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Agroecology of the Naso-Teribe: The Management and Conservation of Traditional Agroecological Systems

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Abstract

The term “agroecology” is used to describe the sustainable design and management of agricultural systems by the application of ecological concepts and principles. The resulting agroecosystems, often practiced by indigenous or poor farmers in marginal environments without access to external technologies, are systems of food production that integrate cultivated crops into surrounding ecosystems. The Naso-Teribe, an indigenous community of approximately 3,800 individuals living in the forests of western Panama, practice a complex agroecological system. The Naso farmers’ agricultural practices contribute to, and are dependent on, the biodiversity of resources available. The ways in which Naso farmers manage, maintain, and preserve the biodiversity on which their agroecosystems depend, affects not only the conservation of their forests, but the preservation of their culture. This paper examines the diversity of resources managed by the Naso farmers, while also addressing the broader cultural and socioeconomic issues influencing their traditional practices.

Sumario Ejecutivo

El termino “agroecología” se usa para describir el designio y manejo sostenible de sistemas agrícolas con la aplicación de conceptos y principios ecológicos. En otras palabras, los agroecosistemas son sistemas de producción alimenticio, a menudo practicado por agricultores indígenas o pobres en medio ambientes marginados, que tienen una integración sus cosechas y el ecosistema alrededor. Estos sistemas no tienen la adición de los insumos externos y están estrechamente ligados con el conocimiento tradicional.

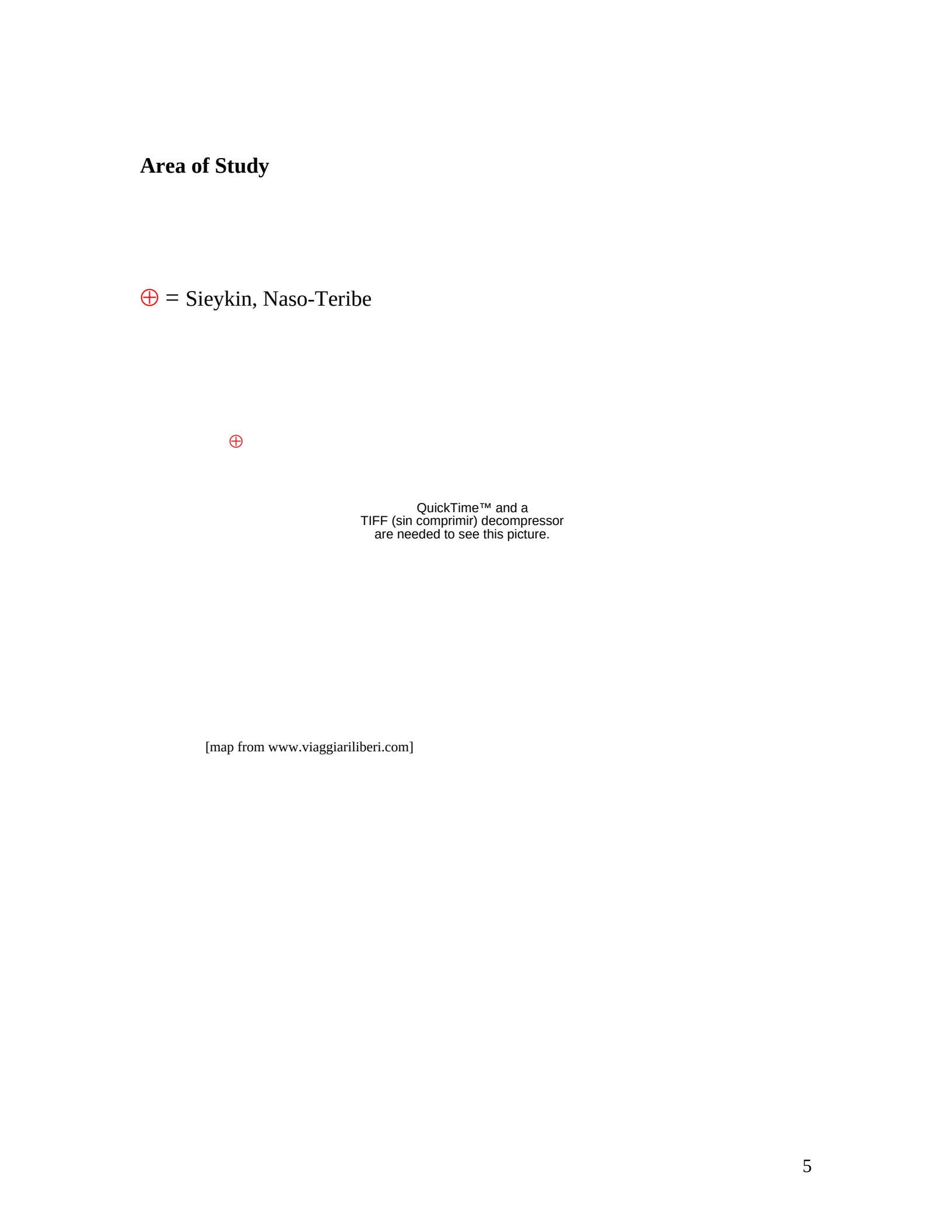
El Naso, una comunidad indígena de 3.800 habitantes cuyas tierras forman parte del Parque Internacional La Amistad y La Reserva Forestal Palo Seco, practican un sistema complicado de agroecología. Los Naso tienen una riqueza de conocimiento ecológico, sobre sus bosques los cuales les han permitido producir comida continuamente y cosechar recursos de una manera sostenible por cientos de años. Sin embargo, alrededor del mundo el conocimiento tradicional se ha estado perdiendo por el alcance cada vez más global del desarrollo agrícola moderno, caracterizado por campos sembrados de un solo cultivo, variedades de semillas adaptadas para ser usadas exclusivamente con insumos químicos, tecnologías costosas, y políticas con un foco de exportación. Además, para los Naso, existen otras presiones sociales y económicas. El mundo cada vez más está llegando a ser una realidad para este grupo de gente que tiene una lucha constante por ser reconocidos como una comarca (el termino usando por las tierras autónomas de las indígenas de Panamá), que está siempre en amenaza por un proyecto hidroeléctrico en su río, y que apenas está empezando a explorar el mundo de “ecoturismo,” agricultura de exportación, y otras actividades para generar ingresos. El manejo agroecológico de los Nasos – que está dependiente de la alta biodiversidad de los cultivos y los bosques – suministra el fundamento para el equilibrio ecológico dentro del paisaje Naso.

La perdida del conocimiento tradicional a causa de dichas presiones no solamente amenaza la conservación de la biodiversidad de las áreas pobladas por ellos, sino que también, la conservación de las culturas tradicionales sobre cuales este conocimiento está basado. La presencia de estas amenazas motiva a este proyecto a evaluar la biodiversidad manejada y preservada por los Naso en sus esfuerzos de conservar su cultura y sus tradiciones.

