

INDIGENOUS AND MESTIZO SETTLEMENTS IN NICARAGUA'S BOSAWAS RESERVE: the Prospects for Sustainability

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INTRODUCTION

The question of sustainability among forest agriculturalists has been a topic of debate since Ruthenberg (1957) in his groundbreaking comparative study of tropical farming systems and identified fallow length as a key variable. Since then, in studying the effects of the interaction of population, soils, crops, on African swidden systems. Hecht & Posey 1989; Salick 1989, Johnson 1983, 1989, Smole 1989), a fact which has led researchers recently to amply documented that variability in swiddens is the norm rather than the exception (cf. Stocks 1983; Gross 1983; Hecht & Posey 1989; Salick 1989, Johnson 1983, 1989, Smole 1989), a fact which has led researchers recently to begin thinking about the respective roles that adaptation to ecological variables, market economics, and culture play in structuring the variability (Irvine & Durham 1998). Gordon Conway (1973) has argued that variability in smallholder farming systems is also a function of livelihood strategy which itself is often linked to land and tenure considerations. This paper will argue that livelihood strategy in the Bosawas International Biosphere Reserve plays a major role in structuring the differences between mestizo agriculture and indigenous agriculture in the region. Particularly significant is the interplay of cultural values, insecure land tenure, and the lack of jobs that make deforestation for speculation a feasible practice on the frontier for mestizos.

Today, no one seriously denies that the spreading agricultural colonist frontier in the humid tropics can be a threat to ecosystems that provide its context (Schumann & Partridge 1989; Little & Horowitz 1987). Agricultural systems affect natural ecosystems with which they interact in three significant ways (Carroll 1990):

1. Fragmentation of ecosystems may upset important ecological linkages between natural ecosystems such as the linkages between hilly areas and wetlands.
2. Fragmentation increases boundary phenomena where natural ecosystems intersect patchy agricultural growth, thus multiplying the negative effects of such phenomena on natural stands.
3. Remaining patches of natural ecosystems become increasingly distant from each other and begin to behave ecologically like islands, contributing to the process of local

and begin to behave ecologically like islands, contributing to the process of local extinction.

However, there have been at least a few relatively successful experiments and methods employed that have allowed peasant farmers to make a sustainable living on smaller pieces of ground, thereby making the damage to ecosystems less extensive and the advance of the agricultural frontier less breakneck. The wide-spread velvet technology and farmer to farmer extension employed by World Neighbors and a host of copycat "green agriculture" NGOs in Central America is a good example (Bunch 1982). The agriculture of most peasant smallholders on the frontier, however, continues to be land extensive and follows the three-stage conversion sequence of forest to pasture. These patterns, it will be argued in this paper, are not ecologically sustainable and sharply distinguish themselves from indigenous agriculture.

How much disturbance of this kind can be suffered by ecosystems such as the humid subtropical forests of the Bosawas International Biosphere Reserve and still permit the reserve to sustain its critical function in conserving habitat for the varied flora and fauna of the area is an open question. The absolute size needed for tropical forests to sustain themselves remains a subject of debate, but everyone agrees that the larger the area, the better chance of resisting perturbations.

The paper will compare three manifestations of agriculture within the Bosawas Reserve - two separate indigenous groups (Miskito and Mayangna) plus mestizo colonists of the southwestern part of the reserve - and will evaluate them in terms of sustainability. It will argue that over the longer term without major external interventions, mestizo agricultural patterns will destroy the Bosawas forests, while indigenous agriculture tends to be sustainable. It will also argue that indigenous residents fully understand the implications of mestizo settlement and have rationally adjusted their goals to defending their own livelihoods and forests from the agricultural frontier through demarcation, land zoning, organizational strengthening, management planning, and indigenous resource rangers who, among other things, patrol demarcated lines. Recently indigenous people have designated a large area in the center of the reserve as the "Waula Conservation Zone" and are beginning to organize its defense.

