

# Contrasting Resource Extraction Impacts and Benefits between Native and Migrant Forest Dwellers in Eastern Panama

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**Summary:** *Wounaan* Amerindians of Eastern Panama are in a bitter struggle with migrating *Colonos* over limited open-access territory to which neither party holds title. This study contrasts each group's natural resource extraction impacts (as measured by deforestation) as well as their extraction benefits (as measured by income). The *Wounaan* engage in diverse resource uses and realize a surface area deforestation of 35 times less per household (39 times per capita) than the *Colonos* who engage exclusively in raising livestock for income generation. Moreover, *Wounaan* income is 3 times greater per household (149 times per hectare) than the *Colonos*'.

Keywords: Natural Resource Extraction, Deforestation, Income, *Wounaan*, Eastern Panama, Central America.

## 1. THE PROBLEM

Finite resources coupled with a growing population are a recipe for fierce competition and violence (Martins, 1984 & 1990; Schmink & Wood, 1992; Almeida, 1990) as well as environmental deterioration, such as deforestation (Anderson et al., 2002). This problem becomes especially apparent if the resource at stake is a common good (Hardin, 1968) and different groups claim the right to use it without recognizing the validity of another group's claim of right. Researchers have shown, for example, that the absence of property rights causes environmental degradation and deforestation (Southgate, 1990; Hyde, Amacher & Magrath, 1996) as well as conflict and confrontation (Alston, Liebecap & Schneider, 1995 & 1996).

The presented case study showcases a microcosm of this common access resource problem by assessing the environmental and economic dimensions of the resource extraction of two groups: The *Wounaan*, Amerindian forest dwellers, and the *Colonos*, migrating Latinos who have built their livelihood on cattle ranching. Both are living in the lowland tropical rainforest of Eastern Panama and fighting over a particular piece of national land (La Prensa, 2004) to which neither party holds title.

In deciding whose claims to the territory should be validated, a myriad of rationales are brought to the table: cultural heritage, primacy, productivity, deforestation, sustainability, and conservation. Behind each of these concepts are different worldviews and potential sources for decision-makers facing the question of to whom to allocate the national land. It is the aim of this study to shed light on who uses the territory more destructively (i.e. deforests relatively more) and who uses the territory more productively (i.e. generates a relatively higher income from the ecosystem's resources).<sup>1</sup>

These two considerations are important pieces in solving the land tenure puzzle not only because they are pivotal concerns for Panama's future environmental and economic health, but also because they facilitate significant policy goals of the Panamanian government. Panama's Constitution stresses environmental protection when it states, "*The State and all the inhabitants of the national territory must foster a social and economic development to prevent pollution of the environment, maintain the ecological balance and avoid the destruction of ecosystems.*" (Article 115) The Constitution also highlights the importance of productivity of the land uses when it states, "*The proper use of agricultural land is a duty of the owner along with the community and is regulated by law in accordance with their ecologic conformity to avoid underutilization and reduction in potential productivity.*" (Article 121)

In Panama, the National Environmental Authority (ANAM) manages and regulates "*the natural production forest of Panama,*" and "*allocate[s] the resources to assure the economic viability of the national policy of the environment.*"<sup>2</sup> This study intends to supplement the evidence available to national agencies such as ANAM, NGO's, local and international advocacy groups and international organizations involved in the land allocation process.

## 2. Deforestation and Cattle Ranching

Excessive deforestation and land degradation in the Central American tropics has been ongoing for several decades (e.g. Achard et al., 2002; FAO, 2005). At a macro level, the deforestation process is catalyzed by a growing population in search of new means of survival in an environment that lacks enforced conservation policies (Barbier, Burgess & Folke, 1994; Cropper & Griffiths, 1994; Geist & Lambin, 2002). Cattle ranching in

particular is chosen as a profession by Latino migrants because (a) most are from relatively poor backgrounds and are seeking a livelihood from a limited set of alternatives (Nicholson, Blake & Lee 1995), and (b) because of the “myth of the cattle,” which convinces them that cattle ranching is a desirable and profitable career. At the end of the day,” *deforestation is not an evil plot, it is something we do on purpose in order to feed and house the six billion and growing human population.*” (Moore, 2000, read in Anderson et al., 2002).

The statistics of environmental destruction caused by deforestation and cattle ranching in Central America vary among authors. While the degree of deforestation caused by cattle ranching is debated, the connectedness itself is not. The general consensus, however, is that the major contribution to deforestation is agriculture (Amelung & Diel, 1992; Geist & Lambin 2002). Nicholson, Blake & Lee (1995) state that a “*substantial part*” of the tropical forest is cut for conversion to pasture and call it the dominant incentive for cutting forest. Hecht (1993) goes so far as to predict that most tropical lowland forest in Latin America will become pasture. Caviglia-Harris & Sills (2005) conclude that forest clearing is consistently associated with cattle ownership in the Brazilian Amazon.

Of all deforestation activities – *inter alia* extraction of valuable lumber, wood for fuel, and agriculture – cattle ranching is widely regarded to cause the most environmental damage. The reasons for the deleterious impact of pastoral-based grazing systems in the tropics are a combination of soil compaction, leaching of nutrients, and erosion (Greenwood & McKenzie, 2001; Ledec, 1992; Place, 1981). Buschenbacher (1986)

argues that soil fertility and lack of efficient infrastructure make it unlikely that conversion to pasture is economically viable. Yet, the forest-to-pasture conversion of the rainforest in eastern Panama continues (FAO, 2005).

The main reason for this trend is presumably the aforementioned “myth of the cattle” or *cultura del potrero* (culture of the pasture) (Heckadon-Moreno, 1984), as it is also called. This myth elevates cattle raising to more than just an economic undertaking; it is an expression of social prestige and makes one a *señorear* (i.e. to be a great *señor*) (Joly, 1986). In this worldview, the forest is an unproductive area that can be claimed by the settler who makes “good use” of it and at the same time “buys” status in the eyes of other Latinos. An additional motivation for cattle ranching is that cattle stocks can provide a vital insurance function to ranchers in the remote rainforest to protect against volatile times (Hecht, 1992; Faminow, 1998). As Caviglia-Harris & Sills (2005) put it: “Cattle may serve as stores of wealth and insurance for farmers who do not have access to bank accounts.”