Area of Study

⊕ = Sieykin, Naso-Teribe

⊕



[map from www.viaggiariliberi.com]

Introduction

Modern agriculture in the tropics has proven to be unsustainable. It is a system focused on intensive monocropping, seed varieties adapted to be used exclusively with chemical inputs, capital intensive technologies, and export-minded policies that are ultimately designed to squeeze maximum yields from limited soil fertility and land. Agriculture with these sorts of short-term productivity goals is threatening small-scale farmers around the world. Already, agricultural systems that were effective for innumerable generations have disappeared in the span of only a few decades.

It is for this reasons that agronomists, economists, scientists, policy-makers, and society as a whole need to turn their attention to the ecologically based agricultural systems that have been used and developed by the traditional cultures around the world. These agricultural systems that meet both the needs of the ecosystem and its people by applying ecological concepts and principles, and so dubbed "agroecosystems," have proven to be both ecologically sustainable and culturally beneficial. Regardless of the cultural and environmental benefits of such systems, they have been virtually ignored for their potential applicability in modern agricultural development and design, or even as valid systems for the people they serve. As a result, the traditional knowledge and cultures of people, such as the Naso-Teribe in the western forests of Panama, is being lost at an alarming rate, and along with it, the supporting biodiversity and genetic crop varieties on which the world's food security is ultimately dependent.

The Naso, an indigenous group of approximately 3,800 people living along the Teribe River bordering La Amistad International Park and Palo Seco Forest Reserve, practice a system of food production too complex to be simply described as agriculture by the conventional standards. Their sources of food, construction materials, medicinal plants, and firewood come not only from the cultivated crops interdispersed throughout the forested land behind their houses, but also from the land in the surrounding mountains and the river by which they live. Naso farmers have been managing this tropical ecosystem for hundreds of years, gaining over the generations a wealth of knowledge and wisdom specific to the forests of the area. The economic and cultural value of this information is immeasurable for the Naso people and anyone concerned in the future of the worlds' agricultural resources. There have been limited studies of the Naso-Teribe, yet the Naso people are holders of important indigenous knowledge, inhabit one of the richest areas in the world in terms of biodiversity, and are on the threshold of much expected change.

The outside world is more and more becoming a reality for this group of people whose relentless struggle for their land to be officially recognized as a "comarca" (the term used for the autonomous lands of indigenous groups of Panama) has yet to be granted. In addition to this ongoing fight, the Naso are under constant threat of a proposed hydrological energy project on their river and are just beginning to explore the world of "ecotourism," export agriculture, and other income-generating activities. The agroecological management of the Naso – which relies upon high levels of biodiversity as well as complex traditional knowledge – provides the basis for the ecological balance within the Naso landscape. Articulating the values of agroecosystems managed by the Naso farmers has important implications for the future conservation of both Naso culture and the surrounding forests and rivers. With this in mind, this paper focuses on evaluating the biodiversity managed and preserved by the Naso as a method to address the broader cultural, social, and political issues related to their traditional agroecosystems.

An Agroecological Background

The Changing Face of Agriculture and the Repercussions in the Tropics

Agriculture, in ecological terms, represents a basic disturbance to the natural cycles of nature. In essence, humans started an uphill battle with the first experiments in cultivation, attempting to make an ecosystem produce nourishment for only one species within a system designed to cycle nutrients and energy throughout the greater food-web (Kricher 1997). Over the subsequent thousands of years the agricultural knowledge of human cultures has evolved, allowing us to produce our own consumption needs in the face of environmental constraints. Although this knowledge allows for a certain level of dominance over nature unknown to most other animal species, it has also created a species aware of its undeniable dependence on the very ecological systems being manipulated. Agriculture is as much about paying attention to the seasonal changes, feeling the consistency of the soil running through one's fingers, and developing an acute awareness for the health of one's plants, as it is about controlling the production of the system.

However, in the last 50 years significant advances in agricultural technologies have been made, affecting the world's ecosystems and cultures in more drastic ways than previously experienced. With the relatively recent discovery of chemical additives and the increasingly globalized market economy, agriculture has come to be characterized by its mono-cultivations, costly seed varieties adapted to be used exclusively with chemical inputs, and export policies often focused on canceling foreign debt (Gliessman 1990).

The modernization of agricultural can be traced to the political and social changes England, beginning in the fourteenth century with the division of communal land in Europe during the rise of industrialization. With the increased urban growth, the subsistence agriculture traditionally practiced by peasants began to shift toward a commercial agriculture appropriate for the times. By the late nineteenth century, with both the Europe and the United States dependent upon the system set into motion centuries earlier, attention was turned to the developing tropical countries that suddenly seemed to be "lagging behind" in the push for agricultural modernization (Wright 1997).

This new face of agriculture, developed and propagated by the developed world, has exerted pressure in even the most remote corners of developing tropical nations. Agricultural systems have changed from ecological systems designed to meet the local subsistence needs of people, to systems focused on external markets and product yields. Farming changed, relatively rapidly in terms of human history, from production based on local cultural and economic needs to a system of production designed to extract the products of agriculture in ways not always beneficial to the people working the land. Past experience has shown that when human and ecological needs are ignored within the development and management of tropical agricultural systems, the basic ecological functioning of these systems, and the associated human knowledge, have increasingly been threatened (Gliessman 1990).

The Concept of Agroecology

For thousands of years human cultures have farmed, developing methods to manage and maintain agricultural systems with the understanding that the sustainability

of the system depends on the conservation of the resources present. The term "agroecology" has been developed to describe this ecologically focused design and management of agricultural systems. Agroecosystems are systems of food production, very often practiced by indigenous or poor farmers in rural areas, which integrate cultivated crops into surrounding ecosystems. At the heart of agroecology is the awareness and conservation of natural ecological cycles. This awareness allows farmers to take advantage of the beneficial interactions between organisms as well as the natural balancing abilities of ecosystems, therefore reducing the need to rely on external, costly, and, most often, chemical inputs characterized by modern agriculture. Instead, the farmers depend more upon the highly localized and traditional ecological knowledge passed down to them from the past generations. In this way agroecology both preserves the ecological knowledge crucial for the long-term health of agricultural and surrounding ecosystems, as well as the cultural knowledge base of rural and indigenous peoples (Gliessman 1990, Altieri 2002).

Agroecology, therefore, takes the holistic view of agriculture as an ecosystem within the human sphere of influence, with related management that inevitably requires a complex foundation of knowledge. Researchers have found that the highly localized knowledge involved, a combination of ecological principles and oral traditions, is difficult to categorize and systemize within the scientific research-based structure it is often studied (Vandermeer 2003). It seems that the traditional knowledge related to the sustainability and conservation of agroecosystems is not exactly something that can be measured directly. The challenge, then, is to consider the many components inherent to the management of agroecosystems and compile the ones most important for the sustainable functioning of that system. Previous research has found that the overall functioning of most ecosystems can be most tightly linked to the level of biodiversity present (Altieri 1999).