THE BOSAWAS INTERNATIONAL BIOSPHERE RESERVE

The Contra War of the 1980s was particularly difficult for indigenous people in the Atlantic regions, but, as Nietschmann (1990) has pointed out, it was somewhat providential for the native flora and fauna of the region. After a campaign of armed resistance to Sandinista social and economic programs on the east coast, the Sandinista government, in 1986, negotiated two large autonomous regions on the Atlantic coast, one northern region (R.A.P.) dominated politically (at least for the present) by the Miskito indigenous group, and one southern region (R.A.P.) dominated by the English-speaking black creole population. These areas became the focus for conservation efforts after the election of Violeta Chamorro. Three large "reserves" were created by decree by 1991, the SI-A-PANAMA along the Costa Rican border, the Miskito Keys Reserve along the North Atlantic coast and offshore keys, and the Bosawas reserve in the north-central part of the country. The Bosawas Natural Reserve (now the Bosawas International Biosphere Reserve), lies in the mountainous area of the middle Coco River and its southern affluents, the Waula River, the Lakus River, and the Bocay River (see Map - The Bosawas Reserve). At 750,000 ha., it is the largest conservation block in Nicaragua, occupying nearly 7% of the national territory and, with the contiguous block of forest in Honduras, constitutes the largest stand of subtropical humid forest in Central America. With the creation of these three reserves, the Nicaraguan government radically increased the amount of national land under protection from approximately 174,000 ha. in 1989 to 1,554,000 ha. in 1991. At this point nearly 12% of the national lands

approximately 174,000 ha. in 1989 to 1,554,000 ha. in 1991. At this point nearly 12% of the national lands are biological reserves of one kind or another.

The BOSAWAS Natural Resources Reserve was created by Executive Decree 44-91 in November of 1991 during the installation of newly-elected President Violeta Chamorro. BOSAWAS's purpose, as established in the decree, is twofold: (1) to conserve the flora and fauna of the region through the sustainable management of resources and (2) to protect the resources and the cultural heritage of the indigenous groups in the area. The category of Natural Resources Reserve has no parallel and no normative laws in Nicaragua, although the later model of a biosphere reserve was suggested. The fact that the reserve contains a national park and overlaps a large part of an already legalized Mayangna (Sumo) communal landholding (the community of Sikilta- titled by the Sandinista government in 1987) as well as a large area of land claimed by Miskito and Mayangna people under the argument of historical right. It is the homeland of the existing Mayangna Indians and is occupied directly or used by 13% of Nicaragua's Miskito Indians.

Recontras and Mestizo Farmers

In the wake of the Contra War of the 1980s, the nation is faced with the land claims of both ex-Contra and Sandinista former combatants. In 1990, politicians saw Nicaragua's north-central region as one possible solution to multiple problems that have plagued the country as the relocation of families of ex-soldiers is attempted on lands already occupied by groups of armed farmers or on lands which had been claimed by previous owner. In the north, politicians who are little interested in the indigenous residents, the north-central rivers and forests were appropriated for settlements and seem ripe for colonization. Plans were hatched early in 1990 to locate ex-combatants at the fringes of the forest in communities called "development poles" on the fringes of what is now Bosawas. The new communities of Ayapal, Waslala, and San José (a.k.a Hormiguero) have become major sources of invasion into the south of the BOSAWAS reserve and the older communities of Siuna, Bonanza, Rosita, San José de Bocay, and Waspitán continue to be staging bases for colonization of the agricultural frontier. To make matters worse, the land around the central Bocay and the upper Coco Rivers is the stopping grounds of Nicaragua's former "Re-Contra" guerrillas. The Siuna area houses the Sandinist Re-Compa (FUAC) guerrilla. In a practical as well as a kinship sense the Re-Compa are just another face of the land invasions of Bosawas, a heavily armed face. While they violate the human rights of indigenous people on a daily basis, their own rights are protected by a powerful international coalition of interests which includes the Organization of American States, a Catholic Cardinal, and Jesse Helms' foreign affairs committee.

The Creation of the Bosawas Reserve

The reserve was created virtually overnight with little political preparation and no consultation of local indigenous and non-indigenous people of the area. The historic residents of Bosawas (Mayangna and Miskito indigenous groups) had been forced to leave during the war along with various small and large landholders. In 1991, they had only been allowed to reinhabit their former villages. They were informed after the fact that they now lived within or near a "national reserve," moreover a reserve that began with restrictive land-use policies that were poorly thought out, poorly communicated, and totally unenforced. Thus a reserve that was supposed to protect their resource tenure was as threatening it. This situation was not improved when, in 1998, the reserve became part of the larger Bosawas International Biosphere Reserve, again totally without consultation with its indigenous residents.

