Export Group in Guatemala calls "Traditional Agricultural Exports" – Coffee, Bananans and Sugar, all old world plants brought to the Americas by Spanish conquistadors). Nor does it address how to prevent local farmers from destroying what little of the forest and their indigenous natural capital is left to them, given their lack of economic buffers. With limited or shrinking markets for NTFPs and no money to invest in long-term sustainable agroforestry, they are reduced to (or seduced into) mining the fertility of forest-subsidized areas (areas where generations of forest cover have created a thin cap of fertile soil) for short term gain. Then they have to move on to the next area as that plot becomes degraded to non-functionality.

Conservation measures today focus on gazetting forests and keeping people out[91]. But these people-antagonistic conservation measures are as expensive as they are

[87] The Economist (April 2000), 47.
[88] See James C Scott *Moral Economy of the Peasant : Rebellion and Subsistence in Southeast Asia*. (New Haven:Yale University Press, 1977), Piers Blaikie "Environment and access to resources in Africa" (*Africa* 59 (1): 18-40. 1989) and P. Blaikie and H. Brookfield, eds. *Land degradation and Society*. (London: Methuen, 1987)
[89] Argawal (1992)
[90] The Economist (May 5th, 2000 p. 36)
[91] Blaikie, (1989)

ineffective, for they demand enforcement and spiral into ever more violent land-use confrontations. The best solution we can imagine would be something that allowed people to live and work within the forests, maintained forest ecosystem services and enhanced biodiversity within ecosystems all while providing competitive returns in terms of the same classes of output currently driving the current "incompatibility" between human beings and forests.

If such a solution did not already exist we would be obliged to invent one.

But as we have learned from our Indigenous Maya partners in Proyecto Iximché, and from the many transnational migrants we meet everyday who have come from Central America to California to share their culture, their labor and their expertise with us, such solutions do indeed exist, and all we need to do is design policies that ensure their equal consideration and competitiveness in the globalized commodity chain.

6.3 Summary and Recommendations

This paper set out to demonstrate that short-sighted destructive land and marketing practices have led to continual impoverishment of indigenous populations and an ecological crisis for everybody in the great forests of the world. Our project suggests the solution of mitigating the destructive process by a series of constructive polices we refer to by the acronym CALMILT F.T., or CALMILT FREE TRADE. To wit:

1. CA FOR CROP ALTERNATIVE.
*Providing a suitable, sustainable, high-value agroforestry crop alternative (Iximché -- the "Mayan breadnut", Brosimum alicastrum) to the inappropriae mono-cultural grass-crop planting now in use.

2. L FOR LINKAGES 1

*Following Florida's successful FAVACA model to link the California economy to rural development projects in Central America that are in need of financial and technical support.

3 MI FOR MARKET INCENTIVES

*Providing strong market incentives through trade with California for the preservation of extant forest areas which contain on average 20% Iximché and other trees of potential socio-economic importance.

4 L FOR LINKAGES 11

*Creating robust linkages with California ethnic markets, upscale niche markets, and promotional venues that can act as outlets for neo-traditional agricultural and non-timber forest product exporters.

5. T FOR TRAINING

*Training immigrant campesino families in pluricultural bio-intensive forest farming techniques that produce high yields on small, permanent plots.

6. F.T. FOR FREE TRADE

*Fostering policies that expedite and facilitate the free trade of these products and permit easy permeability for experts on both sides of the border to share and hybridize modern and indigenous knowledge systems and technologies.

These six specific policies can be further expedited by six general policy recommendations signified on our bulletin and peg boards by another acronym: VPS-PEGS.

These general policy recommendation pegs are:

1. V FOR VALUE

*Engage in valuation exercises that can revive the comparative value of natural stocks of capital.[92]

2. P FOR PLANT

*Establish Ramón plantations in suitable set-aside areas in the U.S. (California, Florida, Texas) using fallow rents (The USDA pays rents to farmers who set aside acreage -- currently some 36.4 million acres of land). The land would still function as a set-aside for economic purposes, but would be ecologically enhanced, mitigate greenhouse gases and provide future revenue to farmers. The perception of future competition would

[92] see Paul Hawken, Amory Loves, and L. Hunter Lovins, *Natural Capitalism: Creating the Next Industrial Revolution* (Rocky Mountain Institute, 1999).

stimulate Guatemala's government to capitalize immediately on its existing stock of mature producing Ramón trees.

3. S FOR SUBSIDIZE

*Shift agricultural subsidies ($26.2 billion in 1994 in the U.S. alone) from unsustainable annual monocropping regimes to the establishment of permaculture (permanent agriculture) agroforestry regimes. This costs the overall economy nothing as it is merely a transfer of already earmarked funds. [Note: The strongest criticism against agroforestry is, like most renewable energy and long-term sustainable yield solutions, the specter of prohibitively high start-up costs. Trees take time to grow and the more complex the system, the more complex the development of infrastructure. In uncertain markets, few people are willing to assume the risk of establishing a plantation of trees when they can derive short-term profits from a mono-crop field more quickly. Indeed, the main theme of this paper is the Time Fight between sort-term and long-term solutions. Hence the universality of shifting agriculture systems that mine an area to exhaustion and then abandon it for the subsidized fertility of another forest area. With the same subsidies now in place for soil-exhuastive agriculture transferred to soil-protective agroforestry and stable land tenure arrangements, farmers could endure the necessary waiting period.

4. P FOR PRIORATIZE

*Give priority and incentives to equity oriented North/South partnerships such as Proyecto Iximché-- partnerships that bring neo-traditional non-timber forest products back into commercial production over other land uses.