Agroecology and the Importance of Biodiversity

The core principle of agroecology is the idea that the agroecological system should be mimicking as closely as possible the natural ecosystem while also providing a sustainable supply of food to the farmer. High levels of biodiversity provide the mixture of integral components needed for nature systems to provide and cycle the nutrients required for functioning. This same structural complexity that is inherent in naturally occurring biodiverse ecosystems, also provides the basis for the "flexibility, dynamism, and resilience" of agroecosystems managed with similarly high levels of biodiversity (Eyzaguirre 2004). In other words, the more interacting components a system contains, the more adaptable it is to change. High levels of biodiversity are not only critical for the structure and long-term survival of tropical forests, but also to the sustainability of managed agroecosystems.

Researching the Biodiversity of Naso Agroecosystems

I began my research with the goal to study the Naso farmer's management of crop diversity, with the hope of demonstrating the value these systems have in conserving the resources, and ultimately, the forests in Naso-Teribe territory. I went to Teribe with the assumption that the farmers' agricultural practices contribute to, and are dependent on, the biodiversity of resources available. Although the factors for assessing the

sustainability of the functions of agroecosystems are innumerable, I decided that the diversity of crops and plants used was something I could realistically measure within the short span of time the independent research project afforded. However, upon arriving in Sieykin, the community in which I did my research, I discovered that every question I directed towards farmers concerning "diversity" was met with a blank face and change in subject. In all my pre-researching into the science of "agroecology," I had created an exaggerated vision of myself conversing with a farmer in the forest: him explaining to me how the diversity of this or that regulates the fertility of the soil, the cycling of nutrients and water, forms the basis of his peoples food security, and essentially provides the ecological balance of his farm. I had obviously set myself up for frustration when in sudden comparison to the books I had been reading and my romanticized assumptions, I was met with silent nods and awkward silences.

In contrast I spent many an hour listening to legends from the elders and many more hours being taught the language of Naso. It was not until a few days after my arrival to my family's house that I realized that these stories and language lessons were not in fact tangents from the investigation I had studiously set out to conduct, but rather the very way in which the people were articulating the importance of biodiversity.

This has been one of the lessons I have taken home with me: that the importance of managed agroecosystems is not solely the sum of its ecological benefits, but also its role in the cultural continuity of the people doing the managing. After those first few days my questions and conversations evolved away from the term "diversity" and its effects on the sustainable functioning of systems, and towards the history of the variety of crops and associated stories and traditions. What I recorded was indeed a demonstration of crop diversity, as evident in the tables that follow, but the value of this variety, for the Naso people involves more than its biological implications.

The Naso-Teribe of Western Panama

The Naso are an indigenous group of approximately 3,800 individuals living in the province of Bocas del Toro, Panama. The 11 communities are located along the Teribe River, bordering La Amistad International Park and the Palo Seco Forest Reserve. The Naso possess a unique form of government, being the only indigenous group in Panama ruled by a king and associated council (Rome 2004, Villagra 11/28). They are also the only indigenous group that has yet to be granted their comarca, the panamanian term for indigenous reservation, which was a much discussed topic in every household I visited. There are currently no roads entering the territory, making the river and muddy foot paths the only means of transportation. The limited access in and out of the territory has left the Naso relatively undisturbed by mainstream Panamanian society and influences. Most families continue to live in their traditional thatched houses, practicing subsistence lifestyles supported by the rich forest and river resources.

Christianity has firmly planted itself in Naso, with the majority of people attending either the Adventist or Evangelist churches. However, the old religion, based in the belief of *Ter*, the grandmother goddess and creator, remains in the many stories and legends recounted and saved through the generations. Although this religion has almost all but been abandoned, the influence of *Ter* remains in certain traditions still followed and the name of the river that serves as the life line of the Naso communities (A. Sánchez 11/28).

Although Spanish is taught in the schools, Naso is the first language of the people. Only three years ago the official written language was created and agreed upon, illustrated by the numerous spellings that exist from years past. Bernardo Sánchez, the father of the family with which I stayed in the community of Sieykin, the day I met him cited this as the reason it is still difficult to spell with exactness every plant and tree. The Naso people I met were fiercely proud of their language and when I was not directly interviewing in Spanish, most often I was spoken to only in Naso (which I was expected to understand with only my basic vocabulary of "yes," "no," and the names of a few dozen crops). Most people I met were also proud of their newly officialized Naso alphabet, and Bernardo expressed to me the first day his hope for the new written language to someday be unambiguous in its spelling, so that his children could learn the different plants, uses, and pronunciation in their own language (B. Sánchez 11/24).

From this first day of my onsite research it came to my attention that the Naso language was intricately linked to the diversity of plants and crops present. Almost every plant we came across in the forest had a Naso name in addition to the Spanish, and I discovered that many only have a Naso name. More importantly, each variety of a single plant crop has a specific name tracing back to the time when the seeds were first found in the mountains or from other communities. These varieties were then planted, and gradually have adapted over the generations. For many – such as Antonio Sanchez, a farmer and self-designated botanical student – the knowledge of the types of crops and associated Naso names represents the manner in which not only the numerous varieties, but also the associated traditions, are conserved (A. Sanchez 11/27).

Land Management

"Sembramos un poco por aca, un poco por allí, y un poco por alla. Así es, para no hacer daño a la tierra." – Bernardo Sánchez November 24th, 2005

(We plant some here, some there, and some over there. This is how it is, so as to not cause harm to the land.)

The diversity of crops in the Naso-Teribe is made possible by the distinctive ecological aspects of the area and the associated agroecological management. The Naso farmers with whom I interviewed worked a variety of cultivated areas, each managed differently in response to its proximity to the river and houses. However, Naso farmers practice a system of land use difficult to refer to as "farms" in the sense of modern conventional standards. Crops are instead interdispersed in the forest, or, in the case of more clearly defined parcels, planted with a variety of crops. One man described most simply the diversity in these systems as including "un poco de todo" (a little of everything) (A. Villagra 11/28).

The basic tenet of the diverse planting systems and the practice of planting multiple sites within the forest is the conservation of healthy soil. Any farmer, conventional, organic, and traditional alike, will cite soil as the key to productive agriculture. Keeping one's soil healthy – which means anything from adding specific proportions of chemical fertilizers to leaving fields fallow (and every technique in between) – is the focus of most agricultural management.

During discussions with Naso farmers, the health of the soil was almost always recognized. Often the soil was referred to as "gastado" (spent) after a succession of crops

such as corn, rice, beans, and bananas had been planted over consecutive years. Eventually the crops in these areas of high use begin to show signs of weakness and finally a significantly lowered production. This pattern makes sense on most any soil, but especially so within the context of the tropics. Tropical soil is known for its tight system of nutrient cycling. The majority of the nutrients and minerals in tropical ecosystem are concentrated in the trees, lianas, and epiphytes above the ground. These characteristics make farming in the tropics, which necessarily requires the removal of at least some percentage of the natural vegetation, a challenge to rural farmers. Once an agricultural area is removed of its biomass, the resulting mineral-poor soil is unable to support or sustain crops for much time (Kritcher 1997).