The status of International Biosphere Reserve triggered a number of high-level planning processes which are top-down exercises clothed in the rhetoric of participation. Thus, the indigenous residents of Bosawas have been highly motivated to organize and document their land claims. A project executed by The Nature Conservancy

highly motivated to organize and document their land claims. A project executed by The Nature Conservancy in cooperation with USAID has been helping them do just that. The mapping and documentation process has been fed into a zoning process and the gradual development of indigenous management plans and indigenous forest guards. These will be discussed below.

The Stage is Set

The above description of Bosawas' political and institutional context serves as a backdrop for the following discussion of the characteristics of the farming in three populations, Miskitu, Mayangna, and mestizo. The mestizo population swept over the southwest portion of the reserve since 1990 and has almost completely deforested some watersheds. In 1997 it was reported by a mestizo organization that there were no more "invasions" in Bosawas, and hadn't occurred for several years. In the invaded area, all land transfers are through the informal land market. There are, however, continuing invasions into the indigenous territories although the spread of the agricultural frontier has been nearly stopped in some areas by indigenous demarcation and patrols. Since 1996, all five indigenous territories have been demarcated along the fronts most susceptible to invasion and groups of volunteer forest rangers patrol these fronts at two month intervals. These post-war invasions of Bosawas by Spanish-speaking colonists (indigenous people call them "Españoles") are perceived by Bosawas indigenous groups as threatening both habitat and cultural identity and they have made repeated requests to the government to repel the invaders or, at least, assist them to do so. However, the invasions have been perceived by the fledgling Bosawas administrative apparatus in far away Managua as impossible to halt and difficult to deflect. Only in one case, the area around the Saslaya National Park, has the government acted decisively with police and army troops, but without significant followup to consolidate the gains. The territory of Mayangna Sauni Bas (Sikilta) has recently had some assistance as well. It appears that the 1996 Land Reform has acquired some land in the biosphere's buffer zone to offer to colonists who have invaded Sikilta.

INDIGENOUS AND MESTIZO SETTLEMENT AND AGRICULTURE

Populations and Settlements

In 1998, the population within the originally designated boundaries of the Bosawas Reserve approaches 25,000, 48% mestizo and 52% indigenous. The mestizo population is recent and between 1991 and 1996 was growing at an amazing 17% each year counting natural fertility and immigration. The indigenous population grows only by natural fertility and I use a figure of 3.5%/year, based on partially-completed recent demographic work among the Miskitu in the Middle Coco. All populations tend to form along the river corridors and the various indigenous territories are essentially watershed units as follows:

- Mayangna Sauni As Waspuk River and Affluents
- Mayangna Sauni Bu Bocay River and Affluents
- Mayangna Sauni Bas (Sikilta) Uli River and Affluents
- Miskitu Indian Tasbaika Kum Upper Coco River and Affluents
- Kipla Sait Tasbaika Middle Coco River, Lakus River
- Mestizo Comarcas Upper Coco River, Middle Bocay River

Table 1
Population, Settlements, and Settlement Size

Population, Settlements, and Settlement Size

Ethnic Group	Projected 1998	# of Settlements	Average Size
Mestizo	12,248*	33	371
Miskitu	7,147**	19	351
Mayangna	6,029**	23	245
Total	25,424	75	339

*1980 population estimate, **1980 population estimate plus 3.5% annual growth rate through 1998. Source: Census of the Iyas River area.

**3.5% growth counting natural fertility only

Settlement size in the indigenous groups tends to reflect the availability of river terrace land for cropping, the all-important bean crop. When one has to walk more than two hours to plant a terrace or riverbank crop, a community will tend to form. In terms of settlement pattern, there is a notable tendency for the Mayangna to settle themselves more evenly over the landscape in smaller communities. This tendency is also attested to in their oral histories. The mestizo settlement pattern reflects the tendency to live on one's "finca" so houses may be dispersed and each other and the community tends to spread over the hillier uplands.