5. EG FOR "ENGENDER GENDER"

*"Engender Gender" in our decision making processes, so that policy concerning basic food production and use of resources affecting households is addressed by those members of society historically and culturally most concerned with these issues. The general exclusion of "non-professional" women from policy has been demonstrated to be one of the drivers of resource degradation and poverty.[93]

6. S FOR SHARE

*Include the indigenous knowledge systems of forest-dependent people, women and men, in everyday discourse about global commodity chains, particularly concerning forest-derived substitutes for the drivers of deforestation.

[93] Gillian Hart, "Engendering Everyday Resistance: Gender, Patronage and Production Politics in Rural Malaysia". (*The Journal of Peasant Studies. Vol. 19, No. 1.* October 1991), 93-121

If policies such as these are implemented, and tree-based agroforestry regimes once again become the mainstay of tropical agricultural production we feel, as did the economist E.F. Schumacher, that the rest of the problems plaguing development can be handled in a more relaxed manner.

Schumacher wrote:

> "There are trees for almost all human needs. One of the greatest teachers of India was the Buddha, who included in his teaching the obligation of every good Buddhist that he should plant and see to the establishment of one tree at least every five years. As long as this was observed, the whole large area of India was covered with trees, free of dust, with plenty of water, plenty of shade, plenty of food and materials. Just imagine you could establish an ideology which would make it obligatory for every able-bodied person… man, woman, and child, to do that little thing – to plant and see to the establishment of one tree a year, five years running… Anyone can work it out on the back of an envelope that the economic value of such an enterprise, intelligently conducted, would be greater than anything that has ever been promised by any… five year plans. It could be done without a penny of foreign aid; there is no problem of savings and investment. It would produce foodstuffs, fibres, building material, shade, water, almost anything that man really needs.[94]"

Our proposal suggests a mechanism through which such an ideology could begin to be established. The policies above are mere ideological seedlings, but eventually they could grow to become mighty forests of economic growth and opportunity. The urgency of biodiversity loss and soil degradation and the concomitant health and poverty problems associated with deforestation must be addressed immediately through proper policy. The rest is up to individual initiative.

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[94]E.F. Schumacher, *Small is Beautiful: Economics as if People Mattered, 25 years later, with commentaries*. (Vancouver: Hartley and Marks, 1973, 1999), 84.

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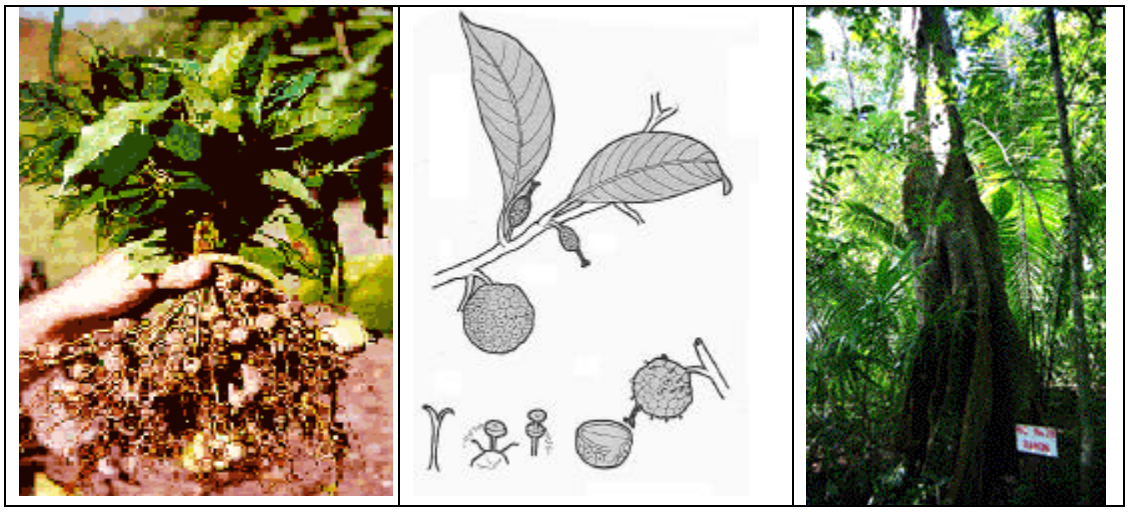
Species with Edible "Nuts" Listed by Families
<www.fao.org/docrep/v8929/v8929e08.htm>

APPENDICES:



Photos: Ramon Seedlings, Botanical drawing of Ramon, Mature Ramon Tree

Source: Angel Orozco, NAID Center

Appendix I: Nutritional Analyses of Ramón

Table 1: Nutritional Content of Ramón Tree Parts (Source: Souza Novela, N. (1950)/ Michoacan

	Dry Seed	Fruit	Leaves
Calories/100%	**386.08**	**56.0**	**127.0**
Moisture Content %	**6.5**	**84**	**62.0**
Ash %	**4.4**	**0.9**	**3.0**
Ether Extract %	**1.59**	**0.48**	**1.2**
Crude Protein %	**13.4**	**2.5**	**3.2**
Crude Fiber %	**6.17**	**1.22**	**8.9**
Free Nitrogen Extract %	**67.94**	**10.90**	**21.7**
Calcium (mg)	**211**	**45**	**530**
Phosphorous (mg)	**142**	**36**	**68**
Iron (mg)	**4.57**	**0.82**	**5.4**
Carotene (mg Vitamin A)	**0.17**	**0.64**	**0.410**
Thiamine (mg Vitamin B)	**0.03**	**0.05**	**0.24**
Riboflavin (mg Vitamin B2)	**0.14**	**1.52**	**0.51**
Niacin (mg Vitamin B)	**2.11**	**0.78**	**1.4**
Ascorbic Acid (mg Vitamin C)	**91.0**	**28.4**	**55**
Dry Base Protein	**14.33**	**15.63**	**8.42**

Product	Protein Content
Dry Egg	**47**
Powdered Milk	**28**
Wheat	**14**
Brosimum alicastrum	**13**
Whole Egg	**12.5**
Sorghum	**10**
Corn	**10**
Whole Milk	**4**