The solution, according to Bernardo, is to leave fields fallow for a certain number of years, depending on the crops previously grown, so that the land can receive the "sustenance" and "nutrition" from the plant matter left behind and renew itself for the next planting (B. Sanchez 11/24). Even on the most poor of soils, this practice can maintain productivity for long periods of time. Conventional systems, on the other hand have shown to degrade tropical soils within only a few years (Picone 2003). The farmer's maintenance of this interplay between cultivated and fallow areas, creates a system that essentially mimics the successional patterns and biological mechanisms found in the natural ecological system (Altieri 2002). These types of systems, often referred to as "shifting agriculture," permit a wide variety of crops to be grown, significant levels of exposure to wild varieties in nearby forests, and a dynamic and continuous source of food for the farmer (McNeety 2002).

Indeed, the "farms" of the Naso-Teribe are anything but the conventional rows of single crops visible throughout the rest of Panama and the world. One of Bernardo's farms, an area of just two hectares, contains bananas, pifas, coconuts, breadfruit, oranges, rice, numerous root crops, sugar cane, beans, various timber trees, and various medicinal plants. On the paths linking the different farms we visited during my research we stopped frequently to discuss a plant or tree used not only for food, but also medicinal, constructional, hunting, or artisan uses. What looked like a forest in my eyes was in theirs a market, pharmacy, and hardware store all in one. And more importantly, these plants were not just used, but had been purposefully planted and continually maintained by the Naso farmers. The areas I was passing through were not simply exploited forests, but managed agroecosystems. Even within the parcels more drastically cleared and planted as farms, intercropping was frequent, such as the case of corn and an edible green, *mörga,* planted among the fields. This strategy of biodiverse agroecosystems not only stabilizes and maximizes yields in the long term by ensuring harvestable crops ready at different times, but also provides high nutritional values for local diets (Altieri 2002).

The techniques used by Naso farmers to manage this diversity depend on the specific local and social conditions of their environment. In addition to maintaining the diversity of their crops, the farmers with whom I spoke were conscious of the cycles and necessities of the natural systems under which they were working. Harvestable timber trees are left for long periods so as to not harm the land, and when harvested, new trees are planted in their place (B.Sánchez 11/25). Farmers remarked on the importance and the practice of reserving certain forested areas, some for the natural breeding ground of wild animals and others for the future needs of their children (B. Sánchez and Anonymous 12/1). And multiple times I was told that the forests along the river and streams were never cut in an effort to protect the waters from drying up (B. Sánchez 11/26, Anonymous 12/1, A. Sanchez 11/27). These techniques are not simply practiced,

but seem to be held strongly as cultural beliefs. These beliefs are more than an accumulation of myths and stories as the word “cultural” may falsely imply, but rather they constitute a complicated system of knowledge; creating an associated system of agriculture that conserves its natural resource base.

Biodiversity of Crops

Table 1: An Inventory of Cultivations in the Naso-Teribe

Spanish	Naso	English	Latin	Uses
Aclas	Lö			Timber
Aguacate	Dborba Bum	Avocado	Persea americana Persea spp	Food
Ají/Chili	Bochi	Chili Pepper	Capsicum frutescens	Food
Arroz	Arroz	Rice	-See Table 2-	Food
Balsa	Balsa	Balsa	Ochroma pyramidale	Timber/Material
Banano/Guineo	Këbin	Banana	-See Table 2-	Food
Bateo	Kionlong		Carapa guianensis	Timber
Bejuco		Vine	-See Table 2-	Food/Mat
Cabezamono	Piö			Food/Timber
Cacao	Kä	Cacao	Theobroma cacoa	Food
Café	Café	Coffee	Coffea Arabica	Food
Cafecillos	Cluclu			Timber
Calabasa	Diblu	Tree Gourd	Cucurbitacca spp.	Artisan
Caña	Srorbo	Sugar Cane	Saccharum spp.	Food
Canela	Ywloko	Cinnamon	Cinnamonum sp.	Food/Med
Caralu	Krögwo			Food
Caraña	Donio		Bursera graveolens	Timber
Casco de vaca	Kjlöbla			Food
Caucho	Srö	Rubber Tree	Havea sp.	Materials
Cedro	Luk	Cedar	Cederla odorata	Timber
Chayote	Shlöte		Sechkum edule	Food
Chichicas	Kã			Food
Cilantro	Cilantro	Cilantro	Erynglum foetidum	Food
Criolla	Shlekson			Timber
Dasheen	Dalling	Eddoe root	Colocasia spp.	Food
	Dürlen			Food
Frijoles	Shtaguo	Beans	Phaseolus spp.	Food
Frutipan	Frutipan	Breadfruit	Artocarpus altilis	Food
Guanábana	Shgushgu	Guava	Annona muricata	Food
Guandu	Shtaguo jkor	Tree Bean	Cajanus cajan	Food
Hortiga	Hortiga	Nettle	Urera caracasana	Food/Med
	Kjlärkjok			Fishing/Med
Laurel	Pü	Laurel	Smilacaceae sp.	Timber

Limón	Gëngmo shop	Lemon	Citrus limon	Food
Jengibre	Jengibre	Ginger	Zingibar officinale	Food/Med
Jengibre Silvestre		Wild Ginger	Astrum sp.	Food/Med
Maíz	Ëp	Corn	-See Table 2-	Food
Makano	Makano			Timber
Maméy	Shalo	Pantin	Mamay sapote	Food
Mandarina	Quënmo	Mandarin	Citrus reticulate	Food
Mango	Mango	Mango	Mangifera indica	Food
Marañon	Marañon	Cashew	Anacardium occidentale	Food
Mata de Limón	Shirgo			Food/Med
	Mörga			Food
Ñame	Tju	Yam	-See Table 2-	Food
Ñampi	Skaïu	Taro	-See Table 2-	Food
Naranja	Quënmo	Orange	Citrus sinensis	Food
Naranjilla	Naranjilla		Solanum quitoense	Food
Bastata	Uerba		Ipomoea batatas	Food
Papas del Aire	Shuabia			Food
Palmito	Shurbo	Palm	-See Table 2-	Food
Pifa/Pixbae	Shup	Peach Palm	Bactris gasipaes	Food
Piña	Pönguo	Pineapple	Ananas comosus	Food
Pipa/Coco	Meg	Coconut Palm	Cocos nucifera	Food
Platano	Bing	Plantain	Musa spp.	Food
Rabos de Mono	Plöson	Fiddleheads		Food
	Shin			Fishing
Sotacaballo	Sotacaballo		Zygia englesingii	Timber/Med
Tomate	Tomate	Tomato	Lycopersicum esculetum	Food
Wawamachete	Poshun			Food/Timber
Yucca	Ikg	Cassava	Manihot esculenta	Food
Zapallo	Shlon	Squash	Cucúrbita ficifolia	Food

In addition to the diversity of crops cultivated by the Naso farmers, there exists an extensive diversity within many of these crops. The roots of many of these variations planted in the farms and forests trace back to the generation of farmers who at one time brought the seeds from the forests in the surrounding mountains. These previously wild, but now purposefully planted and cultivated, varieties of crops represent an enhanced reserve of genetic diversity in the Naso agroecosystems. But more importantly, in the words of Bernardo, these varieties represent a rememberance of the past. When describing a variety of yam planted in the lands behind his house, he made clear that this type of yam was brought by his father from the headwaters of the river deep in the mountains. “Si no fuera por mi papá no había ñame bruju” [If it were not for my father, there would not be the bruju yam] (B. Sanchez 11/24). For Bernardo, the value of this additional variety represents a manner of conserving the memory of his father’s work.