The indigenous population is, from records on birthplace, nearly entirely from the Bosawas Reserve area or from the study area. Many of the younger people were born in Honduras during their time as refugees in the 1980s but their parents were born from the study area and they returned to it in 1991. The mestizo population, on the other hand, is 99.5% from Nicaragua or born in Honduras of parents from western Nicaragua. 59% of them are from the Jinotega department and have simply moved north to the Bosawas area as land became scarce in Jinotega. 50% of the mestizo families report moving into Bosawas in search of better land for agriculture and pastures. The other 50% were repatriated to the zone or came because family members were already in the reserve. If we look at the process of mestizo migration in five year periods, the data are the following:

Table 2 Mestizo Migration into Bosawas in 5-year Increments

1976-1980	191	9.66	38.2
1981-1985	167	8.45	33.4
1986-1990	164	8.30	32.8
1991-1996	1346	68.08	224.3
Total	1977	100.00	

Land Tenure: "fincas" and "trabajos"

Whereas mestizos often refer to their "fincas," a physically bounded space symbolized by a document, indigenous people often refer to their "trabajos" whose boundaries are culturally defined as a visible labor investment maintained by social interaction. 71% of the mestizo families consider themselves "owners" of the land they farm (called "finca") and original "owners" achieved "ownership" by clearing lanes in the forest and systematically clearing within those boundaries. Significantly, most of the "owners" paid someone, either a prior "owner" or an indigenous family, for the right to put in their own boundaries and 79% of them have some informal transfer document related to their rights to land. In Jinotega, shyster lawyers abound who, despite the location of the claim in a national park area in which land titles are theoretically illegal, record these claims as "titulos supletorios" which can, after a certain period, be registered as legitimate land titles. In some areas the cleared lanes (carriles) cross and re-cross each other and purchased rights must be defended in order to be maintained. The remaining 29% of the families have not been able to establish a claim. Some are losers in the struggle for land and some acquire rights to rent, borrow, or share with an existing landholder.

Indigenous farmers, on the other hand, operate under a system of usufruct within the framework of common land resources. Individual families have long-established areas in which they work and new families who cannot be accommodated within the family area are assigned land by village authorities. Usufruct rights are often bought and sold informally, but if a family moves away and a piece of fallow land is not worked within a decade, most people believe someone else may take it over. As long as one's "work" [trabajo] is visible, however, one may assert a claim even in an extended absence. Paper rights play only a minor role in the indigenous world; the rights of individuals are maintained through family connections and maintained by social interaction.

Land Use Patterns

Both mestizo and indigenous farmers can refer to the areas of their activities as "parcels" or "fincas" even though they may mean different things by them. The mestizo finca includes everything within the demarcated lanes whether or not "work" has been applied to it. The "work" of enclosing it is sufficient to establish the claim. Therefore the individual parcel claims of mestizos are considerably larger than those of indigenous people and there is, at this point, a forest remnant of 75% of the total area claimed as part of the average finca, as Table 3 indicates.

Within lands that have "work" invested, mestizo and indigenous agricultural patterns differ sharply. Taking indigenous and Miskitu crops together as "indigenous cropping", indigenous people have 79% more land per household devoted to crops than mestizos (mostly due to indigenous banana cropping - See Table 4). Whereas indigenous people have 10 times as much land devoted to pastures (nearly all pastures are communal and in, or adjacent to, towns), mestizo households have 10 times as much pasture per household. Mestizos have an average of 1 cow per household whereas only one

10 times as much pasture per household. Mestizos have an average of 1 cow per household whereas only one indigenous household in 7 has a cow. Stocking ratios are also telling. Mestizos have 5699 hectares of pasture per household (.32 cows/hectare) while indigenous people have 423 hectares of mainly communal pasture with 277 cows/hectare). One could easily argue that mestizo deforestation for pastures is not driven by the quantity of land that need pasture, but rather by the need to deforest land in order to claim it. This analysis is supported by the mestizo perception that land in forest is "lazy" [perezosa] and that forested lands [tierra de nadie] put them in a state of conflicting claims.

Another sharp contrast between mestizo and indigenous land use comes in fallowing patterns. Mestizos have less land per household in fallow than indigenous households. This pattern reflects an observed trend among mestizo farmers to convert land from crops to pasture after soil fertility is exhausted, especially in lands away from the river terraces. Unfortunately, we do not have data on the relative proportions of river terrace land and highlands used for agriculture, but a common perception of observers is that mestizo farmers are much more likely than indigenous farmers to farm off the floodplain for purposes of eventually converting these highlands to pasture.