	Leucine (IAA, BCAA)	Valine (IAA, BCAA)	Isoleucine (IAA, BCAA)	Phenylalanine (IAA) + Tyrosine (CDAA)	Lysine (IAA)	Threonine (IAA)	Tryptophan (IAA)	Methionine (IAA) + Cystine (CDAA)
Brosimum	**10.1**	**9.8**	**3.3**	**7**	**2.3**	**2.3**	**1.5**	**10.5**
Egg	**8.6**	**7.5**	**6.5**	**9.7**	**6.2**	**5.1**	**1.2**	**5.6**
Milk	**9.8**	**7**	**6**	**10**	**8**	**5**	**1**	**2.8**
Sorghum	**16**	**6**	**5.6**	**8**	**2.4**	**3**	**0.7**	**3**
Corn	**13**	**5.2**	**5**	**10.7**	**2.5**	**3.8**	**0.5**	**3**
Wheat	**6.7**	**5**	**4.6**	**9**	**2.5**	**3**	**0.7**	**4**

Inferior products are already receiving attention in the world market. For example, The Global Development Strategy for Cassava, initiatied by IFAD is seeking to give cassava flour a boost in tropical planting.

At an international cassava conference they stated:

“Global cassava production reached over 160 millions tonnes in 1999, and FAO forecasts that production will rise to nearly 210 million tonnes by 2005”

But they admit:

“ Although cassava roots are an excellent source of calories, they lack protein and vitamins. Cassava leaves, however, are rich in protein and vitamins A and B and can be an important part of a well-balanced, nutritious diet.”

Given the nutritional advantages of Ramón, we suggest that monies now devoted to increasing cassava production should be shifted to the commercialization of Ramón. Subsidizing the initial plantings of Ramón should yield tremendous benefits. "Proyecto Iximché", a Guatemala-California partnership for sustainable development based on neo-traditional agricultural exports has several products lined up from the Ramón tree alone:

Appendix II: The Ramón Product Line:

Ramón Products ready for commercialization:

Leaves: Best Possible markets: 1. Cattle and Sheep Forage 2. Feedstock for Domestic and Captive Exotic Animals	• Young leaves boiled and eaten like spinach or eaten raw. • Mature leaves, along with twigs, continuously trimmed off and fed to cows, horses, mules and pigs. Studies in Venezuela and Mexico have shown that cattle not only prefer Ramón leaves to pasture grasses, but that cows fed on these protein rich, lactogenic leaves actually are healthier and produce 1 to 2 liters more milk per day than cows fed on grass. Tree, when trimmed, is stimulated to produce even more leaves. • One hectare of Ramón trees produces as much cow forage as 2 hectares of pasture (hence the name "Ramón" which is Spanish for "browse"). So much for the rainforest-beef problem.
Seeds: Best possible markets: Cooked and Frozen Vegetable Protein Powder, Nutritional Supplement, Alternative Flour Pig feed Roasted as coffee alternative	• Large seeds contain between 11 and 14 % complete protein and high levels of vitamin C, vitamin A, iron, riboflavin and niacin and calcium, making them more nutritious than corn, wheat and rice, and competitive with soy bean. • From the seeds the Maya people grind a tasty flour that they make into breads, cakes, tortillas, tamales and virtually anything else for which we currently use grain crops – hence the term "breadnut". • The seeds boiled and eaten like little potatoes, or eaten raw. Soldiers lost in the forests of Central America reported living well on nothing but wild Ramón nuts for 15 days. So much for the need to clear forest to plant crops!
Fruits: Best possible markets: 1. Jams and Jellies 2. Alcoholic beverages	• The fruit pulp, while thin, is sweet and tasty and is made into jams and jellies. • Mashed and boiled its fructose is extracted, making a fine, healthy sweetener, eliminating the need to destroy rainforest to plant sugar cane! • Fermented to produce alcoholic beverages and industrial spirits
Sap: Best possible market:	• The sweet white sap can be continuously harvested and is drunk by Amerindians as a delicious lactose-free milk substitute.

1. Non-dairy creamer, Milk substitute for lactose-intolerant people 2. Pharmaceutical companies	• As a non-dairy creamer it is indistinguishable from Carnation condensed milk. • It is also said to have medicinal properties – curing upset stomach and indigestion and helping lactating mothers produce their own milk.
Timber: Best possible market: Construction, Fine Furniture	• The wood is beautiful, strong and easily workable and is used the world over for fine furniture and for construction. Thus when the giant trees get to the end of their useful life span and cease to fruit they canprovide tremendous income for the farmer as a sustainable wood crop.

Details of Product Line

The Leaves

Forage:

Ramón leaves have already proven their utility as cow, horse, mule, sheep and goat forage. MAGA's studies show that cows fed on Ramón leaves produce 1 to 2 liters more milk per day than cows fed on pasture. Pardo-Tejeda reports that one hectare of Ramón trees can produce as much forage as two hectares of pasture grass, meaning that Ramón as a feedstock for producing beef and other meats, dairy products and hides is already a more efficient use of the land than deforestation. The limitation with Ramón is the time spent harvesting the leaves as opposed to simply letting cows roam on pasture, but this ignores the labor that is spent clearing forest in the first place to create pasture. Furthermore, this limitation can be gotten around by pruning specific Ramón trees so that they are low and bushy enough for cows to browse directly on them themselves. Such pruning requires a knowledge of technique and is something that could be provided through technical assistance programs.