Within a collection of crops, including bananas, yams, taro, cassava, rice, corn, palms, and vines, each single cultivation contains anywhere between five and eleven varieties (see Table 2). However, even the information provided may not be the full extent of the diversity present. There were 11 types of "ñame" and "ñampi" (grouped together by Bernardo due to the fact that both are root crops that grow with associated vines) that I was able to record on our walks through the forest and farm. I was assured by Bernardo however, that there were many more "classes" cultivated by other farmers, and even more in the surrounding forests (B. Sánchez 11/26). The same holds true for the palms and the vines; what is documented may only represent the tip of the iceberg. Although I discovered an impressive diversity within various crops, nowhere were the beliefs, agroecological knowledge, and culture more exemplified then within the realm of corn.

Table 2: The Inter-Crop Diversity of the Naso-Teribe

Crop	Variety – Spanish	Variety – Naso
Arroz/Rice	Blanco (con rabito)	Shulgla
Oryza spp.	Blanco (sin rabito)	Plungbo
	Tënma	Tënma
	Negro	Kwosï
	Chato	Chato
	Tico	Tico
Bananos/Bananas	Blanco	
Musa spp.	Cuadrado	
	Primitivo	Shmaico
	Guayaguil	
	Morado	Shitikjwo
Bejucos/Vines	Brote	Pongochuo
Various latin names	Conejo	Kjlidlichu
	Ulosha	Ul¨osha
	Mokuna	Tluchuo
	Morado	Ygui
Maíz/Corn	Negro Brillante	Tjenma
Zea mays	Blanco	Pjlublun
	Azul	Soybó
	Azul con Blanco	Skerku
	Azul con Negro	Shlogle
	Negro Oscuro	Keybo
	"Camaroncito Hervido"	Kjösbó
	Oscuro/Claro Amarillo	Guiybo
	Amarillo Puro	Shõylõr
	Amarillo Oscuro con Manchita	Klusbo
Ñame/Yam	Cabezón	Käkä
Dioscorea spp.	Dedo de Tapir	Sosap
	Amarillo/Jacha	Shöyör/Jacha
	Blanco	Plublun
	Bruju	Bruju

Ñampi/Taro Colocasia spp.	Del Sol Blanco Morado Dasheen Rojo	Dlö tju Plublun Dindin Dalling Kloshbakuo Sluru Skalu Iglu
Palmas/Palms various latin names	Palanquia Pifa/Pixbae	Ugo Shup Shok Kinbo Kincorga Shlön Sënko

Ëp, Maíz, and Corn

On one trip to the farm high in the mountain, Antonio guided us off the trail one of the old corn grinding stones. The stone was light gray, worn smooth and white in the middle, and broken into two large pieces. He described the process of transporting these chosen stones, some as heavy as four thousand pounds, from the rivers up the hills; an effort that required hundreds of people, wide cleared paths, and strongly woven vines. He explained the four motions the women used to grind the corn, and how the women in the past used to work day and night to make the flour, switching off so that some could sleep and take care of the other responsibilities of the house. When using the largest stones, four women were required to work at once, each stationed in the four directions; a fact made visible, according to Antonio, from the four worn spots around the stones that can still be seen today. It was around these ancient stones that the women sang for the healthy harvest, the earth and *Ter*, their families, and their loved ones. (A. Sánchez 11/27, 11/28)

I asked how the stone, which obviously had lived a long life of use, had broken apart. He explained that during the time of the Spanish conquerors, when the killings were wiping out huge numbers of the Naso population, the ancestors believed that the end of their people had arrived. Because they did not think that a future for their people was possible, they built fires atop the stones, causing the rock to fracture from the heat and pressure (A. Sanchez 11/27, 11/28). I can only hypothesis that this action was in a personal effort to destroy what was sacred before the Spanish would have had the chance.

Before Antonio explained the significance of the stones, I had assumed they were not of direct importance to my study. But I slowly came to realize that there is a sacredness placed not only on the varieties of corn preserved from the past, but the legends and traditions surrounding the cultivation. This was to become a theme we visited upon often in the following days and discussions about the corn, when almost every day Antonio came to visit to discuss some aspect of the story that he had forgotten to mention earlier.

The Corn Cycle

Antonio described in detail the traditional processes he considers essential in order to secure the healthy growth and harvest from his corn. Throughout the life cycle of each corn planting, a sequence of practices is carried out corresponding to specific moments in the cycle so as to ensure the corn will provide for the farmer. These practices that Antonio learned from his father, provide a cultural blueprint to the history and traditions that many Naso farmers have continued to observe.

The cycle begins after choosing the best seeds from the previous crop. The initial planting is carried out in complete silence and the children are not allowed in the fields or even to touch the seeds. The children, full of energy and noise, represent the harm – in the form of the birds, wind, rain, and small animals – that could potentially destroy the grains of corn. The young men, however, are invited to open up the fields and paths needed to begin the planting for they contain the vibrant life of youth and represent the health of the corn. The farmer will then enter the field to plant, not in holes or rows, but in the traditional manner of scattering the seeds by hand over the newly cleared land. The corn cob and left-over seeds that have not been planted are kept and stored in the house, for it is believed that if this corn is thrown out or fed to the animals, the corns in the fields will suffer. Only after the corn has flowered and nearing its third month may the unused seed be discarded (A. Sánchez 11/29).

When the corn is in flower, an orphan is sent to the field to make an offering to the spirits to "germinate" the plants (Because the seeds are technically already germinated, this prayer for "germination" may be referring to the process of the undeveloped kernels, or female ovaries of the plant, being pollinated by the pollen from the male tassels of nearby plants). It is thought that because orphans do not have family, they have more humility and are naturally more conscientious. The orphan is therefore chosen to implore to the spirit to protect the corn from harm and ensure a full harvest.

When the first plants have reached maturity, the farmer goes on his own to harvest the first corn referred to as *zbe* or "maíz nuevo." Returning from the harvest, the farmer searches for a nest of leaf-cutter ants. The entrance to these nests appears as a small mound of dirt, which according to Antonio, the material the ants in the creation of their underground chambers have brought up from the earth below. The grains of one cob of corn are finely ground and mixed with this same soil, a representation of abundance, as yet another practice to ensure the subsequent harvest will improve (A. Sánchez 11/27).

Not every Naso farmer has continued these traditions as have Antonio and his father before him. A farmer who owns a plot closer to the river, plants his corn in rows and in individual holes, a method he learned from Costa Rican farmers he met more than a decade ago. He finds this method easier then the traditional ones. Although, he continues to only plant on the full moon, the age-old practice that he has found to produce smaller and healthier corn more resistant to insects and pests (Anonymous 11/29).