Table 3
Mestizo and Indigenous Land Uses***

Ethnic Group	Total Hectares* Claimed as "Property"	"Property" per Household	Total Land in Crops (has.)	Land in Crops per Household	Total Land in Pastures (has.)	Land in Pastures per Household	Total Land in Fallow (has.)	Land in Fallow per Household
Mestizo	122,832	62.13	5,108	2.58	5,699	2.88	19,511	9.87
Miskitu	19,978	18.69	4,390	4.25	248	0.24	15,229	14.76
Mayangna	14,634	18.20	4,001	4.98	175	0.22	10,478	13.01
Totals	157,444	41.29	13,499	3.54	6,122	1.60	45,218	11.86

* Data from Mestizos were taken in manzanas and converted to hectares calculating the manzana as .65 ha.

** This category applies only to mestizos whose concept of holding land includes the forests inside their "property" even though they have not applied "work" to them.

*** "n"s for households are: Mestizo = 1977; Miskitu = 1032; Mayangna = 804

Cropping Patterns

When farming practices at the level of specific crops are analyzed, most of the difference between mestizo and indigenous farmers in the size of the active cropping area (an average of 4.54 has. for indigenous households opposed to 2.58 hectares for mestizo households) is in the indigenous investment in perennial subsistence crops, principally bananas. Nearly 50% of indigenous land use is in highly sustainable perennials. Indigenous annual

principally bananas. Nearly 50% of indigenous land use is in highly sustainable perennials. Indigenous agriculture also have a notable component of manioc, a very minor crop in mestizo agriculture. Mestizo agriculture is characterized as soil exhaustive and grain oriented in that over 99% of the cropped area is in grains, 70% of Miskitu grain agriculture is more balanced in terms of production and tends to emphasize rice with 68% of production in that crop. The data we have on Mayangna grain agriculture is weighted towards corn, but much less than mestizo agriculture with 48% of the grain production in that crop. As the data are mainly from Mayangna of the Bocay River (see note in table), it could be argued that the Mayangna are responding to the market phenomena as the mestizos, a market in which corn is the main cash crop, although they are preserving traditional balances between grain, root, and perennial crops.

One phenomenon sharply distinguishes mestizo and indigenous practice with regard to bean production and its implication for sustainability. Most indigenous agriculturalists produce beans only once each year and do so in water in lands that have annual alluvial deposits. Mestizos report planting beans twice and sometimes three times a year, usually mixed with the corn milpas in the higher ground off the floodplains. Table 4 shows the relationship between bananas and other crops in terms of land coverage whereas Table 5 shows the annual production of different crops. The last year we have data..

Table 4
Crops in Year of Study (hectares per household)

Ethnic Group	Bananas and Plantains	All Other Crops
Mestizo	not enough to report	2.58
Miskitu	2.08	2.17
Mayangna	2.34	2.64

Table 5
Annual Grain Production (quintales [100 sacks])

Ethnic Group	Corn (qq)	qq Corn per household	Beans (qq)	qq Beans per household	Rice (qq)	qq Rice per household
Mestizo	63,461	32.10	17,890	9.18 **	13,617	6.89
Miskitu	6,995	6.78	9,135	8.85	35,026	33.93
Mayangna*	8,006	19.34	2,176	5.25	6,420	15.51

* We do not have the gross production data for Mayangna Sauni As. Therefore the per household data are for the other two Mayangna Territories

** The "n" for mestizo households in which bean production was gathered is only 1950

DISCUSSION AND CONCLUSIONS

Questions of Sustainability - Mestizo Agriculture

The patterns of mestizo agriculture identified in the above data are not sustainable on their current resource base. Because of the expansive nature of mestizo agriculture, the mestizo populations also pose a major threat to the habitat, floral associations, and ecological processes of the reserve. This implies that they must either be contained, or their agricultural activities prohibited; otherwise the Bosawas International Biosphere Reserve ultimately not meet its overall objectives. Some important sustainability issues of mestizo agricultural practices are summed up in four points:

1. Landholding and Settlement Pattern: All land within the mestizo areas is claimed within individual "finca". Individuals live on the fincas they claim and there is a marked tendency toward dispersal. There is no planning for conservation of the resource base, even water sources, at supra-individual levels. Although the mestizo claim 75% forested, the loss of 25% of the forest over an extension of 1500 km² has taken place in seven years. . . of mestizo deforestation in individually held parcels means that, without community planning, the remaining forest will increasingly be fragmented into small individually-held patches with all of the negative effects mentioned in the introduction to this paper, damage to ecological linkages between neighboring ecosystems, edge effects on remaining forests, and the creation of small islands with accompanying hastening of local extinction.