Zoo Browse:

There is tremendous profit potential in marketing the leaves, twigs and branches as hoofstock feed, not only in the domestic animal market but in the Zoo market. Elephants, rhinoceros, antelopes, mountain goats and a host of other herbivorous mammals depend on browse brought in from farms. Unfortunately that browse is often nutritionally deficient, particularly for endangered species whose health is a constant concern. The Zoo director at the Peténcito Zoo in Guatemala uses Ramón leaves with all of his herbivores and finds their health to be excellent. The San Diego Zoo and Los Angeles Zoo horticulture departments are investigating the potential for Ramón to play a key role in worldwide Zoo animal feeding and will be presenting some findings at the international Association of Zoological Horticulturalists at the New York Zoological

Society meeting this October. In this way, these California Zoos hope to be leaders in creating demand for Ramón products that will foster sustainable community development in rainforest regions. This serves both the zoos immediate feeding needs and its larger agenda as promoter of strategies to save wildlife and biodiversity in the animal's home regions.

Human Nutrition: Supplements, Teas and Infusions

Ramón leaves are perfectly edible and digestible by human beings, particularly when they are young. They closely resemble ornamental fig leaves in consistency in their early stages and can be ground into a nutritional powder to be added to nutritional supplements, or eaten raw. They have very little flavor and hence do well when added to other mixes (such as protein powder mixes). Both young and mature leaves can be fried in oil and added as crispy bits to eggs, salads or breads to increase the nutritional content. They can also be prepared as candied leaves according to the ancient Egyptian and medieval European practice described by Lady Ysabet an Gwydyon [95]. In general though the market for leaves in human consumption is expected to be small. A mild green tea can be made from the leaves which is not unpleasant at all and has some potential in the herbal tea market – we see it's primary use as an additive in a blend of herbal tea ingredients.

The Seeds

Prepared as a vegetable

The diameter of the seed is aproximately 1.2 centimeters, covered with a paper-like test that has a yellow-green sheen to it. The inside of the seed is also yellow green. In El Salvador the seeds of "Ujushte" (as Ramón is called) are eaten as a table vegetable with lemon and salt. Preparation is simple – the 1 cm spherical Ramón seed is simply popped out of the fruit by squeezing lightly with thumb and forefinger into a pot of boiling water. The Ramón seeds once boiled have the same consistency as small potatoes and resemble spherical lima beans. With a pinch of salt and lemon they taste identical to potatoes but are far more nutritious. To be served this way the Ramón seeds need to be fresh, refrigerated or frozen; once they dry they become hard and oxidize to a black color. They are still suitable for grinding into flour at this stage. For the vegetable market we

[95] Lady Gwydyon says "The candying of edible flowers and leaves is an ancient art, dating as far back as ancient Egypt, where the remains of honeyed date-flowers have been found in sealed burial sites. In the past, refined sugar was unknown, so more natural sweeteners were used. <http://www.mtsu.edu/~kgregg/dmir/08/0817.html>

envision collecting them fresh and packing them like any other frozen and refrigerated produce and then shipping them to grocery stores.

Seeds prepared as a masa for tortillas

Ramón seeds boiled as described above can also then be ground or mashed into a "masa" from which tortillas are made using the same procedure as is used for wet corn masa – the mash is simply patted into form and heated on a hot griddle.

The tortillas have the same green color as the seed. We feel this has marketing possibilities that will be discussed below.

Ramón flour

When dried the seeds are ground into a flour that can be used to make breads, tamales, cookies, cakes, pancakes and all other manners of baked goods. This flour is also added to other flours (wheat, corn, rice, oat, plantain) to improve their nutritional content and make them last longer.

Because the Ramón flour is nutritionally superior to all other kinds of flour except for soy flour (with which it compares favorably) , the use of this product in protein bars, protein powders and health products and nutritional supplements is anticipated to become a significant revenue generator for Central American economies. We see Ramón having several advantages over Soy, not the least of which is that, unlike Soy (which is responsible for more deforestation in the Amazon today than any other commercial plant)[96] Ramón enhances rather than degrades the forest. Furthermore, Ramón is easier to harvest than soy, since the seeds simply fall onto collection tarps during harvest season, where as soy requires laborers or machines to harvest. Removal of the fruit rind is simple and can be easily mechanized without damaging the seed, but for some flour purposes even this step can be unnecessary since the entire fruit is edible. The easiest way to prepare the flour is simply to dry and grind the whole fruit.

Because of its complete amino acid profile and high levels of vitamin A, vitamin C, B vitamins, calcium, phosphorous and iron, we see Ramón flour becoming the nutritional product of choice for the health conscious people and expect to capture the entire vegetarian and vegan market which is looking for soy alternatives now that soy has been implicated in deforestation and loss of wildlife.

[96] Susanna Hecht, Lectures on Deforestation, UCLA, 2000

The author and his colleagues have eaten a delicious Ramón cake, sweetened with stingless-bee honey (another product that can be integrated in the plantation since native Central American stingless bees not only pollinate Ramón flowers, but often make their nests in Ramón trees). This traditional Maya dessert was presented as a gift upon his departure and he was able to transport it to California along with Café Iximché to serve at a party. Both products were very well received. The cake was a beautiful natural green color, prompting some of the guests who ate it to comment that it could be marketing as "The Worlds First Truly 'Green Food' – a food that is in concert with "Green party" enviro-political ideals. It is felt that the natural green color of Ramón can thus be used as an asset, adding value to the products in a marketing campaign targeted to "Green Consumers" and other health and ecology conscious populations.

Animal feed

The nutrtional value of Ramón seeds is not lost on animals. Hogs are particularly fond of Ramón seeds[97], as are horses and cows[98], so excess seeds rejected for human consumption are easily shuttled to animals. As with the leaves, a robust market in seeds for animal feed, both domestic and exotic, is expected. Again, the Los Angeles Zoo is working with the Peténcito zoo on the idea of feeding the seeds not only to the wildlife that depend on them in the wild (Agoutis, Deer, Peccaries, Howler and Spider monkeys, toucans, parrots) but indeed any and all animals that demand a high protein nutritional feed.