Naso farmers exercise varying degrees of traditional ways, as the history and ancient practices continue to be shared to some extent with each new generation. However, in the last few decades the Naso community has become connected to farmers around the world, the majority of whom manage systems with different ecological constraints than the forests of western Panama. Although it is not within my scientific expertise to judge the applicability of these modern methods to the Naso agroecosystems, from the perspective of an outsider, these methods appear to represent a dramatic change from the traditional ways. This becomes especially apparent when the extensive genetic

diversity of traditional crops in the Naso-Teribe is compared to that of conventional mono-cultivated farms.

Conservation of Seed, Conservation of Culture

From the first day of my research I was told of the numerous types of corn grown. After expressing my desire to see for myself the varieties, Antonio woke me one morning with the announcement that we were going on a trip to see his farm in the mountains. For two hours we hiked through a patchwork of primary forest, secondary re-growth forests, and cleared parcels with different mixtures of crops. At the end of a muddy trail high above the river and with a view of the Atlantic Ocean, we finally reached his *maíz*, a patch intergrown with tomatoes and edible plants. There he harvested a collection of corn in an effort to demonstrate the different varieties and colors. It became clear, however, that, as with any natural gene pool, both humans and corn included, the mixture and crossing over of traits is inevitable. One does not need to have taken even the most rudimentary of biology courses to notice this basic principle shown brilliantly in a field full of intermixed varieties of corn.

Antonio considers the difficult task of conserving these varieties, and the associated traditional names, his responsibility to his ancestors and his culture. For his ancestors, the sale of the corn was prohibited and the seeds were only exchanged and given as gifts. Although the sale of corn is now common practice, Antonio continues to exchange seeds with other farmers in order to avoid the potential complete loss of any one type. He explained that even if suddenly his own cornfield were to be wiped away by an unforeseen event or disease, the seeds would still exist in the other fields (A. Sánchez 11/27). Through this method of seed preservation, Antonio is creating a seed bank – a genetic insurance policy to ensure the conservation of his varieties.

The Diversity of Naso Groups

After our trip to see the corn, I asked Bernardo and Antonio if we could speak with their father about some of the themes surrounding the crop diversity and traditions. Marcelino Sánchez, over 100 years old and hammock-bound, time and time again was credited for the conservation of the corn varieties and for possessing the traditional knowledge. I hoped that conversing with him directly could illuminate some of the history behind the stories and information I had been told.

He began the conversation, according to the translation of Antonio, by saying that the use of the grains of corn is like the life of a Christian. “Oh no,” I thought, “where is this going?” But his comment was yet another example of something that initially I pass off in my mind as tangential, but that eventually revealed itself as having a significant connection. He continued that, as a Christian, one does not only think of the health of oneself, but also makes blessing for others. It is for this same reason that all the varieties of corn are carefully conserved. He explained that the corn, through the workings of *Ter*, is not only food, but when cured by *Ter*, is part of the medicinal base of the peoples’ health. What is more, the people have traditionally belonged to a diversity of groups, each distinct and each with its own Naso name, like the corn. There are over ten different Naso groups (including the “white” and “black” groups referring to outsiders) that, just like the varieties of corn, have been mixed through the generations (M. Sánchez 11/29). Antonio helped to make the connection by referring to these groups as “las semillas de

nosotros" (the seeds of ourselves). Antonio recounted a story of a day when his ancestors discovered that the pure black corn was appearing to mix with the yellow, a sign that the Naso culture was going to disappear. However, he remarked, as of this moment the black corn remains pure, a sign that, for the time being, the culture remains intact (A. Sánchez 11/29).

Yet again Antonio, this time with the support of his father, was making the connection between the corn and the Naso culture. To him, the link is direct. This corn represents his food, his connection to *Ter*, the traditions of his ancestors, and the conservation of his culture. The multitude of elements that make up the Naso family groups and the fields of corn, whether mixed or pure, are conserved because each variety adds to the patchwork that makes Naso life what it is.

Table 3: The Diverse Family Groups of the Naso-Teribe

Spanish Name	Naso Name
	Magroso
	Guemluga
	Shõnuso
	Shloropga
	Guengsopga
	Kjörbaso
	Zgokroso
	Röpgaso
Hombre Blanco	Basde Shisde
Hombre Negro	Äsde drösde

Discussion

There is currently enough land and forest to satisfy the needs of the agroecosystems practiced by the Naso farmers. Fields have time to lay fallow because there has always been plenty of land upstream or deeper into the forest to clear and cultivate. When timber is needed, there is little thought to sustainable harvesting or the conservation of forested land because there has always been enough. The problem instead has simply been finding the man-power to help carry the heavy harvest down the mountain.

Before I continue, it is important to recognize the perspective I bring with me to this discussion. I believe strongly in the conservation of forested and wild areas, not only for their direct economic benefits, but also for the inherent value these places hold. I also come from a place where when a redwood or maple tree is cut down, one will never grow back in its place during my lifetime. The Naso people, in contrast, live in a land where cutting of forests for planting one's food is rarely questioned. However, they also live in a land where a full-grown tree can be grown and harvested in as little as five years, frosts and droughts are not part of the equation, and the growing season is year-long.

The point being that, for the moment, in fact for the past thousand or so moments since the Naso people began farming, their agroecological systems have been sustainable for the specific environment in which they have inhabited. But life is not so simple and safe, as around the world the foundations of similar systems that had functioned since before people can remember are suddenly degrading. Pressures are increasingly arriving

from afar in the form of policies, regional economics, and international affairs. Slowly people are watching – usually powerlessly – as their land is converted to cattle grazing, their rivers harnessed for energy, their paths paved into roads, and their crops grown for export. These changes are not bringing opportunities, as so often promised, but instead are leaving people with a handful of bills, an increased appetite for material goods, and insufficient food for their families.

I, for one, am not sure how to go about curbing the tide of modern agriculture and economics into marginal areas such as the Naso-Teribe. There is little concept among the Naso people of those unnamable pressures, theoretical forces, and external agendas encroaching on their way of life. There is minimal thought extended to these things so distant and foreign, when enough energy is needed just to keep the family fed and the clothes clean each day. I suppose this is the inherent difficulty in promoting "sustainable development" from a university or government office to a people who lack the modern experience of even needing to develop, let alone along with this word *sustainably*. Put a handful of dried beans in front of a starving person and watch to see if he will plant them or throw them in the pot to cook. The difference is between a meal in half an hour or half a year. Or give a farmer the option to kill all the insects that have been harming his crops, simply by apply a "safe" spray, and see what choice he makes. We live in a time when the increasingly desperate situations facing our worlds' populations are making these decisions painfully simple and, unfortunately, unsustainable.

One day, resting in the shade of his hut on the farm, I asked Bernardo to honestly tell me what he thought about his farming practices and the potential repercussions if the population grew to a size in which there would not be enough land to go around, a reality I have seen already affecting the neighboring comarca of the Ngobe Bugle. He responded that, "gracias a Dios," at the moment his people have the freedom to work the land as they please. In other words, things are fine now, lets not think about tomorrow. This is not to say that the Naso people or Bernardo are too simple-minded to reflect on the future consequences of their actions. On the contrary, as humans we are all wonderfully equipped with minds able to grasp cause and result, including the ability to manipulate the cause to receive the best results. However, when suddenly the causes are out of one's hands and the knowledge of the consequences is no longer local but external, the ability to think in a sustainable manner falters.