### 3. RESEARCH SITE AND METHODOLOGY

#### *(a) Studied Groups, Study Site, and Methods*

Two groups (52 households) of the *Wounan* tribe, previously semi-nomadic forest-dwelling Amerindians, settled the occupied territory forty years ago (See Figure 1), and marked their territory with a boundary swatch (*trocha*), consisting of non-endemic bamboo and other poles.<sup>3</sup> The two groups live on the watersheds of two rivers: the Rio Hondo and the Rio Platanares, wherefrom the names of the villages Rio Hondo (28 households) and Platanares<sup>4</sup> (24 households) are derived. The communities can be

reached via ocean coastline and rivers from the closest port of Coquira with a three to eight hour boat ride, depending on the boat, motor and weather conditions.

The encroaching *Colonos*<sup>5</sup> (7 households) are permanent colonizers who have been entering *Wounaan* demarked territory of 11,430 hectares<sup>6</sup> (ha) over the last fifteen years and have clear-cut a total area of 350 ha (by January 2008) within the boundary of the *trocha*. This deforestation was produced by seven *Colonos* households who predominately use the land for cattle pasture. Violent confrontations have occurred between the two groups (La Prensa, 2004), to the point where it is dangerous at present to be affiliated with one group and cross paths with the other.

The author lived in the communities of Rio Hondo and Platanares from early May until the end of July in 2008. All data collection was done during that time, which involved hiking the 11,430 ha area – with one or two *Wounaan* guides present at all time – and interviewing community households. The interviews were finished within the first month and were complemented with subsequent *in-situ* observations. The principal objectives of this study were to: measure and compare the scale of deforestation caused by *Colonos* and *Wounaan* (Objective 1); and estimate and compare income from natural resources extracted by the *Wounaan* and the *Colonos* (Objective 2).

The income generated from the extraction of natural resources by indigenous communities and the Latino cattle ranchers, and the impact on ecosystems by deforestation was measured using the following techniques: (i) Semi-structured interviews of the *Wounaan* communities of Rio Hondo and Platanares, the *Colonos* in the area, slaughterhouse vendors, and art traders; (ii) Recording the personal accounts of the *Wounaan*; (iii) *In-situ* observations by the researcher in the field; (iv) GPS ground

tracking of the greater area and of the deforested parcels; (v) Gathering the accounting records and produce invoices from fisheries.

(i) *Interviews*

All interviews were conducted by the author under a voluntary participation scheme. Quantitative as well as qualitative questions were posed. The participation rate was 100% in the two communities of Rio Hondo (n = 28) and Platanares (n = 24), making the data collected not just a sample of the population but the true population. The interviews exploring the resource extraction strategies<sup>7</sup> and demographics of the *Wounaan* were conducted face-to-face in Spanish<sup>8</sup> with the head of the household, which was exclusively male. The presence of spouses (if existing) was required for the research. The rest of the “labor force” household members were also often present, which facilitated accuracy and reduced the perspective bias.

Interviews were conducted with two out of the seven *Colonos* living inside the *trocha* at the time of the study. A third household could not be interviewed due to a medical emergency and the remaining four had to be omitted due to hostility with the *Wounaan* or mistrust of the intentions of the author.<sup>9</sup> In order to boost the sample size, the author included three additional *campesinos* (*Colonos* peasants) living on the immediate outskirts of the *trocha* into the sample. The *campesinos*' grazing lands were directly adjacent to the outer perimeter of the *trocha* and their land-use practices did not differ from the *Colonos*'.<sup>10</sup> Hence, the total sample household number for *Colonos* was five (n = 5).

Three independent slaughterhouses in the surrounding area of Chepo were interviewed to determine the price paid for meat and to corroborate the reported figures

of the interviewed *Colonos*. Informal interviews were also conducted with local art buyers in the field and national and international art buyers, art traders and middlemen to corroborate the reported prices of the *Wounaan* and control for price-variations across time.

*(ii) & (iii) Personal Accounts and Participant Observations*

The author verified the data on resource extraction and sales that the tribe members revealed during interviews via *in-situ* observations. The livelihood strategies of the *Wounaan* were investigated in the villages, agriculture fields, forests, on the rivers and the ocean. A diary was kept, including detailed descriptions of novel findings and amendments to information collected at earlier stages of the field research. In case of discrepancies of survey data with on-site observations, additional interviews were conducted as needed to correct the reported data. Reported numbers in this study are the final product of this adjustment process.

*(iv) GPS*

GPS ground-tracking data was combined with ArcGIS software in order to determine the relative deforestation and land use of the two groups. The author walked the perimeter of every agricultural field of the *Wounaan* and Cameron Ellis, a consultant for *Native Future*,<sup>11</sup> walked all agricultural sites of the *Colonos* with a *Garmin GPS-60* device.<sup>12</sup>

*(v) Accounting Records*

The *Asociación Pesca del Pueblo Wounaan (APPW)*, an association of all fishermen<sup>13</sup> in Platanares and some in Rio Hondo, kept a complete record of all fish and



seafood sales from May 2007 to July 2008. This data allowed for an accurate measurement of total annual fish and shrimp produce sold and costs accrued.

*(b) Methodology*

Deforestation was expressed as the surface area of converted agricultural and village areas. The deforestation per household and per capita of both groups was compared. According to accounts by *Wounaan* and *Colonos*, land-use areas were under forest cover prior to settlement. Observed weed incursions and secondary forest re-growth on fields that were left idle confirmed these accounts.

The valuation of extracted resources is strictly price-based in that actual extraction of terrestrial, coastal and marine resources was considered for commercial uses only. Personal consumption is not valued as it does not alter the comparative analysis between *Wounaan* and *Colonos*.<sup>14</sup> Economic benefits of wild resources – native and non-native flora and fauna – as they are sold in the market were calculated and presented as income data with the metric of Gross Income (GI) per annum and expressed relative to  $n$  households or  $ha$  for agriculture deforested hectares:

$$GI^k = \frac{\sum_{i=1}^7 \sum_{n=1}^{57} (Q_{i,n}^k \times P_{i,n}^k) + \sum_{z=1, T \cup H}^6 S_z^W}{n^k} \quad \text{and} \quad GI^k = \frac{\sum_{i=1}^7 \sum_{n=1}^{57} (Q_{i,n}^k \times P_{i,n}^k)}{ha^k}$$

where  $k$  refers either to the *Wounaan* ( $W$ ) or the *Colonos* ( $C$ ) households (both groups together have 57 households). Income is calculated as  $Q$  the quantity of goods extracted and sold times  $P$ , the farm-gate or ex-vessel price for the  $n^{\text{th}}$  household engaging in one

of the seven  $i$  extractive and productive activities, which are fishing, clamming, wood carving, nut carving, basket weaving, boat construction, and raising livestock.