2. The Areas Farmed: Mestizo agriculture is moving away from the river terraces where farming is easiest to the uplands. The clearing of forests on steeper slopes in large patches and the establishment of pastures will ultimately severely degrade the resource base (Hecht 1984) unless permanent tree crops are the objective which is not the case. The objective is the establishment of pastures

3. The Nature of the Crops: Mestizo crop choices might be characterized as generally commercially oriented and inappropriate for steep slopes and poor soils: Mestizo agriculture, concentrating as it does, on corn and beans, a major cash crop, exhausts soils rapidly. Without fairly long fallow periods, corn farming cannot be sustained on hilly slopes where mestizos are planting it. Corn planting now takes place in three agricultural cycles each year, accompanied by beans. To maintain soil fertility it is necessary to deforest new lands. While manioc does well on poorer soils and provides some soil cover, mestizo farmers seem relatively uninterested in it, probably because of difficulties in marketing manioc in remote areas. Rice farming is also increasingly moving away from the river valleys and fallows to the uplands where it will also require long fallow periods. There is no emphasis in mestizo agriculture on perennial crops or tree crops that might protect soils.

4. Fallow Practices and Pastures:: Mestizo agriculture tends to follow this sequence: forest → crop → pasture. At present 64% of all cleared lands are in some stage of secondary forest fallow (13% less than indigenous agricultural lands), the amount of fallow is diminishing as lands are converted to pastures. The overall practices of mestizo agriculture are less adjusted to the nature of the ecosystem than they are to issues such as the need for immediate cash and the necessity of clearing land and maintaining it cleared in order to claim it as property and to eventual sale. Cleared land is counted as "improvement" and "improved" land sells for much more than forested land. Mestizo stocking ratios tell us that the creation of pasture lands is proceeding well in advance of any demand placed on the numbers of cattle on the land.

numbers of cattle on the land.

Questions of Sustainability - Indigenous Agriculture

Miskitu and Mayangna agriculture differentiate mainly in the crops planted in the various ecosystems and microclimates of the reserve, as evidenced by the tendency of the Bocay River Mayangna to imitate mestizo farmers, emphasizing corn and beans over rice and beans as a cash crop. Given these differences, indigenous agriculture will still be taken as a type when we consider the similarities in the size of the agricultural parcel, the tendency to use river terraces, the emphasis on balance between perennial crops and grain crops, the tendency to maintain continuous forests rather than patches of forest, the lack of pastures in the uplands, and the high percentages (average 70%) of secondary forest fallows in the agricultural parcels.

Indigenous agriculture can be contrasted with mestizo agriculture along the same four dimensions used to describe mestizo practices.

1. Landholding and Settlement Patterns: Indigenous people claim as personal property through usufruct only the land that they work; they tend to live in communities and walk to their "work." This pattern implies a tendency for indigenous agriculture to form a ring around indigenous communities in which the forest is intervened and 75% of the land is in secondary forest fallow. A ring further out will be forested and will form a resource base for gathering and hunting. Once one arrives in the forest, the cover tends to be continuous. The "communal" nature of the forest makes simplifies land-use planning and communities can easily agree to protect water, soil, floral, and animal resources. Increasingly they have done so.

2. The Areas Farmed: Indigenous agriculture tends to be subsistence oriented and strongly emphasizes the riverbanks and riverbanks themselves, and except for rice cropping, there has been relatively little tendency to move into the primary forests of the hillier uplands. Indigenous lands taken as a whole have over 90% primary forest after 70 years of use, compared to the mestizo loss of 25% of the primary forest cover in only 7 years of occupation.

3. The Crops: In general, indigenous farmers strive for balance between grain, root, and perennial crops, and plant crops on appropriate soils. The alluvial soils of the floodplain are quite extensively used for bananas/plantains. Where low water, the riverbanks themselves are used for beans which tend to be an early dry season monocrop. While indigenous farmers of the Bocay River are moving corn inland from its usual site on the less humid terraces, and while intercropping corn with beans on inappropriate soils, the tendency is not nearly as strong as the mestizo practice. Manioc is extensively planted by indigenous people on poorer soils.