This is the basic problem I fear to be around the corner for the Naso communities. The people with whom I spoke feel strongly for their right and need for a comarca to protect their lives and cultures in the face Panamanian politics, hydrological dams, and the numerous other mounting pressures knocking on their doors. The formation of a comarca may indeed be the most important step for their immediate future, but it is definitely not the ultimate protective measure. One can build a castle and install the king and council, but if the maintenance of the moat or the threats of the more powerful surrounding kingdoms are overlooked, then that castle becomes nothing but a symbol.

Local food security is arguably the most important necessity for the poor and rural populations on our planet. But when local subsistence practices are threatened by modern pressures or abandoned in pursue of income generating economies, the most basic components of peoples' lives – the growth of their food and the conservation of their sources of water – become of secondary importance. This is not to say that rural farmers should not be making an effort to secure an income aside from their basic subsistence needs. Education, medical care, and a desire for a higher standard of living are realities of the modern world, all of which require money. But the push for income must not sacrifice

the consumption needs of the people or ecological integrity of the land (Altieri 2003). The loss of such an ecological foundation and its biodiversity are permanent. A farmer can now send his children to primary school, have a new roof over his head, and maybe even a television blaring under that roof, but he may also suddenly find himself surrounding by an environmentally degraded landscape and out of a job. Obviously this ecological loss has drastic implications for the health of the environment and people, but often overlooked is the effect these changes have on the cultural knowledge and traditions wrapped up in what is being lost.

Conservation of the farmer's management of biodiversity in the Naso-Teribe, as Antonio Sánchez articulates in the traditional stories surrounding his varieties of corn, is the key to the long-term preservation of Naso culture. As Antonio makes clear, the two cannot be separated. Culture is much more than dances and handicrafts; culture is also the way in which people interact with their environments. First and foremost this implies balancing their basic subsistence needs with the resource base that supports them.

It is important to recognize that the agroecological knowledge and practices of the Naso people are more complicated than this short study has even come close to revealing. Shifting agriculture and corn diversity are important elements but nowhere near the extent of what is involved in the functioning of these systems. Despite the brevity of this investigation, however, the fact that the Naso farmers have managed their agricultural systems for hundreds of years is inarguable. This is not to say that the Naso have all the knowledge they will need to handle the new types of outside influences and internal changes that they will have to face. They are, however, the keepers of a foundation of local ecological wisdom that cannot be denied nor should be overlooked when approaching the management of the new changes arriving. If the Naso have any hope of retaining their culture, their forests, and their ability to provide food for themselves and future generations, they – along with the whole of Panama and the international community – must recognize the value in their traditional agroecological knowledge.

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Appendixes:

1.Original Research Question and Methods

How do Naso farmers manage, maintain, and preserve the biodiversity of their traditional agroecological systems in the face of change?

Research Objectives:

- To document the diversity of plants and resources used
- To document the practices of the Naso farmers to maintain this diversity
- To include the opinions and attitudes of the Naso farmers toward their traditional practices

Methods:

Unstructured Interviews with farmers in their fields/forests – I believe that the most effective way to learn from these farmers in terms of what resources they use and how they maintain their agroecosystems is to spend time with them where they work and ask them a rough set of questions that naturally arise in such a context. In that way I will be able to document the diversity of plants while also allowing the person interviewed to discuss what is important and pertinent to him.

-Semi-Structured Interviews with leaders in the community and development organizations working with the Naso – This method is more appropriate for these subjects and a potentially important perspective for finding the sources of outside pressures on the Naso.

-Participant Observation – This method involves traveling to the mountains and farmland and spending time helping with the cultivation while also allowing myself the opportunity to step back to observe the practices and take notes on the agroecosystems. I have chosen this method because not only do I love farming and want the opportunity to learn first-hand from the Naso farmers, but I believe this show of true interest and passion for working the land on my part, has the potential to open the farmers up to feeling comfortable talking about their beliefs and opinions.

2. Annotated Bibliography

Altieri, Miguel A. "Agroecology: the science of natural resource management for poor farmers in marginal environments." Agriculture, Ecosystems, and the Environment. Volume 93, Issues 1-3, Dec 2002, pp. 1-24

Altieri defines agroecology, citing it as the concept able to provide scientific basis in addressing the functions of biodiverse agroecosystems. Most agroecosystems are managed by poor farmers in marginal areas and contain variable and diverse farm conditions. The practices of these resource-poor but knowledge-rich farmers that

"promote biodiversity, thrive without agrochemicals, and sustain year-round yields," offer a promising model for modern developmental management strategies. To take advantage of traditional knowledge, and to ensure the sustainability of such systems, there needs to be a shift in current research that focuses on purely improving agricultural yields. This requires integrative studies that involve the ecological knowledge and needs of the farmers and accounts for the constraints of the local environment. Altieri presents agroecology as the fundamental scientific basis for how to "study, design, and manage agroecosystems that are both productive and natural resource conserving, and that are also culturally sensitive, socially just and economically viable." The article also illuminated the challenging topics for agroecological research including mimicking nature, understanding multi-species agroecosystems, vegetational diversity and pest out-breaks, and assessing the sustainability of agroecological systems.

Altieri MA and MK Anderson. "Peasant Farming Systems, Agricultural Modernization, and the Consevation of Crop Genetic Resources in Latin America." In: Fielder PL and SK Jains, (eds.) Conservation Biology: The Theory and Practice of Nature Preservation and Management. Chapman and Hall, NY. 1992. pp 49-64.

The article provides a description of the effects of agricultural modernization and environmental degradation on crop genetic diversity in peasant farming systems. It also suggests that research is needed to document farmers knowledge and integrate it with western scientific knowledge as a way to design successful and sustainable crop genetic conservation strategies. In addition to a description of why native crop diversity is crucial for developing countries and why it is threatened, Altieri highlights the socioeconomic, agroecological, and ethnoecological features of traditional farming systems.

Altieri, Miguel A. "The ecological role of biodiversity in agroecosystems." Agriculture, Ecosystems, and the Environment. Volume 73, 1999, pp. 19-31

In this paper Altieri focuses on the values and functions of biodiversity in natural and agricultural ecological systems as contrasted with modern agriculture low in diversity and dependent of few varieties of crops. He also provides details of the characteristics of agroecosystems that support biodiversity, the multiple roles this biodiversity plays in the functioning of systems, and how farmers´ management factors into the equation. Insect pest management is expanded upon as a method for examining the functions of biodiversity.

Altieri, Miguel A. "The Lessons of the Past." SlowArk. January 2003, issue 35

This article by Altieri addresses the importance of traditional farming systems (and the cultures that nurture them) which are being threatened by external economic forces. This article is a call for politicians and agricultural developmentalists to recognize the complexity and knowledge of traditional systems (and cultures) as a method for developing more sustainable agroecosystems and biodiversity conservation strategies. This includes the potential for the dual advantages for both developing and industrial countries.