*Colonos* and *Wounaan* engage in different activities but also in the same activities with different intensities. In the case of the *Wounaan*, services ( $S$ ) are performed in six ( $z$ ) different households that receive wage-income as either a teacher ( $T$ ) or a health assistant ( $H$ ) from the Panamanian government. The salary of two teachers was paid by the World Bank. To yield the Net Income (NI) Variable Costs (VC) are subtracted from the Gross Income.

$$NI^k = GI^k - VC^k$$

VC of extraction practices were recorded on a case-to-case product specific basis and refer to capital input. Art crafting (baskets, tagua and wood carving), Clamming or Canoe Crafting<sup>15</sup> did not require VC. The VC of Fishing were foremost for the purchase of gasoline, ice, labor shares,<sup>16</sup> gloves, maintenance and repair. For cattle ranching, they include repair barbed wire, vaccinations, pasture seedlings and salt. The VC for services were taxes.

Certain natural assets provide an income stream from extracted resources over time. To account for differences in values over time, the sum of the Net Present Value of the stream of incomes (NPV) over a period ( $t$ ) is calculated as<sup>17</sup>:

$$NPV^k = \frac{\sum_t GI^k - \sum_t TC^k}{(1+r)^t}$$

where  $TC^k = FC^k + VC^k$

with a discount rates ( $r$ ) applied, and where Total Costs (TC) are the sum of Fixed Costs (FC) plus VC. FC arose for cattle ranching in the form of barbed wire and cattle acquisition, as well as for fishing in the form of fiberglass boats, outboard motors, fish nets and coolers.

## 4. RESULTS

### *(a) Deforestation and Land Use: Wounaan versus Colonos (Objective 1)*

Although Sierra (1999) did not find significant differences in deforestation rates of Ecuadorian *Colonos* agricultural systems and traditional native resource-use systems, the *Wounaan* accomplish very different surface area deforestation scales than the *Colonos*. The two groups differ in magnitude, rate and permanence of forest clearing. Overall, the seven *Colonos* households living within the *trocha* converted a total of 350 ha of tropical forest (red areas in Figure 1) to pasture sites starting around fifteen years ago. Approximately seven ha of this area was used for crop cultivation and 260 ha (74.3%) was used for rotational cattle grazing. The remaining 90 ha were cut by the present *Colonos* households in order to expand their territory or by new *Colonos* migrants in an attempt to secure territory for aspired future settlement.

This scale of deforestation by the *Colonos* stands in stark contrast to the *Wounaan*. In total, the fifty-two *Wounaan* households deforested 74 ha, 23 of which were used for two cattle ranches (see yellow areas in Figure 1) and 43 ha of which were used for crop cultivation and eight ha for village space. The parcels used for crop cultivation ranged in size from 0.6ha – 2.1ha. Expressing these numbers in relative terms reveals

major differences between *Wounaan* and *Colonos*. The average *Wounaan* household deforests an area of 1.42ha (0.21ha per capita) and the average *Colonos* household clear cuts an area of 50ha (8.2ha per capita), which equals a 35 times higher deforestation scale per household (39 times per capita) than the *Wounaan*. The difference in magnitude of deforestation is attributable to the *Colonos*' greater reliance on land as an input in cattle production function more than alternative land uses.

Forest-to-pasture conversion is not only more extensive than forest-to-crop conversion, it is also more permanent because cattle ranchers conduct weed control with fire. The main difference in the crop cultivation strategies of the *Wounaan* and *Colonos* is that crop fields are converted to pasture under a *Colonos* land-use scheme after harvesting while native land-use allows the parcel to re-grow to secondary forest. The two most prominent kinds of crop cultivation by both groups are shifting agriculture of Rice (*Oryza Sativa*), Maize (*Zea Mays*), Yams (*Dioscorea*)<sup>18</sup>, Sugarcane and Pineapple (*Ananas Comosus*); and plantation agriculture of Plantain (*Musa paradisica L.*), Banana (*Musa Sapientum L.*) and *Cuatro Filas* (a starchier type of banana). All crops were exclusively used for subsistence consumption. Both groups show similar patterns of general resource extraction tendencies for personal consumption, with the main exception being that the *Colonos* do not fish. They compensate the lower amount of protein by growing a relatively greater number of chickens.

For both shifting and plantation agriculture, vegetation is cleared<sup>19</sup> and burned during the dry season in March in order for the biomass to release the nutrients stored in the plants into the tropic soil until May or June, when plantation starts. The field is then designated to shifting crop cultivation for one to two years, until the nutrient supply of

the Ultisol<sup>20</sup> has been depleted. The *Wounaan* then leave it fallow allowing secondary forest re-growth for approximately 8.4 years to close the cropping cycle. Plantation agriculture is usually practiced for an average of six years at the same location.

In the forty years of *Wounaan* settlement, farmers cleared a mix of primary forest (*bosque virgen*) and secondary forest (*rastrojo*) for crop cultivation with a focus on the secondary forest in recent years. In fact, 85% of the interviewed households stated that they were cutting and burning *rastrojo* this year. The reason for this focus on secondary forest is that the *Wounaan* inherit the land from their parents who have worked on the land before.<sup>21</sup>

The necessary land for one cow raised for beef in the tropics is between one and seven hectares, depending on soil fertility and the rate of decline of grass nutritional value (Shane, 1986). McCorkle (1968) stated that the carrying capacity in Panama is slightly less than one hectare (i.e. 2.48 acres), deriving a hectare per cow as the rule of thumb. At the time of fieldwork, the average actual stocking rate of the seven *Colonos* households in the demarked territory was 1.1 ha per cow, with a total of 182 cows observed and reported, spanning a range of eleven to sixty cows per farm.<sup>22</sup>

*(b) Market Economy: Sources of Income (Wounaan versus Colonos)*

The *Wounaan* are currently in a transitional phase from a traditional form of subsistence economy to an income-earning market economy.<sup>23</sup> It is hard to foresee whether they will eventually be fully integrated into the market economy and to what extent they will utilize their comparative production advantage. At present, they extract and produce goods for both the market and village (subsistence) consumption. The *Colonos* also engage in production for these dual purposes.

Davis et al. (2007) found that more than 75% of the rural population of Panama produced crops and around 65% raised livestock in 2003. The *Wounaan* closely approximate this crop cultivation number with 78.8% of households participating in some form of crop cultivation. Out of the two Amerindian communities, 3.8% held cattle, 63.5% held poultry (for personal consumption only) and 0% held pork. All interviewed *Colonos* households dedicated themselves to some degree of crop activities and cattle ranching. Three out of five also held pork and all five held poultry on their *finca* (cottage).