Alternative caffeine-free coffee

Traditionally Ramón seeds are roasted and ground just like coffee beans to make a hot beverage. Remarkably this "coffee" tastes quite like the real thing but has absolutely no caffeine. Some coffee drinkers describe it as having a superior taste to decaf, some can't tell he difference and others have described it as being slightly mocha in flavor. We have yet to encounter anybody who didn't like it. We expect to position "Café Iximché" in the market as a substitute for Postum and other grain-based alternative coffees. Don Pedro already has a tour operator in El Remate selling bags of this coffee to tourists with some success. What is needed are funds for an aggressive marketing campaign and linkage with distributors in the world market. We feel this is something that California businesses can act on immediately.

[97] Personal communication from former forester Ruben Silva , May29, 2000, now living in Los Angeles and working as a mechanic: "We used to feed Ramon seeds to our hogs to make them fat. I remember my mother saying they were the best food for the pigs".

[98] Personal communication from former farmer Ernesto Caseras, May 6, 2000, now living in Los Angeles and working as a cab driver: "I used to feed Ramon seeds to my horses. We all did. They loved it!"

There are certainly precedents for establishing such a naturally caffeine free coffee substitute. For example, The Post family empire (Post Cereals) began in 1895, when "Experimenting in a horse barn in Battle Creek, Michigan with mixtures of molasses, bran and wheat, Charles William Post invented a coffee substitute, which he humbly named after himself: 'Postum.' Americans had 'Coffee-free Coffee.' It tasted like the real thing, but with none of the caffeine risks. "With that first batch of POSTUM®, a cereal beverage… he entered the brand new retail cereal industry" Sales zoomed, sparking Post to introduce a second brand of coffee substitute. Two years later he introduced Grape Nuts Cereal, made from the same ingredients. C. W. Post used marketing techniques that are now considered industry standards, but which were innovative for their time. These included extensive advertising, coupons, free samples, product demonstrations, plant tours and recipe booklets. The Postum Cereal Company followed the formula for success which he had established: selling high-quality, nutritious cereal products through marketing and advertising techniques that appealed to the common man and woman."[99]

Like Postum, Café Iximché is "a grain-based hot beverage that is 100% natural and naturally caffeine-free. With a milder taste than coffee, like Postum "it's a great alternative to decaf." Unlike Postum, our product has the advantage of helping to preserve the rainforest, is 100% organic, can be produced with minimal water, and virtually no fertilizer or pesticides (thus lowering factor inputs and costs). Even better from a marketing standpoint is the value added that comes from Café Iximché being a traditional Maya beverage which can be used as a marketing theme.

Tree sap

A non-dairy creamer/lactose free milk substitute

Ramón trees can be tapped during the rainy season for an abundant latex which is digestible. While not as abundant as the sap of its cousin, the "Cow tree", Brosimum utile, the sap of Brosimum alicastrum has also been historically drunk by Amerindians as a nutrifying beverage. It can be bitter straight from the tree during the dry season but is quite palatable during other times of the year, when it has been described as "slightly sweet." If sweeteners are added it is even better. It acts as a non-dairy milk substitute for lactose intolerant people and makes a reliable non-dairy creamer for the coffee crowd. We see marketing small packets of the sap as a creamer to go along with the Café Iximché for a totally healhty, organic, rainforest protecting and community empowering beverage. We expect it to be quite popular in health-conscious, socially activist

[99]< http://www.kraftfoods.com/postcereals/heritage.html>

communities in Calfornia. We expect California's leadership to stimulate demand elsewhere, particularly in Europe.

Alicastrum™ and Galactodendron™ – galactogen for nursing mothers

The sap is also said to have medicinal properties – it is under investigation by Venezuelan pharmaceutical companies for its galactogenic properties and is said to help nursing mothers lactate. It has also been described as helping with digestive problems. The sap can be tapped the same way Chicle is tapped, by making superficial cuts in the tree bark with a machete, or as maple syrup is tapped.

The Fruit

Eaten Raw

The Fruit of the Ramón tree, although containing very little flesh, ripens into quite a sweet tasting food. The fruits can be yellow-green or orange in color. These "berries" are from 2 to 2.5 centimeters in diameter, with a fleshy pericarp; the skin is covered by numerous white scales. The pulp of the fruit is edible, is colored like the skin and has a sweet flavor.[100] The fruits usually mature from March to May, depending on the region. We have observed them as late as September in Tikal.

One eats the entire fruit, leathery skin and pulp; usually by sucking them right off the large seed in the center. The entire fruit, seed and all, can also be eaten right off the tree; in this case the raw seed feels crunchy like a raw peanut and can only be described as tasting "green". It has been reported that soldiers lost in the forest were able to live on nothing but raw Ramón fruit and seeds for 15 days.

In Jams and Jellies and as a Sweetener

The fruit is high in fructose and traditionally the skin and pulp are collected in a vat and made into jams and jellies. Marketed as "jungle jam" or "jungle jelly" it should place well in the children's market alongside popular kids conserves like "Smuckers". The fruit can also be boiled and fructose sugar extracted, making Ramón a good alternative to the soil destructive sugar cane plantations. We see this product positioned in liquid form as an alternative to corn syrup and in crystalline form as a healthy fructose sweetener.

[100] Guzman, 1986, 20.

As a fermentable product for alcoholic beverages and industrial spirits

The Maya also fermented the fruit sugars to make alcoholic beverages. Under the name "Jungle Juice" or "Mighty Mayan Breadnut Beer" we see these spirits either standing alone or being mixed in with other beverages, particularly positioning well in the fruit-beer market and becoming a favorite in micro-breweries. All of these uses await product development and are expected to provide yet another possible income stream for a Ramón plantation owner.