Eyzaguirre, Pablo B. and Olga F. Linares (eds.) Home Gardens and Agrobiodiversity. Smithsonian Books. USA. 2004.

This book concentrates on the conservation and sustainable use of agrobiodiversity in homegardens. It includes associated case-studies highlighting different aspects of the management of agrobiodiversity and the modern forces affecting the sustainability of such systems. These studies are compiled by the author in order to contribute to the understanding of the "interactions that exist between ecological, socioeconomic, and cultural processes," and to show the valuable role this understanding can play in rural development efforts. The introduction also includes helpful commentary on the definition and functions of biodiversity in ecosystems and the implications of this structural complexity for agroecosystems.

Garcia-Barrios, Luis. "Plant-Plant Interactions in Tropical Agriculture." In: Vandermeer, John H (ed.) Tropical Agroecosystems. CRC Press, New York. 2003

This paper is a general recommendation for further study of plant interactions in order to increase ecological sustainability in tropical agriculture. Garcia-Barrios highlights the obvious conclusion that preserving and promoting plant diversity is an important (and most available) effort in maintaining and improving upon sustainability in tropical agriculture, but warns of the often over-generalized promotion of biodiversity as the ultimate sustainability strategy. Recommendations are made for further investigation into evaluating the types of complex interactions within multispecies ecosystems.

Gari, Josep A. "Biodiversity and Indigenous Agroecology in Amazonia: The Indigenous Peoples of Pastaza." Etnoecologia. Volume.5, Number 7, 2001 pp 21-37

This is a rather redundant paper making the connection between indigenous culture and biodiversity. The author uses his research with the Pastaza people of Western Amazonia as the case study. The paper is interesting in terms of overall structure (including introduction to indigenous people, ecosystem management, and the diversity of cultivations), however he uses the word "biodiversity" at least once in every sentence. He makes the conclusion that indigenous agroecologies are crucial forces for the "ecological integrity, food security, and well-being of poor and marginalized communities inhabiting megabiodiversity centers," but lacks the information to back up this statement. Includes Agrobiodiversity table with Spanish/English/Latin names of crops used.

Gliessman, Stephen and Robert Grantham. "Agroecology: Reshaping Agricultural Development." In: Head, s. And R. Heinzman (eds.) Lesson of the Rainforest. Sierra Club Books, San Francisco, 1990, pp. 196-207.

This is an introduction to agricultural systems as ecosystems. Begins with basic failures of modern agriculture and continues on to define and discuss the alternative agroecological approach. He raises the issue of how traditional knowledge needs to become available to development planners and therefore "legitimized by science." He challenges the current "cash-crop agro-export model" of the tropics by discussing the

characteristics of sustainable agroecosystems and the implications of the study of these characteristic for future development policies.

Kricher, John. "Living Off the Land in the Tropics." A Neotropical Companion. Princeton University Press, New Jersey, USA. 1997 pp 168-187.

Kricher provides an overall examination of the history and practices of tropical agriculture. Implications of the practices farmers face with managing nutrient-poor rainforest soils are addressed. This chapter also provides a description of swidden (also known as slash-and-burn) agriculture as the main practice in the tropics, the effect this technique has on soil quality, and the connection it has to ecological succession. The chapter ends with a description of the major crops of the neotropical region.

McNeety, Jeffrey A. "Biodiversity Conservation and Traditional Agroecosystems." In: Saunier, Richard E. and Richard A. Meganck (eds.) Conservation of Biodiversity and the New Regional Planning. 1995

This introduction to a textbook highlights that not only "wild" areas but human-managed ecosystems contain an important part of global biodiversity. The recognition of this basic fact has significant implications for conservation efforts. If existing traditional systems are respected and seen as part of an overall system of conservation-oriented management, "traditional farming can continue to be a meaningful part of the total agricultural productivity of a region" as well as "contribute to the conservation of its biodiversity." McNeety also highlights the difference between "protection" of wild areas and the long-term conservation of an area that includes a basic recognition of the farming system and the accumulated knowledge that goes along with it.

Picone, Chris. "Managing Mycorrhizae for Sustainable Agriculture in the Tropics." In: Vandermeer, John H (ed.) Tropical Agroecosystems. CRC Press, New York. 2003

Picone´s extensive research on tropic soils brings him to comment that certain traditional techniques used in native systems manage to maintain productivity even on poor soils. He contrasts this to modern agricultural techniques used on these same soils that degrade the health of the system within a few years. He concludes that the key to sustainable agriculture is learning to "mimic and incorporate biological mechanisms found in natural systems," as a way to handle the nutrient-poor soils of the tropics.

Perfecto, Ivette and Inge Armbrecht. "The Coffee Agroecosystem in the Neotropics: Combining Ecological and Economic Goals." In: Vandermeer, John H (ed.) Tropical Agroecosystems. CRC Press, New York. 2003

This article discusses the struggle between policy makers, economist, and conservationists to balance economic development with environmental conservation. Using a system of coffee production that takes advantage of a diversity of shade trees, the authors present an example of a win-win situation in which, "generating economic benefits, conserving biodiversity, and enhancing the livelihoods of small producers" are

all included. This study has implications for combining economic and conservation goals in Latin America

Rome, Abigail. "Expanding Ecoturism Opportunities for the Naso People of Northern Panama." In Focus. April 2004.
http://www.cepf.net/xp/cepf/news/in_focus/2004/april_features.xml

Rome explores the current Wekso lodge eco-tourism venture and the challenges the Naso face to maintain it. She writes that the Wekso Ecolodge gives tourists the "opportunity to experience the vast biodiversity and cultural diversity of the rainforest while also contributing to its conservation." She also clarifies the associations between ODESEN (Organización para el Desarrollo Ecoturistico Naso) and Critical Ecosystem Partnership Fund (CEPF), Conservation International (CI), Autoridad Nacional de Ambiente (ANAM), and the Asociación de Médicos Tradicionales Naso (ASOMETRAN). This article is general but provides a view, albeit over-simplified, of the dynamics between finding ways to generate income from the forest while still conserving it.

Thrupp, Lori Ann. "Linking Agricultural Biodiversity and Food Security: the Valuable Role of Agrobiodiversity for Sustainable Agriculture." International Affairs. Volume 76, Number 2, April 2000, pp. 283-297

Thrupp makes the general connection between agricultural biodiversity and the worlds local and global food security. She compares the conflicting agricultural policies that promote "monocultural industrial farming models and uniform technology packages" to management strategies that build upon local knowledge and experience of traditional practices (combined with recent scientific agroecological studies).

Vandermeer, John H (ed.) Tropical Agroecosystems. CRC Press, New York. 2003

It is the commonly held belief that tropical agriculture is at odds with conservation goals, and therefore farmers and conservationists are in competition for the limited land available. Vandermeer calls for a rethinking of this dualism with the introduction of an agroecological approach to viewing and researching tropical agriculture. He discusses the nature of ecological knowledge as made up of both the local intimate knowledge of farmers and the scientific knowledge of ecological principles. Both are types of knowledge are needed in order to create agricultural development that provides food for people while taking the local ecological realities into account.