The *Colonos*' income depends solely on the sale of beef (92.3% of income) and pork (7.7% of income) (see Figure 2). The *Wounaan*'s activities are more diverse, with the community of Rio Hondo spreading the income stream into three equal generating sources (in order of importance): clamming, fishing and artisanship. The *Wounaan* of Platanares are less diversified with almost 80% of their financial returns stemming from Fishing, 10% from Artisanship, 8% from Clamming and 1% from each Canoe Crafting and Cattle Ranching.

(i) *Fishing*

Most of fishing takes place in the coastal salt-water with occasional exceptions of estuarine and fresh-water fishing. While the *Colonos* do not fish, it is the principal source of income and protein for the *Wounaan*. In 78.8% of the indigenous households members actively fish with a boat. During the period of one year (May 25, 2007 to May 25, 2008), the fifty-two *Wounaan* households fished a total of 92,637 lbs of fish (1,782 lbs per household): 26.6% (474lbs per household) of which they consumed and 73.4% (1,308 lbs per household) of which they sold. The ratio of fish consumed to fish sold is 1: 2.75.

While they catch many different kinds, fish is customarily categorized into two classes: fine fish and fish *revoltura*. Fish *revoltura* fetches approximately half the price of fine fish (prices range from US\$ 0.10 to US\$ 1.15 per pound, depending on kind of fish and size).

While fish are of great importance for the *Wounaan* – in terms of both consumption and income – shrimp are the preferred catch. Overall, the *Wounaan* caught and sold 56,326 lbs of shrimp (1,083 lbs per household).<sup>24</sup> An average pound of decapitated shrimp is sold for approximately twelve times more than a pound of fish. Fishing has high expenditures: Out of US\$ 235,144 of GI (see Table 1), the *Wounaan* pay US\$ 72,100 per year in VC, which leaves them with US\$ 163,044 of NI. The GI of fish per average household was US\$ 4,522 out of which US\$3,135 remained as NI, which spread the range from a maximum of US\$ 11,942 to US\$ 0 across different *Wounaan* households.

#### (ii) Clamming

At low tide, the *Wounaan* poke in the mud of a mangrove-strip looking for a clam-like shellfish, called *concha negra* (*Anadara tuberculosa*). In Rio Hondo a commercial clamming vendor boat arrives two to three times a month and stays for two to three days close to the two communities. *Wounaan* sell a *cubo* (i.e. a bucket of 38 Pounds or 5 US Gal) of clams for US\$ 9 to the vendor. An average household sells approximately 121 *cubos* of shellfish per annum, which earns US\$ 1,128. The weighted daily average catch of an individual clamming in Rio Hondo is 1.8 *cubos* and 1.4 *cubos* in Platanares. Clamming is a very important activity for the *Wounaan* as it secures a continuous cash-input and therefore provides an income-insurance function.

(iii) *Art*

Important non-timber forest resources for the *Wounaan* are the fibers of the Chunga Palm Tree (*Astrocaryum standleyanum*) from which they weave artesian baskets. They also use the nuts of the Tagua Palm Tree (*Phytelephas seemannii*) and pieces of wood from the Rosewood-cocobolo (*Dalbergia Retusa*) for wood carving.<sup>25</sup> From the three branches of artisanship, Rosewood Carving (US\$ 24,598) adds the most to village income, followed by basket weaving (US\$ 16,042) and *Tagua* nut carving (US\$ 12,746) (for average per household values, see Table 1). These handicrafts are exclusively produced for sale. Velásques-Runk et al. (2007) note that a master cocobolo artist can earn between US\$ 5 to US\$ 30 per day in the community of Majé, a nearby *Wounaan* community, which has a reputation for making excellent pieces of art. In Rio Hondo and Platanares, the cocobolo artists make markedly less with at most US\$ 10.5 per working day.

The Amerindians conscientiously realize certain production advantages, making use of them while at the same time conscientiously ignoring others. As tagua nut carving has proven to be more profitable than rosewood carving, *Wounaan* from Majé hold workshops in Rio Hondo to familiarize fellow indigenous artists with nut carving techniques. Woodcarvers usually take around three days – working five to six hours a day – to finish a *cocobolo* piece, which they sell on average for US\$ 25. When reviewing the oeuvres of some artists and observing their crafting techniques over time, it became apparent that Amerindian rosewood artists do not craft their products based on economic returns. Their crafting decisions are strongly influenced by their traditions and personal preferences. One notable example illustrating this trend occurred while interviewing a



master carver and comparing two pieces of his recent work. Both pieces were about the same size, one depicting an intricate harpy eagle which took the artist 2 weeks and the other one a jaguar, which took only one week to complete. Despite the different time required, the financial return on both was identical: US\$ 150. His response of why he chooses to craft the complicated eagle despite the lower return to effort was crisp: “Por Gusto” (Because I like it).

*(iv) Canoe Construction*

Timber from the *Espavé (Anacardium excelsum)* tree is used for dugout canoe construction. From cutting the tree to letting the boat into the water usually takes two weeks for two men, depending on the size of the boat. Some Amerindians also craft dugout canoes for sale in contracted work. They build boats that range in size from 27"x22' to 64"38' and usually sell anywhere between US\$ 200 and US\$ 500, which contrasts to a fiberglass boat that sells for US\$ 3,000 and above in the market. The six canoes sold by the two villages within the past year generated an income of US\$ 2,400 (US\$ 46 per average community household).

*(v) Cattle-Ranching<sup>26</sup>*

Beef was never used for subsistence consumption as its value on the market is very high and thus any personal consumption would mean a substantial loss of income. Six to seven cows were sold by an average *Colonos* household per year with a total weight of 3,890 lbs, which yielded a GI of US\$ 2,401 (NI of US\$ 2,350). The observed carrying capacity was 1.1 cows<sup>27</sup> per hectare. Two *Wounaan* households also practice cattle-ranching and stock 12 and 20 cattle and are not significantly distinct in their cattle ranching techniques from the *Colonos*.

*(c) Income of Wounaan versus Colonos (Objective 2)*

The composition of income activities between *Wounaan* and *Colonos* is different, as seen in the earlier chapter. This chapter compares the returns from these different income activity compositions, as expressed by the two metrics: Income per household (and per capita) as well as Income per hectare of land used (i.e converted forest) is also different.