The Wood

Timber Products

The timber from a Ramón tree – an easily worked semi-hardwood with a lustrous blonde finish -- is much prized for the construction of furniture, especially in Europe. Ramón, usually under the name "Capomo" is used in Building construction, Cabinetmaking, Chairs, Construction, Flooring, Furniture, Handles, Rustic furniture, Shafts/Handles, Tables, and Veneer. Turning properties are reported to be good. The wood has good screwing characteristics, and it can be polished and finished very well with no filling. The timber is reported to be often quartered into veneers to display its cross-ripple figure.[101] The Guatemalan Government reports that

> "The tone of the wood is a brilliant red in the center section of the trunk, and has a yellow stem, with a fine grain that is somewhat variable; the texture is fine and compact, heavy, resistent and durable At the present time people are accustomed to using the wood in construction. Nonetheless, because of its qualities, it is considered to hold great promise for use in the luxury furniture industry as well as interior decoration."[102]

The music industry has found use for the wood in the manufacture of fine guitars and Ramón holds up well in construction. In a interview with Ruben Silva, a former Guatemalan forester who moved to South Central L.A. after all the big primary timber (fine hardwoods like Mahogany, Cedar, Ceiba, Caoba) was logged out of his country and his industry collapsed, Ramón became a good "secondary" timber source. Unfortunately it has also suffered extensively from over-extraction. One of the ironies of the loggers switching from primary to secondary woods is that they often come into direct conflict with indigenous groups who depend on these formerly un-exploited trees for other uses, particularly food. However, if managed properly Ramón timber could easily be

[101] <http://www.woodweb.com/~treetalk/Capomo/wowhome.html>
[102] Guzman, (1986).

harvested on a sustainable yield basis once the trees have exhausted their breadnut productivity. A successful model for such a food-to-timber industry can be found on the Indonesian island of Sulawesi where retired coconut trees are cut down and replaced by new seedlings, the timber turned into beautiful dark-grained hardwood boards and laminates and shipped abroad for the custom furniture and housing markets. If such a practice were applied to Central America, a sunk investment in a Ramón plantation would never be lost, for no matter what happens to the markets for the seed product line, the leaf product line, the fruit product line or the sap product line, the timber can always be sold abroad or used in local construction. Every Ramón tree planted represents a future investment with a definite return. Trees that mature beyond their productive life are taken out of the plantation and replaced by young trees and the timber recoups the cost of replanting with a huge profit.

Carbon Trading

In December of 1997, President Clinton's negotiators traveled to Kyoto, Japan where both industrialized and developing nations signed a treaty binding them to a detailed plan of action that limits the emissions of Carbon Dioxide. This protocol included agreement on trading in emission credits and the use of planted forests

Australia has jumped ahead of the curve in responding to the suggestions hammered out through the Kyoto Protocol on Global Warming. They are hoping to become world leaders in using afforestation and reforestation to mitigate greenhouse gases and boost their economy through "carbon credit trading" or "Certified Tradeable Offsets" (CTO's). California could use its links to Central America to do the same thing but in a transnational way, promoting Ramón-based agroforests in trade for emissions rights in California. Benefits could accrue to both sides.

According the Australian Agronomy reports:

> "Forests have traditionally been grown for timber, pulpwood and other wood products, but they also provide a range of environmental benefits such as soil protection and improved biodiversity, if compared with improved pasture. A market is now developing for another environmental benefit. This benefit is the capture of carbon dioxide. Forest growers could potentially receive income from their trees capturing such greenhouse gases, but this is dependent on a market developing for 'carbon credits'.
>
> Australian State Forests is at the forefront in trying to develop these markets to benefit growers and the forest industry. Carbon Credits, or Certified Tradeable Offsets (CTO's), are recognized reductions or absorptions of carbon.

> As governments work to reduce greenhouse gas emissions and to expand the use of greenhouse sinks such as planted forests, such actions can be registered as credits. Credits need to be certified and recognized by a certificate owned by the individual or company who has created the greenhouse gas saving Over time, companies or individuals who create more certificates than they need can sell these to others who need to reduce their greenhouse gas emissions."
>
> "Planted forests are profitable. When combined with the new role of carbon capture (sequestration), planted forests can be an economically attractive way to address
> the reduction of greenhouse gas emissions. Planting 100,000 hectares of new forest can remove one million tones of carbon per year from the atmosphere. Trading emissions will be international. In the case of planted forests, Australia could be a world leader. We will have the opportunity to establish one million hectares or more of new plantation in coming years. It is likely companies and governments in Europe, Japan and North America will look to Australia as a place where carbon credits can be developed for international use. Emissions trading could be a totally new export for Australia. Carbon credits will commence in 2008. Australia's carbon emitters such as power generators should not wait for international emission trading to commence."[103]

Because Ramón is a slow growing hardwood that reaches 120 feet tall with a diameter at breast height of up to 10 feet, it acts as a superb carbon sink, helping to mitigate the effects of greenhouse gases by sequestering CO2. On Don Pedros plantation we expect to get reforestation monies from Industrial nations who must follow the Kyoto Protocol and offset their greenhouse gas production by funding tree planting initiatives.

Most reforestation policies are resisted by tropical governments because the forests are said to compete with food production. Because Ramón forests serve several functions simultaneously – providing subsistence food for people and animals, providing surplus food stuffs for export and creating a multi-layered rainforest canopy that fixes carbon and enhances biodiversity we see it as the species of choice for helping poor countries capture the revenue streams from Carbon Trading without taking land out of economic production.

As an Ornamental Plant

The Ramón tree has a long history of usage in Mexico as an ornamental and shade tree due to its spreading canopy (said to be "like a giant green pyramid") and interesting foliage. Ramón starts out with waxy yellow-green leaves and matures into a tree with full branches of 5-7 cm leathery dark green leaves. It is in the Moraceae,

[103] <http://www.newcrops.uq.edu.au/newslett/ncn11188.htm>

or fig family, and when young it can resemble the ornamental Ficus trees ubiquitous throughout L.A..