4. Fallow Practices and Pastures: Indigenous farmers of Bosawas often characterize their farming as sustainable. They point out that they farm their fallows over and over rather than converting them to pastures. Indigenous fallows in the reserve tend to be revisited at 5-7 year intervals and are not generally converted to pasture. Cattle generally graze on or very near the community and its river beaches. While this pattern may create a health problem within the community and has negative impacts for downstream communities in terms of river contamination, the cattle are generally in good condition and the forests are not riddled with pastures. Stocking ratios indicate that the expansion of indigenous agriculture is consistent with the number of indigenous cattle, given the fact that pasturing and many community activities take place in the same space.

The Sustainability of Bosawas as a Reserve

Sustainability has ecological, economic, and social aspects. I have argued that mestizo corn/bean upland agriculture cannot be ecologically sustained on its current soil base under existing technology. If true, this necessitates either steady conversion of new forests to agriculture or the evolution of an adequate fallow system. Under the present rate of deforestation, the mestizo lands will lack all but remnants of forest within two decades. Under the present state of mestizo agricultural evolution, forested land is still available on their fincas and cutting it down for eventual conversion to pasture contributes to both immediate cash goals through cash-cropping and occasional sales, and also to their ultimate livelihood goals of converting labor to cash through land speculation. Fallow management may be necessary for family subsistence but extensive fallows are inconsistent with the overall strategy. Thus, the forests on mestizo lands, without intervention, will inevitably be converted mainly to pasture. The ecological sustainability of mestizo agriculture is highly questionable and whose presence contributes nothing to the goals of the Bosawas Reserve. An evaluation of the ecological sustainability of mestizo farming inevitably must distinguish livelihood strategies from simple marketing strategies and highlight the expansive and speculative nature of mestizo agriculture.

The Nature Conservancy Project

The present federal managers of the reserve (MARENA - The Ministry of Environment and Natural Resources) deal with this central problem through regulation and control. Severe budget restrictions and political constraints make this option unreal. Nor are the various "green" development projects currently operating with the larger Biodiversity Conservation Program enough or focused enough to change the trajectory of forest destruction. Perhaps for this reason, MARENA in 1983 turned to a project proposed by The Nature Conservancy to identify indigenous land claims within the reserve and help develop indigenous institutions fully capable of participation in reserve management. While this paper does not have the place to fully describe these developments, I will comment on the implications of this project for the long-term sustainability of the Bosawas Reserve.

Logically, the survival of the forests of the Bosawas Reserve is intimately involved with the fate of the indigenous residents if present trends continue. The interplay of cultural values, insecure land tenure, and the lack of jobs make deforestation for speculation a feasible practice for mestizos cannot easily be deflected by regulation. The creation of secure land tenure, ecologically sustainable agriculture, system-maintaining social interaction and active indigenous defense make placing bets on the sustainability of indigenous management more likely, although not assured. In the case of indigenous territories covering nearly 80% of the reserve have demarcated their lands, have completed the process of zoning them,

[Map - Indigenous Land Use Zones]

and have elaborated norms for land and resource use and indigenous territories are represented by legalized indigenous societies; each has a representative on the Bosawas National Commission. The active patrolling of these territories boundaries by indigenous volunteer resource rangers has slowed the advance of the agricultural frontier. In the case of Sikilta (Mayangna Sauni Bas) the frontier's advance may be reversed through a productive interaction between indigenous defense and government intervention.

The Sikilta case shows us the way for Bosawas survival which involves two parallel lines of action, first continued support for the integrity of indigenous co-management in which government and indigenous roles are clear

support for the integrity of indigenous co-management in which government and indigenous roles are clear and in which each plays its part effectively. Second, the reserve must initiate community-wide resource use in the mestizo areas and integration of mestizo organizations into reserve management as a contribution toward the stabilization of mestizo occupation. This process must involve constant dialogue between mestizo and indigenous residents as one of the goals of such planning must be to stabilize the boundaries between them. The recognition of government of mestizo land and resource rights must be reciprocated by recognition of similar government on the part of mestizo communities. All development assistance to mestizo farmers in the reserve must be subject to progress on these goals

Is Bosawas itself sustainable? Potentially yes, but the main factors determining its sustainability in the large are institutional and political, not ecological or even, *sensu strictu*, economic at the micro level. The model of indigenous and eventually mestizo co-management being pioneered in Bosawas is a novel approach to the problem of sustainability and will bear watching.

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