*(i) Income per household (capita)*

The average *Wounaan* household from both villages generates an annual GI of US\$ 7,247 (see Table 1). After taxes and expenditures the representative household has US\$ 5,685 of NI at its disposal of which 94% stems from the trade of goods and the remainder of only 6% from the delivery of services.<sup>28</sup> The *Colonos* generate US\$ 2,329 of NI, only 41% the amount earned by the *Wounaan*. To aid the comparability of this household metric, the different household sizes of the two groups are being corrected to yield per capita results. With 6.8 *Wounaan* ‘living under one roof’ compared to 6.1 *Colonos*, the average per capita NI of one of the 358 *Wounaan* living in the two watersheds is US\$ 836, which compares to US\$ 382 NI generated by one of the 42 *Colonos*.<sup>29</sup> Hence, the average *Colonos* individual earns 46% of what the average *Wounaan* individual earns. The lowest household income tercile of the *Wounaan* (11 out of the 17 from Rio Hondo) earn an average NI of US\$ 2,449 per annum, which is above the mean overall income of US\$ 2,329 for the *Colonos*. Expressed in daily figures, the *Wounaan* per capita income is US \$ 2.30 per day and the *Colonos*’ is US\$ 1.05 per day.

Also from the perspective of gross values, representing the overall social utility generated by working individuals, a *Wounaan* household earning US\$ 7,247 of Gross Income is more productive than a *Colonos* household earning US\$ 2,596. A comparison

of the GI's of the two groups shows that the *Colonos* only yield approximately 1/3 (36%) of what the *Wounaan* yield per annum. Table 1 also gives insight into the VC of activities, which shows US\$ 72,202 of expenses on the Amerindian side compared to US\$ 255 of expenses made by the *Colonos*. Overall, the difference in contribution to other private sectors of the Panamanian economy (via expenditures) and the public sector (via taxes) is quantified by US\$ 1,602 per *Wounaan* household and annum and contrasts to a *Colono* household of US\$ 51 per annum.

To appropriately account for the high FC of fishing and cattle ranching and compare the developments of benefits and costs over time, Net Present Values (NPV's) were calculated for different time horizons.<sup>30</sup> The FC for an average *Wounaan* household was US\$ 5,125, which compares to the FC of a cattle ranching household of US\$ 2,714, assuming that *Wounaan* and *Colonos* commence their activities at the same time, the fishermen buy all the equipment, and the cattle ranchers start out with ten cows during the first year ( $t = 0$ ). The *Wounaan*'s benefits outweighed the costs after the first year ( $t = 1$ ), which occurred for the *Colonos* three years later ( $t = 4$ ), due to the lagged returns of a cattle ranch after establishment. Fishing and other indigenous activities yield maximum returns in the first period. In the period  $t = 4$ , the NPV of the *Wounaan* was 10.1 times greater, a numerical relation converging eventually to 2.4, as time approaches infinity.<sup>31</sup>

*(ii) Income per hectare*

Averaging over the entire set of activities, GI for the average deforested and converted forest parcel yields a return per hectare of US\$ 35 for the *Colonos* and US\$ 5,103 for the *Wounaan* per hectare. The income return per hectare for the Amerindians is thus 149 times more than for the Latino migrants. Limiting the analysis to only the

terrestrial resource extraction of the *Wounaan* reveals that they earn US\$ 1,125 per hectare annually, which is 32 times more than the monetary value of goods extracted by the *Colonos*. It should be noted that simply omitting aquatic resource extraction from the analysis, however, leads to an underestimation of the *Wounaan*'s relative output, because if they did not engage in fishing and clamming, they would redirect their time and labor to other occupations.

An artesian household (92.3% of total households) earns an average of US\$1,113 from the sale of pieces of art, which in turn causes zero deforestation, as *cocobolo* trees, *tagua* nuts and *chunga* palm fibers are selectively harvested. The same holds true for the average canoe crafter who earns US\$ 796 from selectively harvesting Espavé. It should not be forgotten, however, that both Artesian as well as Canoe Crafting households also engage in other work.

## 5. DISCUSSION

### *(a) Differences in Tropical Deforestation between Wounaan and Colonos (Objective 1)*

*Colonos* bring about serious ecological changes to the region when entering a territory as they rapidly and permanently convert large areas of the forest to pasture. Researchers have raised concerns as to how sustainable this land use practice is in the long run, stating: "...the tropical forest soil, while able to sustain low population densities practicing slash-and-burn agriculture, soon becomes depleted when large numbers of colonists place untenable pressure on the forest environment" (Shane, 1986). A valid question that needs to be addressed in this context is, how robust are the presented results indicating less deforestation by the *Wounaan*? Are they going to be

more inclined to deforest as they get more integrated into the market or negative external shocks prevent them from being able to fish?

Rudel, Bates & Machinguiashi (2002) found that even with increased acculturation of Amerindians in Ecuador, they maintain more biological diversity than the *Colonos*. Assuming that natives would engage in more forest-to-pasture conversion is not substantiated by surveyed data. None of the *Wounaan* – besides the two households already engaging in it for more than twenty years – stated that they plan on establishing a cattle ranch after imagining a no-fishing scenario. Cattle ranching is not a substitute for fishing. A feasible assumption on the other hand would be that the *Wounaan* might divert their efforts to production of resources that offer a tighter integration to the market, such as basket weaving, rosewood carving, or tagua nut carving.

Future research quantifying the complete extent of negative environmental externalities (if any) caused by aquatic extraction of the *Wounaan* has to be conducted to complement the data on terrestrial resource extraction. Nevertheless, tentative evidence of this study points to a sustainability of the *Wounaan's* fish and shrimp extraction: (1) fish and shrimp extraction is well-regulated by Panamanian authorities, with a three months per year ban (*veda*), which allows for replenishment of the stocks; (2) time series analysis based on complete and accurate invoices from May 2007 and July 2008 and less complete invoice data from 2002 to 2008 has shown little difference in caught volume over time. This indicates a non-decreasing stock of fish and shrimp; (3) *Wounaan* fishermen have responded they have not perceived differences in catch-rates (other than those attributable to the acquisition of better equipment) and fish availabilities over the last five years. That being said, however, they did report a marked decrease in *concha*

*negra* stocks. Extraction of on average six to eight *cubos* of these clams for a day of picking has dropped to one to two *cubos* over the course of the last ten years and was accompanied by a threefold increase in prices over the same period.