Zone Ten nursery in Miami Florida (18900 SW 186 Street, southern Miami-Dade County, south and west of Miami proper and north of Homestead, phone number 305 255 9825) sells them in gallon pots for $ 20.00. Their trees are approximately 4 years old, are about 3 feet tall and were planted from seed. One nursery in Holland sells Ramón's cousin, the Cow Tree, Brosimum galactodendron as an ornamental indoor plant. They advertise a large number of 6-8 foot tall potted specimens on their website but no pricing information is available[104].

The sale of agroforestry plants is a huge international business.

Animal Nutrition

Just as there is no dearth of agroforestry alternatives to grass crops for human nutrition, there is an equal abundance of tree-derived foods for animal nutrition. Ramon is principal among these.

Ramón has been listed by the FAO as one of the preferred feeds in Jamaica and Cuba:

"Breadnut tree, Ramón
Evergreen tree up to 30 m high, native to tropical America. Used in some countries as a fodder tree during the dry season. The leaves, seeds and entire fruits are eaten by animals. One tree can produce about 40 kg of seeds, which are relished by pigs."[105]

"The rate of liveweight gain was significantly faster when rice polishings or Ramón forage were given separately as supplements to the sisal pulp/urea, when alone, barely supported maintenance (99 g/d). The growth rate when rice polishings or Ramón forage were given together was significantly higher than when either one was fed separately (460 vs 271 and 282 g/d; SEx ±65).[106]

Ramón added to cow rice polishings as cow feed:

"The concentration of rumen NH and the quantity of OM apparently fermented in the forestomachs were both higher when Brosimum forage was given… When both supplements were given together, there appeared to be an increase in the flow of N to the

[104] (Bennebroekerweg 8-28 1435 CK Rijsenhout Holland http://www.maarse.com/page41.htm)
[105] BARNETT, W.L. Misc. Circ., Dep. Sci. Agric., Jamaica, No. 2:16., CALVINO, M. 1952. Plantas forrajeras tropicales y subtropicales. Mexico, B. Trucco.
http://www.fao.org/ag/aga/agap/frg/tfeed8/Data/365.HTM
[106] http://www.fao.org/ag/aga/agap/frg/tap41/4_1_13.pdf

duodenum above that which was expected from relationships between N intake and duodenal flow of N obtained for either supplement individually."[107]

Biodiversity Enhancement:

Planting of Ramón can play a tremendous role in the preservation of Biodiversity. Just as shade grown coffee in cafetals in El Salavador's Finca was noted to provide habitat for a huge wealth of animals and plants[108], A Ramónal can be shown to have even greater benefits.

Marpesia chiron, the rare Banded Daggerwing Butterfly, is said to favor Ramón groves during its migration. Ramón is also a favorite tree for howler monkeys, spider monkeys, toucans, oropendulas, agoutis, many species of deer, and peccaries. In fact Ramón is one of those keystone tree species that acts as a kind of "foddering hole" for wildlife.

Other Species of Brosimum of potential commercial importance:

"The cow tree (palo de vaca to the natives) has been cultivated and used by indigenous peoples throughout Central and South America for thousands of years. The latex sap it produces in great quantity can be used in a variety of applications, even as a substitute for milk (hence the name). On Isla del Cano in Costa Rica a large grove was planted many hundreds of years ago by Indians who made periodic crossings from the mainland to perform religious ceremonies on this "holy" island. The huge buttressing roots spreading out from the base of the tree are a bright reddish-orange, but frequently overgrown with mosses and vines. They help support the heavy canopy of the tall tree, which is exposed to occasional heavy winds up in the emergent layer of the canopy. These trees are entire ecosystems in their own right, with massive batteries of epiphytic orchids, vines, mosses, bromeliads, growing in the branches, supporting thousands of birds, amphibians, and insects."[109]

Appendix III: Economic and Environmental Advantages of Tree Cereals in Comparison with Corn and Pasture:

Grass species (Common name)	Scientific name	Regional Agroforestry replacement
Corn	Zea maize	Ramon
Rice	Oryza sativa	Durian
Wheat	Triticum aestivum	Chestnut, Acorn

107 A Priego, R Elliott and T R Preston STUDIES ON THE DIGESTION IN THE FORESTOMACHS OF CATTLE OF A DIET BASED ON SISAL PULP: II SUPPLEMENTATION WITH RAMON (BROSIMUM ALICASTRUM) FORAGE AND RICE POLISHINGS 1

[2] Escuela de Medicina Veterinaria y Zootecnia, Universidad de Yucatan, Apartado 11 6D, Merida, Yucatan, Mexico. Trop Anim Prod 1979 4:3 287 <http://www.fao.org/ag/aga/agap/frg/tap43/4_3_12.pdf>

[108] Martinez (2000), 3.

[109] <http://www.hooked.net/~ecotrip/Photo_Pages/%2ACowtree.html>

Pasture grass	Festuca arundinaceae	Carob
Millet	Panicum miliaceum	African Breadnut
Sorghum	Sorghum vulgare	Breadfruit

Benefits and Disadvantages

	Economic Benefits	Environmental Benefits	Disadvantages
Ramón	• Inexpensive and Organic • Multiple Uses • Produces 7- 10 times as much food per hectare in the tropics as corn, requires hardly any labor and no pesticides, demands very little to no irrigation and no fallow period, keeps the soil stable and fertile, and shades the ground. • Trunk acts as support for vanilla and pitahaya • Canopy acts as beneficial shade for coffee, cocoa and other understory crops	• The Ramón tree prevents erosion and regulates climate, preventing the greenhouse effect by fixing carbon. It is the preferred food of most endangered species (monkeys and birds love the fruit, ground mammals love the leaves and seeds) and produces abundantly enough that a forest farm can share food with wild animals and still turn a profit.	• Slow growing • Takes 6 – 8 years before first harvest • When not managed and pruned properly, leaves and branches must be collected manually to feed to livestock. • Virtually unknown outside of region • Limited acceptance • No demand
Corn	• Quick growing • multiple uses • broad acceptance, high demand • Stalks act as supports, can be grown in tandem with beans	None	• Demands intensive labor • Demands fertilizer and pesticide inputs for high yields • Demands surveillance • Exhausts soil within 3 to 5 years • Creates conditions unfavorable to reforestation
Pasture	• Quick growing • low maintenance after initial labor demand for clearing forest • Domestic Animals can forage for themselves	None	• Exhausts soil within 3 to 5 years • Creates conditions unfavorable to reforestation