*(b) Income Differences between Wounaan and Colonos land use? (Objective 2)*

It has been argued by some authors that cattle production does not repay its production costs (Browder, 1988; Hecht, 1989; Hecht, 1993) and by others that benefits only marginally outweigh the costs (Faminow, 1998; Bojanic-Helbingen, 2001). This study, in line with more recent studies, finds that cattle ranching generates some returns to inputted capital and labor but is not on par with the diverse livelihood strategies of the *Wounaan*. The lacuna of hourly income figures per activity makes it impossible to directly compare the productivity of separate activities with one-another. Identifying the driving causal factors for why *Wounaan* out-perform the *Colonos* threefold in income per household thus demands caution. This study identifies ten factors contributing to a higher performance of the *Wounaan* compared to the *Colonos*:

**(1)** The high establishment costs of a cattle ranch. Establishment costs in Central America are very high and particularly capital intensive (Ayre-Smith, 1971). The *campesinos* acquire a cow for an average of US\$ 213 (2008 prices), which equals around two thirds of the final sale of the cow. Barbed wire has high costs due to double perimeter fencing and the division of separate ranges to enable a rotational grazing scheme. **(2)** Remoteness and lack of infrastructure. Farm-gate prices are below market selling prices due to the high transportation costs for the buyer due to the remote location and difficult accessibility of the cattle ranches. **(3)** Imperfect market conditions. Economic theory suggests that individual cattle should be retained by the producer so long as its slaughter

value does not exceed the capital value of the standing animal (Jarvis, 1974). Due to the scarcity of visits of cattle buyers and the necessity for immediate income, the *campesinos* are in a sub-optimal negotiation position. Not only do they receive a price per pound that is well below the documented market selling price, but they also sell cattle at times when they are not yet fit to kill.<sup>32</sup> Cattle reportedly weigh between 700 to 800 lbs when sent to slaughter by the *Colonos*, which is lower than the reported 900 to 1,100 lbs weight range for the region reported by McCorkle (1968). (4) Sub-optimal pasture growth. Low productivity soils affect beef yield. A lack of pesticides, herbicides, fungicides and fertilizer use to boost pasture growth efficiency. (5) Capital Constraints. Besides a carrying capacity of the land for cattle, there is also a financial feasibility condition in which the owners can only stock as many cattle for which they have sufficient funds. Limited capital is chiefly responsible for an inelasticity of supply (Jarvis, 1974 & 1986). (6) Economies of scale. All *Colonos* households were small-scale “production enterprises”: the numbers of cattle owned at the time of the interview ranged from eleven to sixty, which usually face relatively higher production costs than mid- or large scale ranches. (7) No dairy use. Cattle were not being used for milk or dairy products due to the lack of refrigeration and an absence of the cultural inclination to consume milk products. (8) Minerals, supplemental feed, hormones or cattle housing were not provided.

(9) Diverse activities. While an entire *Colonos* family only engages in livestock development as a means of generating income, *Wounaan* households are more diversified. They spread their income generating activities within a family (e.g. females weave baskets and men carve wood) and across time (e.g. in the morning they go fishing

and in the afternoon they carve wood, interspersed with days of clamming). This versatility allows them to use time productively. **(10) Network effects.** The more people in a system (community), the more network externalities arise to its members. In the case of the *Wounaan*, these externalities are positive and generate service positions (Teachers and Health Care Assistant) as well as commonly owned goods that would have been infeasible for smaller communities or single households (such as the *Colonos*). An example for a positive externality is the collectively owned transportation boat that is used to transport the catch of the individual shipping boats (on average around 20 boats) to the harbor and market of Coquira. This saves gasoline, time, and ultimately money. An additional benefit accruing due to this size-effect is that *Wounaan* acquire micro credits and also relatively large credits<sup>33</sup> from creditors due to community size enabled risk pooling between the Amerindians.

## 7. CONCLUSION

*Colonos* deforest 35 times more tropical rainforest per household (39 times more per capita) than the *Wounaan*. At the same time, they generate three times less annual Gross Income per household (149 times less per hectare). These findings indicate that the Amerindians input less land into their production function but have a relatively higher output in terms of income. In other words, the *Wounaan* use the available terrestrial and aquatic resources not only more productively but also cause less deforestation than the *Colonos*. The presented findings contribute to the understanding of native land-use strategies. They contradict common notions of inferior productivity of traditional native-practiced livelihood systems to livestock strategies (Pichón, 1997) and confirm reports of low productivity of cattle ranching (e.g. Faminow, 1998).



Overexploitation of national land resources by raising cattle leads to the destruction of the forest ecosystem. Such destruction hurts not only Panama's economy and future ecology but also the stated principles of the Constitution and other laws.<sup>34</sup> A timely response of governmental decision makers to the struggle over limited territory is of utmost importance as the lack of land tenure and clearly defined property rights has resulted in a *might make right* situation. This in turn leads to continued deforestation for cattle-pastures, violence, and perhaps the eventual expulsion of the *Wounaan* and consequently a deterioration of their culture, which is inextricably linked to the forest on which they depend. This study provides evidence for why this scenario might not only be an ecologic mistake, but also an economic mistake.

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## NOTES

<sup>1</sup> Productivity refers to the notion of higher output (Income) measure per unit of input (land and labor) in this paper.

<sup>2</sup> This quote is principle # 9 of ANAM's core principles, which can be accessed at <http://www.anam.gob.pa/principios.htm>. (Page last visited on January 20, 2009).

<sup>3</sup> This sedentary process is a gradual process, in which an established kin group progressively grows over time as its tribe members follow.

<sup>4</sup> Rio Hondo (Latitude: 8° 51' 14.29", Longitude: 78° 44' 23.21") and Rio Platanares (Latitude: 8° 52' 23.00", Longitude: 78° 46' 23.48")

<sup>5</sup> All of the *Colonos* were Latinos.

<sup>6</sup> 11,430ha = 114.3 km<sup>2</sup>. 1 ha = 2.5 acres.

<sup>7</sup> Other authors refer to it as "production strategies" or "wild resource extraction strategies".

<sup>8</sup> Spanish is a second language to the *Wounaan*. Their maternal language is Wounmeu. However, in Rio Hondo, all male household leaders and some females had a good command of Spanish. In the community of Platanares, all Amerindians spoke fluent Spanish, a fact stemming from the last generation, were the *Wounaan* intermarried with the *Emberá*, one of the seven indigenous groups in Panama. Both speak mutually unintelligible languages. In order to communicate, they agreed on speaking Spanish. Other studies (Velásquez Runk et al., 2007) have used translators from the very communities they were studying to conduct interviews. The author however found that the Spanish skills of the *Wounaan* were beyond sufficient. Also, he is convinced that having one of their peers present at the interview may cause reporting biases.

<sup>9</sup> These negative preconceptions of the author were rooted in his apparent affiliation with the *Wounaan*.

<sup>10</sup> The *Wounaan* in fact had harmonious relationships with these three *Colonos* households. They even engaged in trade relations with one-another (e.g. trading fish with chicken), which was possible because these *Colonos* respected the territorial claims of the *Wounaan* and did not infringe on "their" territory.

<sup>11</sup> Native Future is a nongovernmental organization promoting the link between conservation and indigenous livelihoods.

<sup>12</sup> 7.2 meter accuracy.

<sup>13</sup> Only men fish.

<sup>14</sup> Only the monetarily compensated occupations are considered in this study. Both groups engage in similar subsistence agriculture, such as shifting agriculture, plantation cultivation and dooryard cultivation and have similar levels of hunting and gathering. Both also extract non-timber forest products for construction of houses, tools and infrastructure and consume water from the rivers. For studies valuing the consumption of goods brought into indigenous communities, see e.g. Godoy et al., 2000 & 2002. Other non-compensated activities including community services, such as mowing the villages "lawn", and maintenance of the harbor were also not included.

<sup>15</sup> Gasoline used for felling the trees with a motor saw was negligible on an annual household scale.

<sup>16</sup> Sometime the fishermen would pay workers in the harbor to unload the vessel.

<sup>17</sup> Recorded annual data of income per activity was assumed to be invariant over time. While fishing, artesian crafting, clamming and canoe construction realize their full production capacity within the first year (annual income from these activities was assumed to be invariant over time), cattle ranchers report that it takes about four years to reach the optimal production performance. Ranchers reported incomes of about ¼ of their current levels, in the first years of the ranch establishment.

<sup>18</sup> Preferred yams grown were: *Ñame*, *Yuca* and *Otoe*

<sup>19</sup> Machetes and chainsaws were used to cut along the perimeter of the selected area.

<sup>20</sup> From author's unpublished data on chemical and physical soil properties of *Wounaan* and *Colonos* agricultural land parcels.

<sup>21</sup> Although the *Wounaan* do inherit the right to work on the land through family, all *Wounaan* acknowledged that the land belongs to the community as a whole. Under their laws and regulations, *Wounaan* are not permitted to sell the land to an outsider, or even to one another.

<sup>22</sup> None of the cattle data could have been expressed in terms of animal units, due to a lack of specific weight information of the cattle.

<sup>23</sup> According to Williams (2004), trade between the Chocó Amerindians (*Wounaan* and *Emberá*) and outsiders (Spanish Conquistadores) already took place in the 1500's.

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<sup>24</sup> Coastal shrimp is hardly ever consumed personally due to its relatively high market prize.

<sup>25</sup> For a detailed study on the ecology and sustainability of extraction of these resources by the *Wounaan* see Velásquez Runk et al. (2004).

<sup>26</sup> Pork is held supplementary to cattle. While pork meat is sold too, it only marginally contributes to a *Colonos'* income and is hence not discussed in detail here. The two *Wounaan* cattle-ranchers do not hold pork.

<sup>27</sup> *Braham* was the most prevalent breed of cattle.

<sup>28</sup> Rio Hondo and Platanares have the option of working in the service based fields of teaching and providing health care due to (a) policies put in place by former president Omar Torrijos in the 1970's, who made a deliberate attempt of improving the well-being of indigenous communities and initiated school establishment in remote indigenous villages and (b) development projects of the World Bank, financing some *Wounaan* teachers.

<sup>29</sup> López & Valdéz (2000) calculate the annual per capita income for the poorest quintile and quartile of small-scale rural farmers in six Latin American countries (Chile, El Salvador, Colombia, Honduras, Paraguay and Peru) to be US\$155 [CPI: US\$ 229]. (Estimations from other authors are indexed for the effect of inflation by the consumer price index (CPI) to represent values for 2008.) The average farmer of these six countries had an average income of US\$ 774 [CPI: US\$ 1,142]. With an average per capita gross (net) income of US\$ 1066 (US\$ 836) per annum, *Wounaan* are only slightly below this average. The *Colonos* with an annual per capita gross (net) income of US\$ 426 (US\$ 382) are well below the average, yet above the poorest segment of the population. Comparing to Anriquez & Stamoulis (2007) data, who calculated the average per capita GDP for eleven Latin American rural inhabitants to range from the lower end of US\$336 [CPI: US\$ 354] in Bolivia to the higher end of US\$4,229 [CPI: US\$ 4,462] in Uruguay with the mean in Brazil with US\$833 [CPI: US\$ 878] per annum, yields similar inferences. While the *Colonos* are in the lower end in terms of income, the *Wounaan* reflect a central tendency of rural farmers with their income.

Unsurprisingly, the average income of Panama is a multifold higher than the incomes of the *Wounaan* and *Colonos*. World Development Indicators data of the World Bank (WDI, 2005) show that the average GNI per capita in Panama in 2007 was US\$ 5,510 [CPI: US\$ 5,814]. Comparing the 5-6 times higher GI per capita of the average Panamanian with the average *Wounaan/Colonos* GI however has to be done with caution and the following information in mind: (1) *Wounaan/Colonos* have a very high household size (2) they have lower expenses, for example, they build their own houses, infrastructure and tools, do not have to pay rent, for water, collected fruit and hunted game and they can grow their own food and (3) a dollar in remote areas buys more than a dollar in the cities.

<sup>30</sup> The choice of a discount rate while pivotal for regulatory decisions does not alter the comparative analysis between *Wounaan* and *Colonos* income.

<sup>31</sup> With FC approaching zero *ad infinitum*, a comparison of the NPV's becomes a comparison of the NI's.