Table 2 : Trees from which flour and other "cereal" type grain products are produced

Scientific name	Common name	Countries	Uses
Brosimum alicastrum	Ramón, Maya Breadnut, Iximché, Capomo, Ujushte	Central America, Carribean, South America	Multiple – source of flour, bulk staple nutrition for humans and livestock
Brosimum utile	Arbol de vaca, "Cow Tree"	Central America, Carribean, South America	same
Treculia africana	African Breadnut Tree	Africa	same
Ceratonia siliqua	St. John's Bread Tree, Carob	Mediterranean	Both pod and seed are made into flours of different nutritional value
Castanea sp,	Chestnut tree	Europe, North America, Asia	Same
Durio zibenthus	Durian tree	South East Asia	Seeds ground into flour
Mangifera indica	Mango tree	India	Seeds ground into flour[110]
Pachira aquatica	Provision tree, Malabar chestnut	Central and South America	same[111]
Canarium australianum	Turpentine tree[112]	Indonesia, Australia	Edible nut ground into flour
Artocarpus heterophyllus	Jackfruit	Southeast Asia	Seeds ground into flour
Artocarpus altilis	Breadfruit	Pacific	Seeds ground into flour
Pithecellobium dulce	Manila tamarind	Southeast asia	Multiple seeds used for flour
Cycas sp.	Sago (cycad)	Indonesia	Pith of tree made into flour
Metroxylon sagu	Sago palm	Indonesia	flour
Arenga	Arenga palm	Indonesia	Seeds made into flour
Borassus sp.	Sago Palm	Indonesia	Pith made into flour
Araucaria bidwillii.	Bunya bunya pine	Australia	Large seeds eaten by Aborigines
Phytelephas macrocarpa	Yarina, Ivory Palm	Central America	Seed eaten directly, nutritious albumen

[110] The fresh kernel of the mango seed (stone) constitutes 13% of the weight of the fruit, 55% to 65% of the weightof the stone. The kernel is a major by-product of the mango-processing industry. In times of food scarcity in India, the kernels are roasted or boiled and eaten. It is said to be equal to rice in food value, if tannin-free, containing 5.56% protein, 16.17% fat and 69.2% carbohydrate. After soaking to dispel the astringency (tannins), the kernels are dried and ground to flour which is mixed with wheat or rice flour to make bread and it is also used in puddings. Indian analyses of the mango kernel reveal the amino acids;alanine, arginine, aspartic acid, cystine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tyrosine, valine, at levels lower than in wheat and gluten..<http://newcrop.hort.purdue.edu/newcrop/morton/mango_ars.html#Toxicity>

[111] The nuts of the Malabar chestnut are harvested when the seed pods burst. They are edible raw or roasted. The raw nuts taste like peanuts and will keep for months in a cool, dry place. Roasted or fried in oil they have the flavor of chestnuts, and can be ground into a flour for bread baking. Young leaves and flowers are cooked and used as a vegetable. http://www.crfg.org/pubs/ff/malabar.html

[112]< http://www.geocities.com:0080/Athens/Delphi/2970/turpent.htm>

Quercus sp.	Oak tree, acorn tree	Europe, North America, Asia	Acorn Flour produced by many companies in Korea and exported to the U.S.
Livistonia sp.	Australian Date palm	Australia	nuts roasted and ground into flour
Pandanus spiralis	Pandanus	Australia	large composite edible nuts contain several wedge-shaped woody segments which must be split open to extract the edible seeds
Sterculia quadrifida	Monkeynut tree	Australia	Seeds edible raw, but can be made into flour
Attalea tessmannii	Shapaja	Peru	Seed eaten directly or cooked
Astrocaryum chambira	Chambira Palm	Peru	Seed directly consumed[113]

Agroforestry species used as fodder for Cows and other Livestock

Brosimum alicastrum	Ramón
Brosimum galactodendron	Cow-tree
Ceratonia siliqua	Carob
Morus sp.	Common Mulberry
Gnetum gnemon	Gnemon tree[114]
Zizyphus jujuba or Ziziphus zizyphus	Jujube
Dovyalis caffra	Kei Apple
Pisonia alba	Lettuce tree
Gingko biloba	Maidenhair tree
Acer spp.	Maple
Shorea robusta	Sal[115]
Atriplex spp	Salt-bush
Salix babylonica	Weeping willow

[113] < http://www.conam.gob.pe/endb/docs/PuntosFocales/flora9.htm>
[114] Common names of edible nuts < http://www.aoi.com.au/atcros/FM.htm>
[115] Shorea robusta, a giant rainforest dipterocarp tree, has great religious significance in India, and hence is protected, according to M.K Jena, et.al. in "Economic and Social Aspects of Forestry in Developing Countries" < http://www.metla.fi/conf/iufro95abs/d6pap57.htm > They make the point that "as long as resources used for economic maintenance do matter socially and spiritually they are to some extent safeguarded form overexploitation. The fact that there is no definite perceived distinction between economic value, the achievement of religious merit by using a plant in a ritual and the social ties and obligations that are part and parcel of its common or private management provides the respective communities with a holistic practice of resource use".