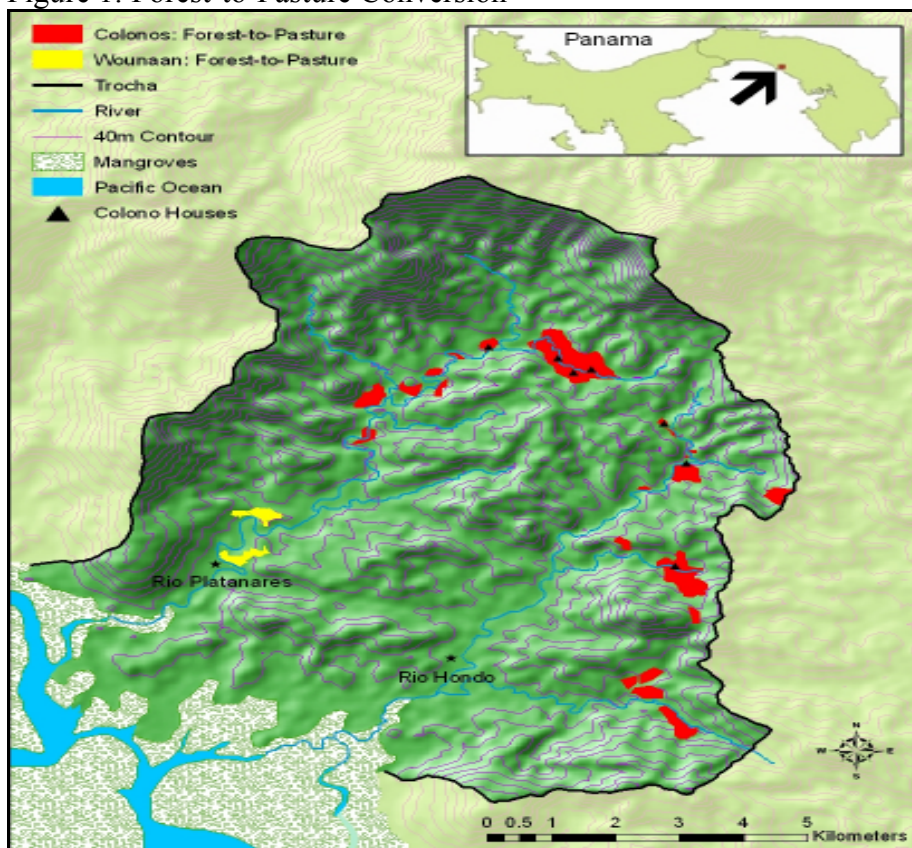
<sup>32</sup> On average, *Colonos* reported three to four years until cattle is fit to kill.

<sup>33</sup> Notably is the example of Rio Platanares. Around ten years ago the community founded the *Asociación Pesca del Pueblo Wounaan* (APPW) with loans they received from private moneylenders, most importantly, one individual financier. Receiving a lump-sum low interest rate credit, they obligated themselves to sell their catch to him for as long as its debt is standing. With the capital, it bought fiber-glass fishing boats, motors, nets, and the earlier mentioned transport boat. These kind of contractual agreements are untenable for the *Colonos*.

<sup>34</sup> See earlier quotes of Panama's constitution in the text and article 116, which states: "*The State shall regulate, monitor and implement timely measures to ensure that the use and exploitation of the terrestrial fauna, river and sea, as well as forests, land and water, are rationally and prevent degradation and ensure their preservation, renovation and permanence.*" (Political Constitution of the Republic of Panama from 1972); See Agrarian Code, article 3, paragraph 1, which states that it is the duty of the state to "... *protect, conserve and improve the existing forest resources in the country and promote its rational and sustainable use.*" and article 5, which states: "*The conservation and rational use of natural renewable resources, such as flora and forest cover, the soils and waters, constitute principal ends of the present code*"; See current Forestry Law, article 34, which states: "*The state will create incentives for whoever exploits the land in accord with its social function and so contributes to the economic development of the country*" (G.O 22.470, first of three decrees, on February 7, 1994).

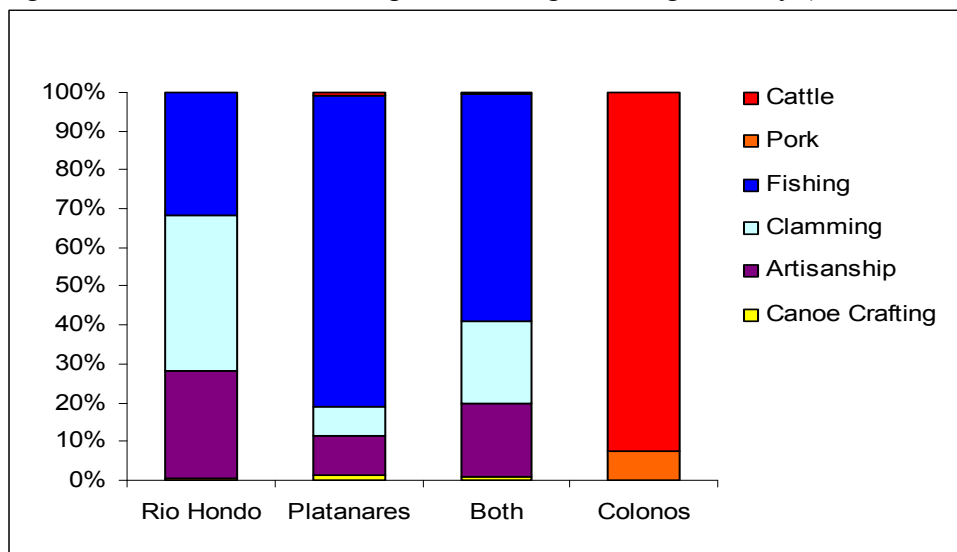
## TABLES AND FIGURES

Figure 1: Forest-to-Pasture Conversion



Note: Crop Cultivation for both groups not plotted<sup>1</sup>

Figure 2: Net Income Sources per Income-generating Activity (Data in US\$)



Source: Primary data at the household level.

Table 1: Mean Household Income from Goods and Services Sold (US\$ / annum)

	Rio Hondo (n = 28)	Platanares (n = 24)	Wounaan (both) (n = 52)	Colonos (n = 5)
<b>Total Income, GI</b>	6,211	8,782	7,247	2,596
<b>(Total Income, NI)</b>	(5,366)	(6,384)	(5,685)	(2,329)
<b>Goods Income:</b>	5,508	8,532	6,753	2,596
	(4,911)	(6,221)	(5,365)	(2,545)
(i) Fishing	2,163	7,274	4,522	0
	(1,566)	(4,967)	(3,135)	0
(ii) Clamming	1,960	484	1,128	0
(iii) Artisanship	1,364	633	1,027	0
- Baskets	292	328	309	0
- Rosewood	633	286	473	0
- Tagua Nut	439	19	245	0
(iv) Canoe	21	75	46	0
(v) Livestock	0	67	31	2,596
		(62)	(29)	(2,545)
- Cattle	0	67	31	2,401
		(62)	(29)	(2,350)
- Pork	0	0	0	195
<b>Services Income:</b>	703	250	592	0
	(455)	(163)	(373)	0
(i) Teacher	489	250	378	0
	(341)	(163)	(259)	0
(ii) Health Assistant	214	0	214	0
	(114)	0	(114)	0
<b>Total Costs:</b>	845	2,398	1,602	51
- Costs Goods	597	2,311	1,389	51
- Total Taxes	248	87	214	0

Note: Reported are Gross Values. Net Values are in parenthesis if there are costs/taxes. No values in parentheses indicate no costs/taxes accruing to the activity, ergo Gross Values = Net Values in this case. Costs are VC only. Source: Primary data.

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